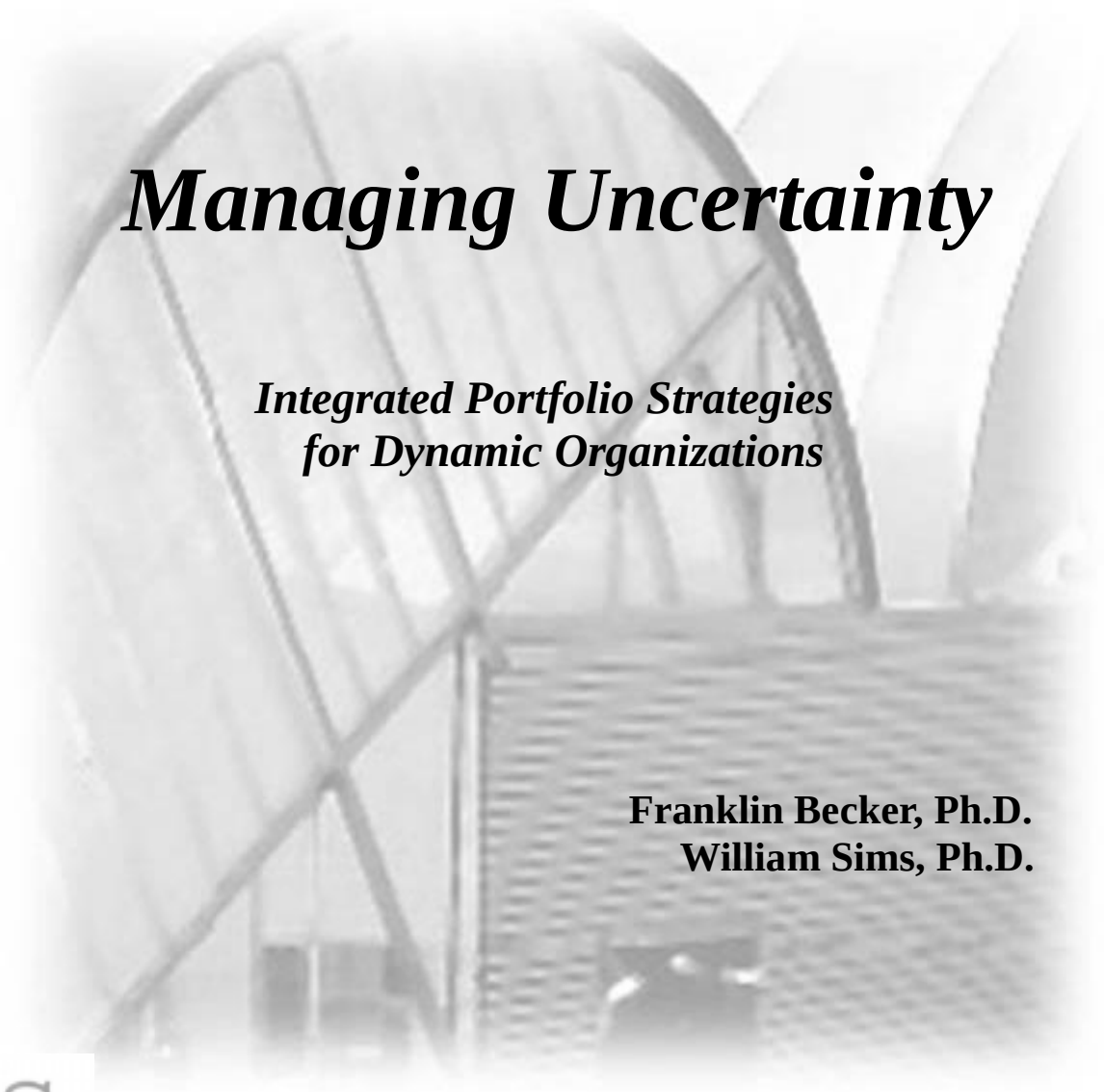


Managing Uncertainty

Integrated Portfolio Strategies for Dynamic Organizations

Franklin Becker, Ph.D.
William Sims, Ph.D.

The International Workplace Studies Program
College of Human Ecology
Cornell University

(February, 2000)

International Workplace Study Program

SPONSORS

Arthur Andersen
Blue Cross Blue Shield of North Carolina
Champion International
Citibank
Federal Building Agency of the Netherlands
Herman Miller
Hewlett Packard Company
Kokuyo Co., Ltd.
Public Works and Government Services Canada
Sears, Roebuck and Company

Acknowledgements

As is always the case in a major research effort, more people than can be named individually have contributed to this report, and to the IWSP. We would like to thank, in particular, our IWSP sponsors: Arthur Andersen, Blue Cross/Blue Shield of North Carolina, Champion International, Citibank, Federal Building Agency of the Netherlands, Herman Miller, Hewlett Packard Company, Kokuyo Co., Ltd., Sears Roebuck and Company, Public Works and Government Services Canada. As members of the IWSP staff, Carrie Tennessen, Lisa Dahl, and Bill Erickson contributed in many ways to the research and report, in particular in collecting both archival and case study site data. We interviewed and visited many companies as part of the research program, but we want to thank in particular, Frank Blase of IGUS in Germany, Peter Costello of Orange in England, and Loes Diemel of ABN/AMBRO Bank in the Netherlands for helping organize and participate in three of the more extensive case study sites. Two graduate students in our Cornell Facility Planning and Management Program also deserve special mention: Christian Kasper and Anne Scott, who helped in the final preparation of the report. Alan Drake was responsible for designing and helping edit the final report, for which we are tremendously grateful. The report draws on several columns from the Cornell University International Workplace Studies Program newsletter, *The International Workplace Review*, and an article in the *Journal of Corporate Real Estate*, which Franklin Becker wrote. The authors are solely responsible for the content of the report.

Table of Contents

The Uncertainty Dilemma

- *A Pharmaceutical company wants to launch a new science program, involving the immediate hiring of 50 new scientists, but is constrained from doing so because existing lab space cannot accommodate the new hires and it will take at least 18 months to build new space once plans and designs are complete.*
- *Two companies merge and in doing so determine that a two hundred thousand s.f. building in the Midwest used as a back office data processing facility is no longer needed. The new firm wants to divest itself of that building so it can invest in the renovation of another facility that is better located.*
- *A consulting firm obtains a major project which will involve 30 consultants working on-site for a period of six months. The project begins in a week's time; but there is no space in the client's offices for the consultants to work. Conventional leasing and fit out of space would take several weeks to complete, and involve a 2-year lease commitment, much longer than needed.*
- *A global retailer builds a new building for its creative marketing group, with key design features to support the collaborative work of teams who need considerable open space to accommodate clothing samples and advertising layouts. One month before occupancy, leased space closer to where the creative group already works becomes available. Management decides to house IT, Facilities, and other corporate support services in the new building, increasing headcount by several hundred and requiring more closed and cubicle space.*

Mergers like the world's largest for $173 billion between AOL and Time Warner only punctuate what has become commonplace. Seven of the 10 biggest deals in U.S. history occurred in the second quarter of 1998 alone. In 1998 there were more than $1.36 trillion worth of mergers, (38)

Uncertainty is endemic and chronic in today's organizations. The reasons reveal themselves in daily newspaper and TV headlines: mammoth mergers and acquisitions, technology that changes with anxiety-provoking speed, a labor force for which demand greatly exceeds supply for qualified workers, fierce and unpredictable global markets and competition, and new products and services lead by e-commerce that rewrite the rules of the game with dizzying speed. All of these factors force organizations to rethink how they do business: how they manage their business, where and when they convene workers, and the manner in which work is done.

"Most gazelles don't understand real estate basics. Failing to consider the one or two years that a site selection process generally entails cost one fast growth aerospace manufacture a years delay—and some $1 million in revenues when opposition nixed plans for two new sites before the firm secured an existing plant" (34a)

Factors driving Uncertainty:

- Mergers/acquisitions
- Downsizing/expansion
- Demographics
- Labor supply/demand
- Changing technology
- Changing political/economic climate
- Product services/success/failure

Perhaps nowhere is the face of uncertainty so sharply in relief as surrounding new technologies. We think trying to understand and predict the impact of new technologies is a "current event," but as experience with ATMs suggests, the unpredictable consequences of new technology are hardly new. The ATM was originally designed to ease congestion at branch counters. By providing a cash-and-dash service for customers, ATM's also dramatically reduced operational costs and changed customer expectations. Customers demanded 24-hour, 365 days-a-year service—wherever they were. That was not at branch banks, but in supermarkets, convenience stores, and gas stations, which now receive a far higher volume of customers than branch banks (45). One outcome? A huge surplus of branch bank offices from which banks are still trying to extricate themselves.

The unexpected keeps happening. If ATMs are in supermarkets and other retail establishments, why not work more closely together? Retailers benefit from increased store traffic, higher store sales and rental revenue from the ATM owner.

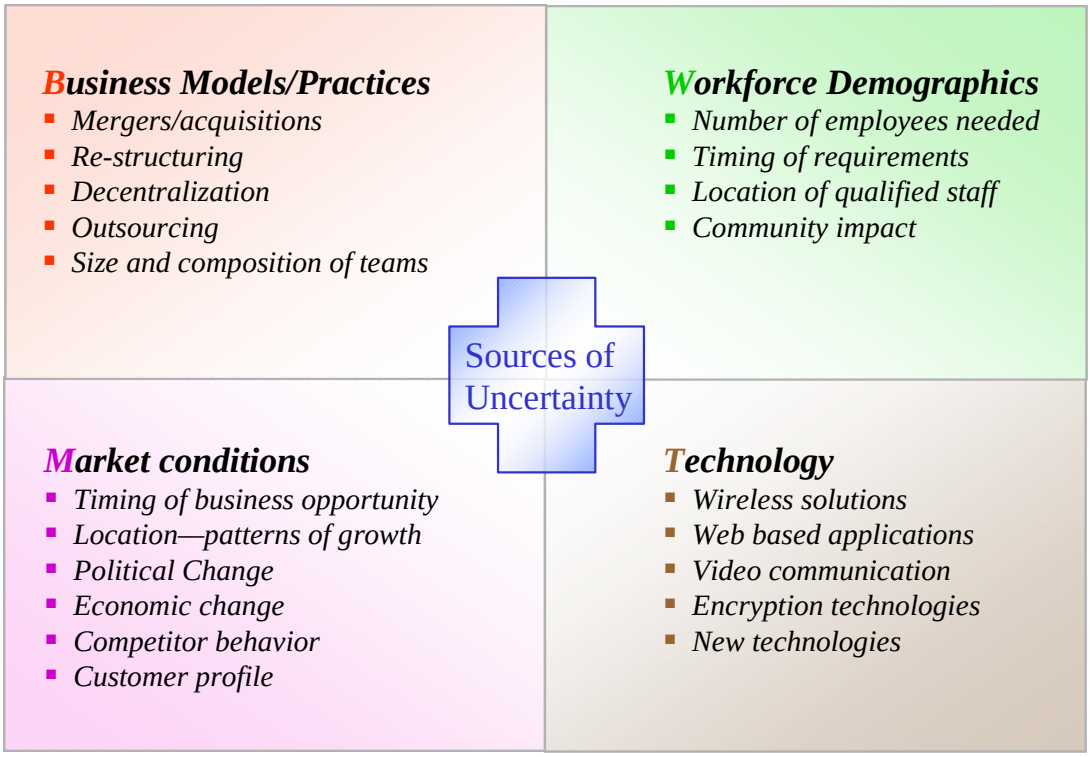
Well Fargo Bank of San Francisco, for example, has been working with Safeway supermarkets to dramatically increase the number of in-store branches. As they do, they will become multi-functional, enabling customers to do everything from getting money and paying bills to buying theater and airline tickets, insurance certificates, and savings bonds, as well as obtaining Web-based information. Real estate and facilities are still a key issue, but the form, size, location, function and permanence are radically different (8).

As radical and unpredictable as are the changes in technology are those in the nature of the workforce itself. Faced with fluctuating demand for products and services, short project cycles, stiff peaks and valleys in service demand, staff absences from work, rising labor costs, and uncertainty about where, when, and for how long they will need labor, companies are turning with increasing frequency to a continent workforce that takes many forms. These range from outsourcing of various functions, utilizing temporary workers, or even leasing an entire work force to meet all labor needs (15). And the contingent workforce is no longer synonymous with lower level support positions.

Over 230 U.S. firms now specialize in placing managerial, professional, and technical workers in temporary jobs—more than five times the number that existed in 1990 (35).

Technology, mergers and acquisitions, changing workforce demographics, constantly shifting organizational strategies, new ways of working, global competition—all of these factors generate chronic uncertainty.

Sources of Uncertainty



This report focuses on the nature of innovative workplace strategies that leading-edge companies in North America and Europe have adopted to keep pace with the challenge of managing the kinds of uncertainty no organization can escape. Doing this with speed and imagination is transforming how companies procure, construct, and manage their space.

Beyond Alternative Officing

Alternative Officing Options:

- *Non territorial offices ("hoteling").*
- *Home-based telecommuting.*
- *Team/collaborative environments.*
- *Universal plan environments.*
- *Activity setting environments.*
- *Satellite offices*

Over the last decade various forms of "alternative officing" (AO) have grown from a fringe activity found in a handful of teams and departments within large companies to just another "tool" in the corporate real estate and facility management toolbox of workplace solutions (4, 17, 28). A recent La Salle Partners and IFMA study found that 62% of the companies surveyed were using some form of alternative workplace strategy (AWS), with team environments the most commonly used approach. They also found the AWS were in the early stages of implementation and likely to increase rapidly, particularly for telecommuting (30).

The Cornell University International Workplace Studies Program (IWSP) has been a leader in examining factors associated with the successful implementation of workplace solutions like unassigned offices ("hoteling"), satellite offices, remote collaborative work, telework, and other alternative approaches to convening workers in space and time (5, 6, 9).

For the most part, alternative office research and practice has focused on:

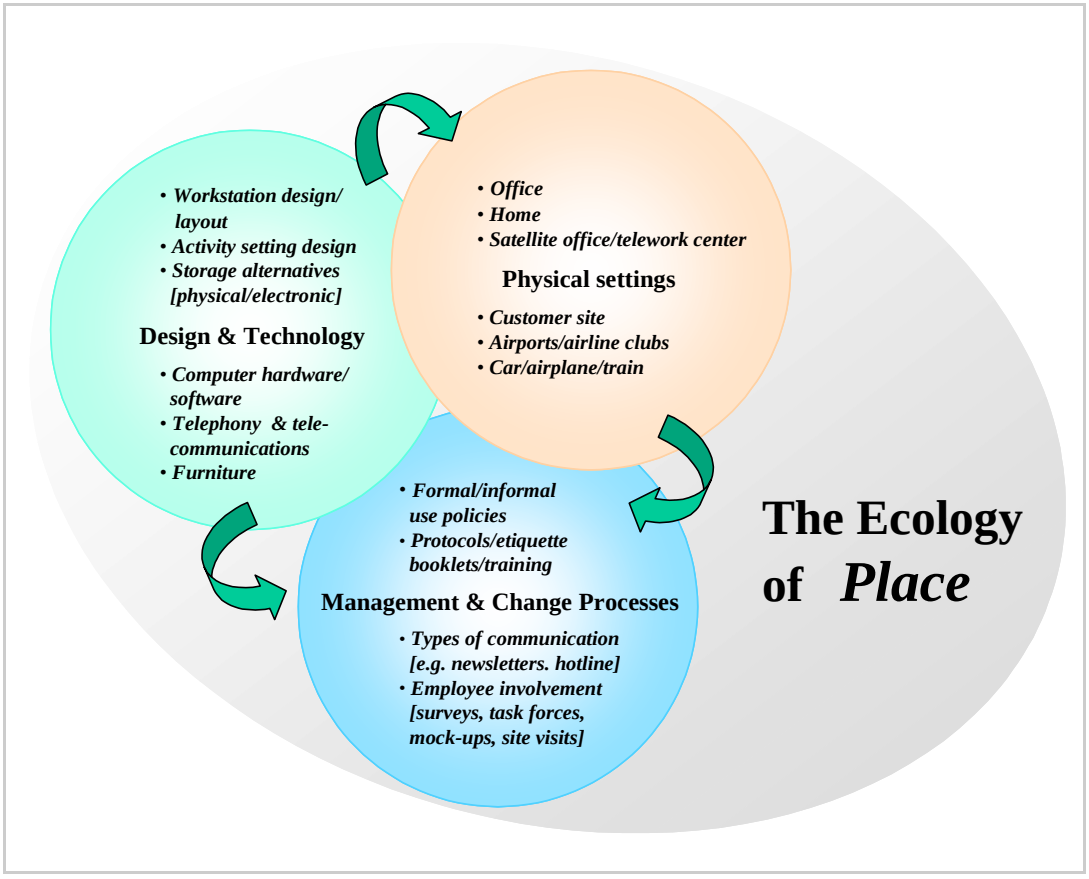
- the design and technology of the interior work environment;
- the physical settings of the office environment;
- the management and change processes used to implement some form of "alternative" office.

The Cornell IWSP research has drawn on the concept of organizational ecology rooted in the fundamental idea of the workplace as an ecological system, to better understand these new ways of working (8). The underlying premise is that, as an integrated system, one cannot understand what makes a workplace intervention successful without considering *within the same analytical framework* the nature of the organizational culture (formal and informal values, norms, and work practices), the times and places where work is carried out, the technology that carries the information life-blood of an organization, and the work processes that constitute the reason for the organization's existence.

For the most part AO has been examined in the office service sector (e.g., field sales, consulting, project management, tax audit). The primary organizational drivers have been the need to reduce costs and the opportunity to exploit informa-

tion technology (computers and telecommunications)(3). Other rationale including the desire to better serve customers and provide a more flexible work environment for employees, secondary. (Evidenced by the fact that if the potential for cost savings were eliminated, most alternative officing programs would neither start nor continue).

Organizational Ecology: the basis of an Integrated Workplace Strategy



The Next Leap Forward

Three fundamental corporate realities have surfaced from research and experience with AO:

1) Individuals work in multiple settings, inside and outside the office.
2) Precisely where and when an organization will need space or an individual will need or want to work is difficult to predict.
3) The time horizon between when an organization realizes it needs space and when it wants to occupy (or exit) it is short and unpredictable.

Together, these conditions mean that managing uncertainty has become a major business challenge.

What has not been much investigated as part of the AO movement are workplace strategies centered around innovative ways of procuring and constructing work settings, particularly when conceived as part of an Integrated Portfolio Strategy (IPS), not a one-off building or design project or even a corporate-wide workplace standards program . Cost-reduction remains an important driver for an IPS, just as it is with "traditional" AO. But the primary companion driver with an IPS is flexibility: the ability to manage the workplace portfolio with speed and grace in the face of organizational uncertainty.

The primary driver for an Integrated Portfolio Strategy (IPS) is flexibility: the ability to manage the workplace portfolio with speed and grace in the face of organizational uncertainty.

Said another way, an IPS provides the right type and amount of space, when and where it is needed, for only as long as it is needed. In principle, it follows the same logic as Just-In-Time and lean manufacturing processes: pay for and use resources only as you need them (7). An IPS facilitates procuring and exiting the settings in which work is done *on demand.* Like the concept of an "agile" organization (23), the intent is to remove "change" as an ad hoc disturbance by making it a fundamental condition of organizational behavior. An IPS acknowledges the "death of predictability" (23).

Integrated Portfolio Strategy (IPS) and Zero-Time Space

Zero-time space borrows from the concept of "acting in zero time" in an agile organization. This occurs by meeting customer demands and exploiting "market opportunities instantly by means of simultaneous enterprise-wide collabo-

In effect, the need for an IPS is not at heart about real estate or facilities. It is a business strategy designed to enable the organization to constantly and quickly morph in response to uncertainty about how many employees will be needed, doing what work, in what locations, for what period of time.

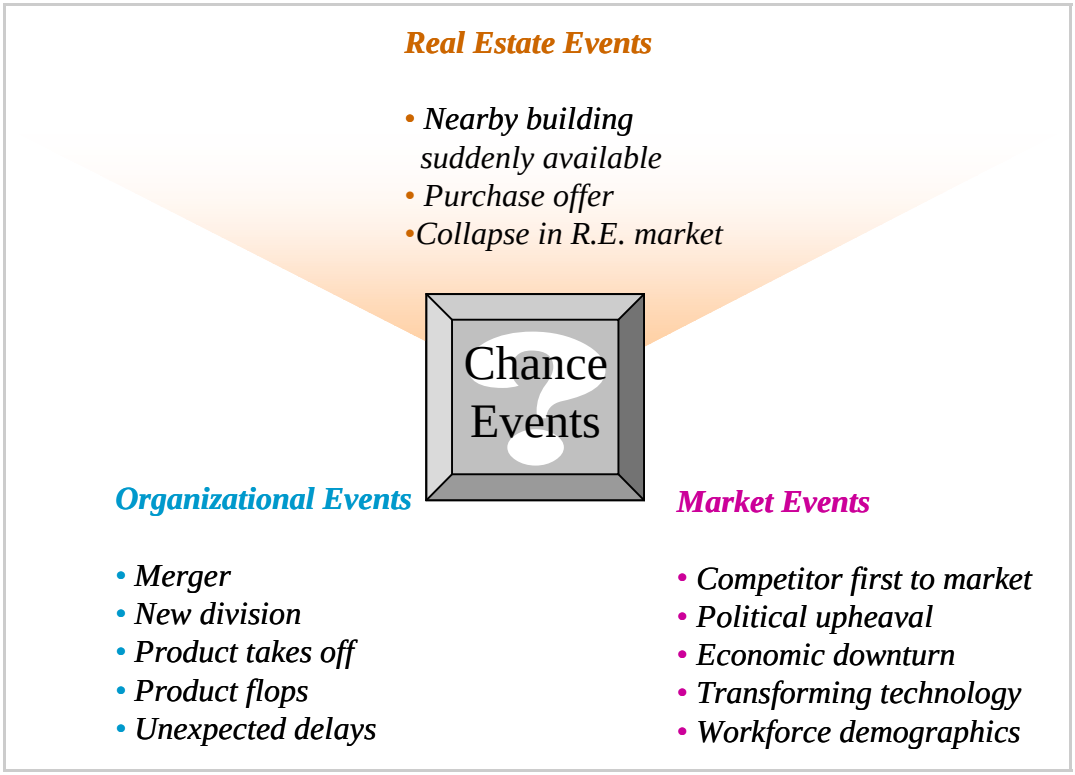
rations and actions" (23). Zero-time space is space that can be procured and/or constructed and ready for use in as short a period of time (as close to zero) as possible from when space is needed. Unlike much of the AO movement, the focus is not on how to reduce the amount of space needed. It is on the ability to quickly procure and be able to use space once demand for it is known. The corollary of procuring space quickly is divesting it in zero time. The problem, of course, is that conventional approaches to procuring and constructing space, and divesting oneself of it, take time. Yet management in today's organizations are low on patience. It is unsurprising that the motto "Just Get It Done!" underlies much of what passes for "process" as we enter the new millennium. Facility managers and real estate professionals in organizations today find themselves struggling to match the sloth-like-speed of conventional workplace making with the time-warp rush of organizational change. It is like trying to run a hundred yard dash wearing concrete blocks for shoes.

An IPS Strategy considers diverse
Organizational Outcomes

Workplace decisions have a range of organizational consequences. Some of these are the cost of doing business, and the speed with which decisions are carried out. Others concern the amount and quality of work done. In practice, such organizational outcomes typically interact and are interdependent. Taking eighteen rather than six months to launch a new software team can mean losing competitive advantage or perhaps the business opportunity itself to the firm that can launch its team faster. It may also mean losing staff who decide to go where the action is *now*, rather than waiting for things to happen. But procuring premises fast may cost more, or result in separating groups who should be located near each other. The fact that organizational outcomes interact with each other and with workplace solutions is the defining characteristic of a *system*; that is, decisions and consequences in one area affect decisions and consequences in another.

Characteristics of Uncertainty

"Chance events", like wind shifts in sailing, shape business decisions. They range from internal organizational events like a merger, organizational re-structuring or downsizing to real estate and market events like being beaten to market by a competitor.



Such events, in combination, directly influence the nature of workplace strategies. Twenty years ago, in large companies in mature industries the number of employees needed, when, and where, was predictable At the very least, once such decisions were made, there was sufficient time to make the necessary arrangements to accommodate them. Infrastructure changes associated with space changes were also relatively simple and inexpensive: adding and connecting telephones, for example. Workplace strategies reflected this high degree of certainty: planning cycles more closely approximated conventional building and leasing strategies, which often required lead times of from 12-36 months. Churn, or the percentage of workstations and offices rearranged each year, was infrequent compared with the one hundred percent or more experienced by many companies today.

Uncertainty takes many forms. Five key characteristics are:

Frequency refers to how often some kind of event occurs. A company might find itself facing the need to accommodate new hires on a weekly, monthly or annual basis. Changes in organizational structure and reporting relationships might occur once every few years or several times annually.

Amplitude refers to the magnitude of an event. Rearranging a few workstations requires different commitments of energy, time, money, and planning than leasing premises or constructing and fitting-out a new building.

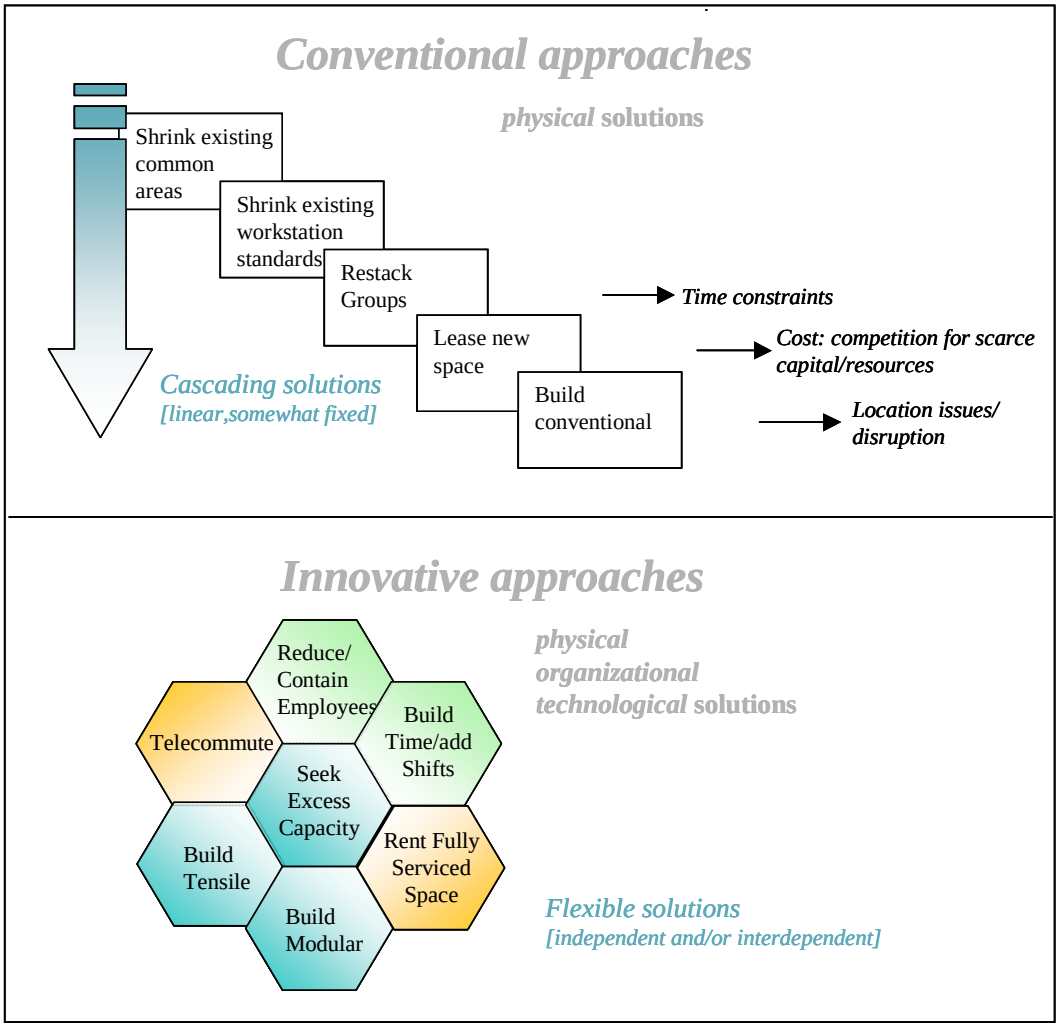
Scope refers to the organizational unit within which the uncertainty exists. This might be at a group, team, department, division, site, or company level. Thus scope spans decisions ranging from parts of a floor to a building to a portfolio of buildings across multiple sites.

Predictability refers to the certainty surrounding the target event. Is there a ten or a ninety-five percent chance that five new employees will be hired in a particular department? What's the probability that a project team will need to be accommodated in six months or a year's time?

Criticality refers to how important it is that the change be accommodated quickly. Will it cause a loss of the business opportunity or simply an inconvenience?

Every single organizational decision and its associated portfolio implication has a degree of uncertainty associated with it. Effectively managing that uncertainty is the new challenge for corporate management.

Conventional vs Innovative Strategies

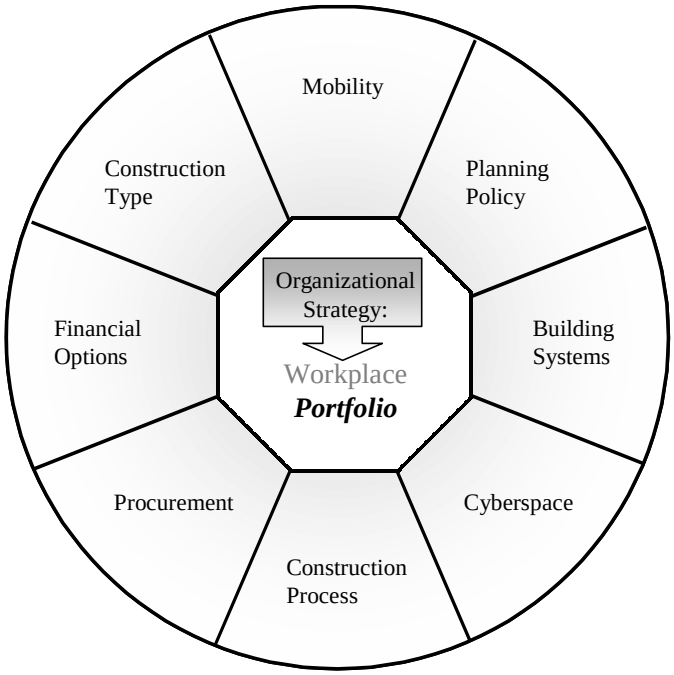


IPS and Diversity

Just as organizational outcomes are interdependent, so are workplace solutions. How the number, type, and use patterns of individual workplace solutions are organized determines the nature and effectiveness of the overall portfolio strategy. The similarity to a financial portfolio is striking. Putting all of one's workplace resources into one or two ways of constructing and procuring space is as dangerous as having all of one's financial resources in a single investment vehicle. The

concept of diversification so critical to a financial portfolio is equally critical to a workplace portfolio. Yet many organizations are still putting almost everything they "own" into the equivalent of a standard bank savings account. It is safe, but the ROI puts you at a financial disadvantage. In an analogous way, a real estate and facilities strategy that only considers conventional leased or owned space in "traditional" types of office buildings under performs organizationally.

Elements of an Integrated Portfolio Strategy

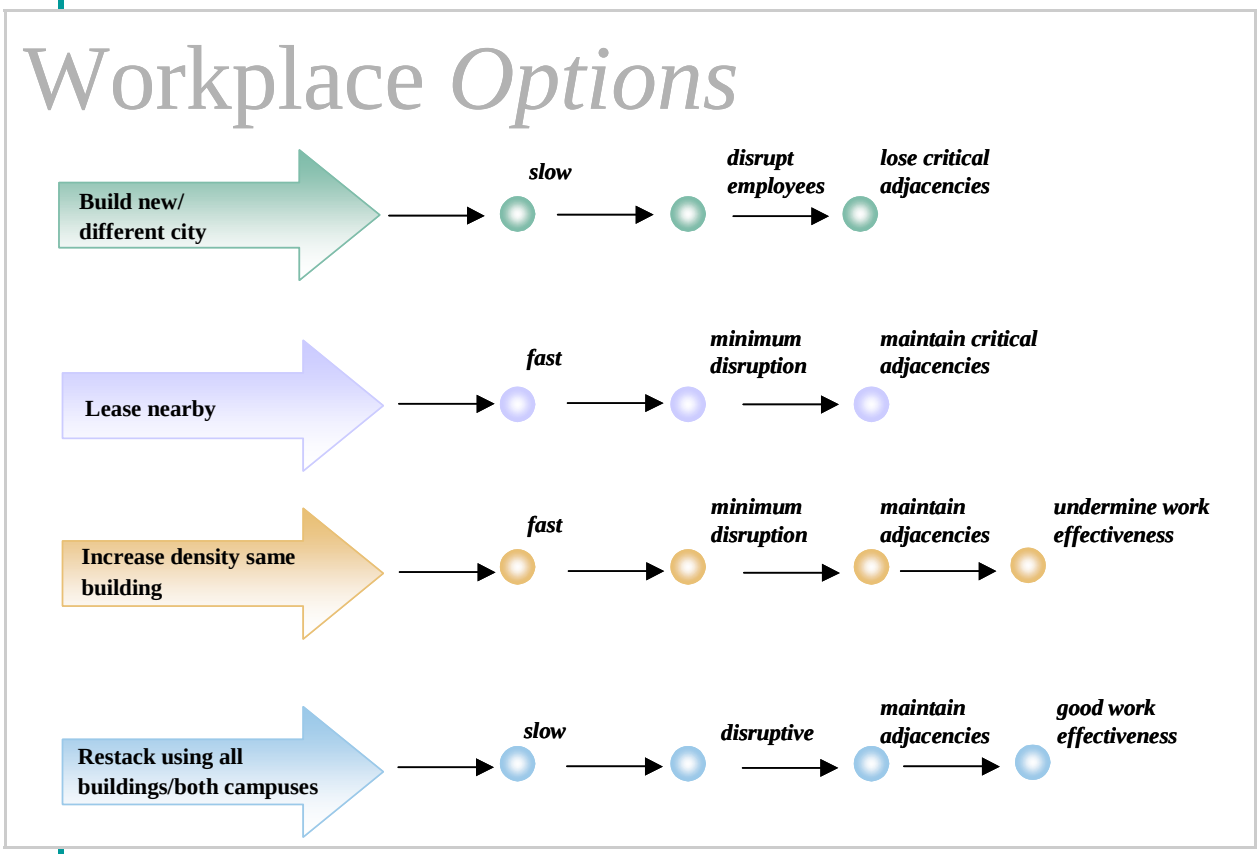


A wide range of solutions needs to be considered to avoid undesirable organizational outcomes that, over time, undermine competitive advantage. Building a conventional office building where the company owns land, even if the location is wrong; or space is only needed for a few years; or some competitive edge will be lost because of the delay in launching a business activity is like investing in a bank savings account simply because it is safe and familiar. A more inclusive and less conventional IPS considers a broader range of workplace solutions, from how space is constructed to how it is procured.

This kind of IPS may include tensile and modular or mobile buildings that can, in comparison to standard building types, reduce the construction time from thirty to almost a hundred percent and even be recycled when no longer needed; new ways of procuring space including fully-serviced offices paid for on the basis of how

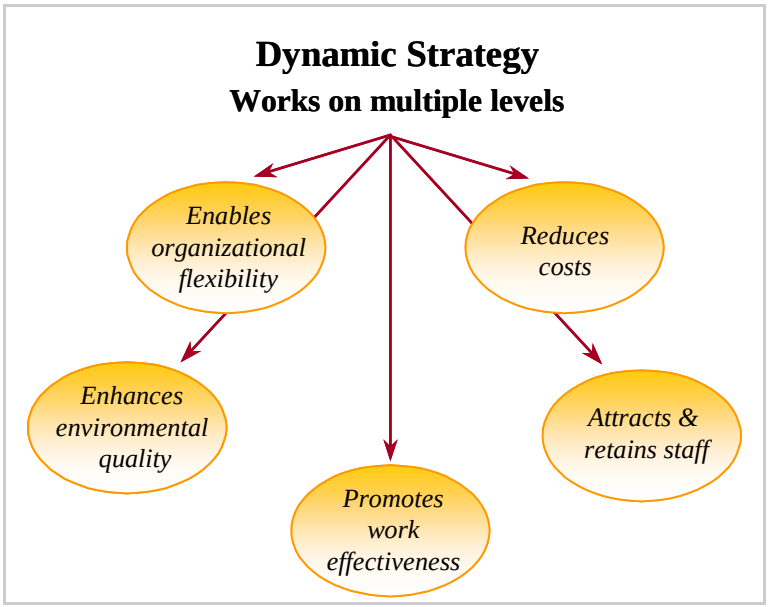
often they are used, not how much space they occupy; as well as the exploitation of information technology for telework.

Any corporate goal, like reducing facility costs, can be achieved through a variety of workplace solutions. What makes decisions about which approach to select difficult is that each one may affect the organization in different ways, to different degrees, and have both positive and negative consequences. Increasing density, for example, is fast. But it often is done at the expense of eliminating common areas that may contribute significantly to how teams interact and communicate. Leasing back office space reduces costs, but if it is of poor quality or in the wrong location it can undermine communication patterns or weaken an organization's ability to attract and retain scarce and valuable staff.



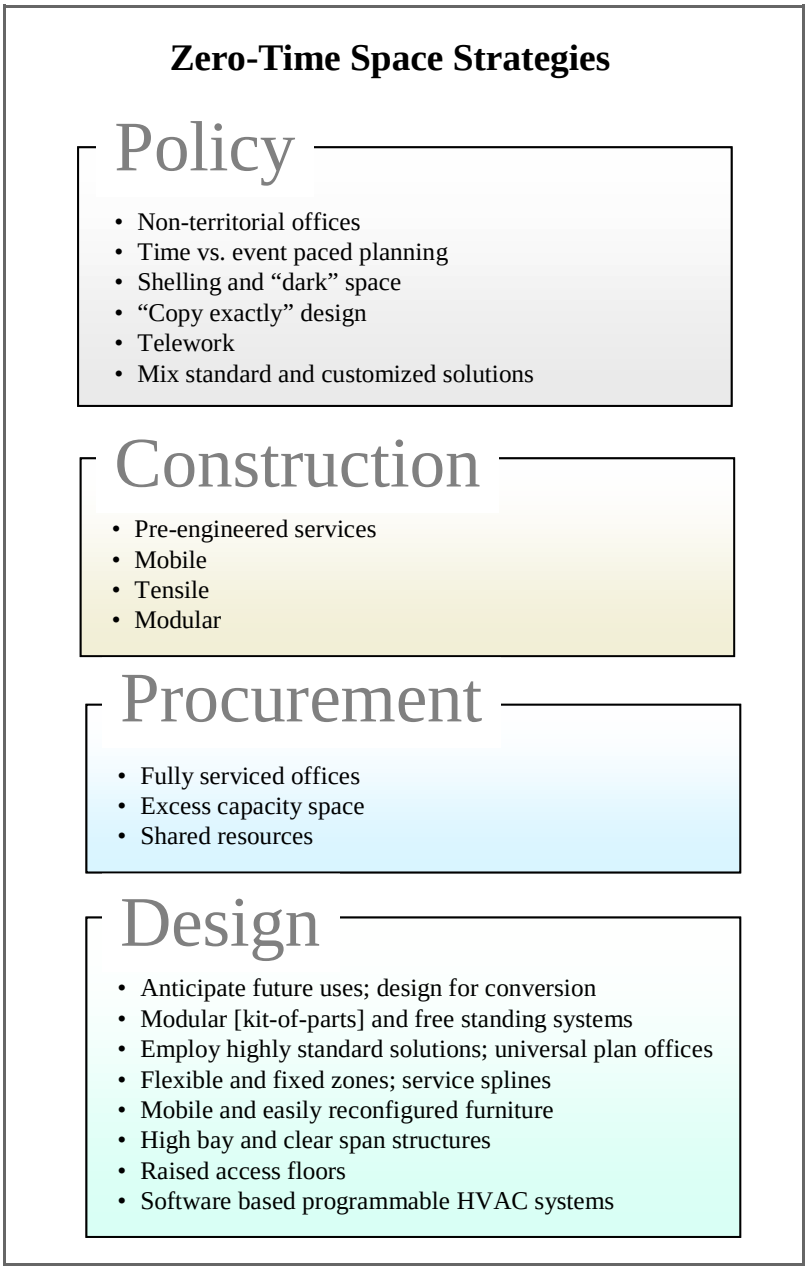
Complicating such decisions further is that many organizations deny the reality that uncertainty abounds about how long and how much space will be needed, or if it will be needed in a particular location, supporting specific work processes and job functions, and so on.

An Integrated Portfolio Strategy must, then, work on multiple levels. It must consider in some fashion not just whether some event or consequence will or will not occur (yes or no), but what the probability of that event or consequence is.



Selected Workplace Solutions

The potential universe of approaches for managing workplace related uncertainty is enormous. These range from real estate practices like buy-out clauses, sublease rights and lease vs. own decisions to exit strategies that allow in a campus each building to be separately leased or sold. Building generic rather than signature buildings, which are more difficult to sell or lease, is also a familiar strategy today, as are building systems like raised access floors and mobile furniture that makes reconfiguration fast and easy. We make no claims about being exhaustive in the approaches discussed in this report. Rather, we have selected a few workplace zero-time solutions that are familiar when applied in one context, but which become "innovative" by new applications. Tensile (tent-like) construction, for example, is widely used by construction companies to provide fast,



inexpensive protection from winter elements or as storage buildings, but not as R&D space. Warehouses of increasingly sophisticated design are hardly "innovative" as storage repositories. But as the basis for a modern call center they are more interesting. Similarly, school systems have employed "modulars" for decades to accommodate population overflow. Much rarer is one of the

world's largest international banks using modular buildings to create a corporate office building indistinguishable from a conventional headquarters building. Small independent professional service businesses have used fully-serviced offices on very short and variable leases or a "rent by the day/hour" basis for years. Making such space part of a workplace strategy is new. Wineries and breweries have long used competitors excess capacity, but this has been less common in the corporate service world. Our goal was to understand some of these "application innovations."

This report seeks to enrich management's image bank of *acceptable* workplace options. The intent is not to promote one or even a few workplace solutions in their own right. Rather, it is to recognize, just as we are slowly beginning to do in the health field, that alternative choices can make sense under some circumstances. Few reputable doctors want to prescribe a herbal remedy for appendicitis; many more these days are willing to consider acupuncture for stress or chronic back pain.

The purpose of this report is to 1) expand the image bank of possible workplace solutions; 2) explore the nature of robust adaptive strategies that reflect the world as it is, not as we want it to be. That is a world characterized by uncertainty and diversity, not predictability and uniformity

Elements of an Integrated Portfolio Strategy

Zero-Time Space Approaches

Zero-time space can be achieved: 1) operationally, by new policies for allocating and using space; 2) physically, by new approaches to construction; and 3) organizationally, by new approaches to procurement and by exploiting the potential of information technology. In practice, these categories overlap and interact.

1. Policy Approaches

NonTerritorial Space

Some forms of AO, notably non-territorial offices, are in fact a form of zero-time space. Unlike conventional office allocation, in which each person has their own assigned office or workstation, and therefore any growth in employee population requires physically adding new workstations or offices, non-territorial space accommodates (within limits) such growth seamlessly, simply by changing the ratio of workers to office spaces. Similarly, this system can accommodate reductions in population without creating vacant workstations that may be permanently reassigned, thus losing the ability to accommodate future growth. The fact that spaces are unassigned maintains this flexibility (36).

Once the system is in place, policy changes (e.g., the ratio of employees to workstations) can accommodate organizational changes at a far faster and less disruptive rate than virtually any other zero-time space approach.

Andersen Consulting, for example, has over time shifted its unassigned office ratio for its management consultants from about 3:1 to in some cases 6:1 or more. IWSP research has found, in examining non-territorial offices for field sales and management consultancy staff in the United States, England, and Scandinavia that about seventy-five percent of the employees surveyed report that such arrangements are “as good” or “better than” their previous individually assigned offices (25).

Non-Territorial Considerations

- Work patterns must reflect staff being out of the office fifty percent or more of the time for extended periods on a regular basis.
- Needs senior management commitment.
- Needs "right" technology to access information and communicate with anyone from virtually any location at any time.
- Requires significant investment for maintaining and supporting technology in multiple locations.
- To avoid "second-class" citizenship, unassigned space (including the total setting, not just the individual work station) should be as good, if not better quality, than assigned space.
- Need to consider potential for social isolation and impact on tacit learning; that means developing and exploiting both information technology and other formal and informal policies to promote the sharing of social as well as work-related information.

Shelling or "dark" space

One of the most typical forms of zero-time space policies is "shelling." This is the policy of deliberately building out space (the shell) that will not initially be occupied. When the need for the space arises, the time between making the decision to occupy the space to moving in the occupants is dramatically shorter than building or leasing new space. At Sears corporate headquarters outside Chicago, the shelling concept has been refined to better accommodate the fact that exactly where in a building or complex more space will be needed is rarely known. Sears addressed this issue by leaving some space in each building "dark." Distributing "dark" space throughout the large complex (rather than in a single building) creates more flexibility and allows groups like IT to be located closer to their internal customer when the need arises.

One difficulty with such "undedicated" spaces is keeping them from becoming informally but permanently dedicated to a group or purpose, often in response to the department that "yells the loudest" getting the space; or, once having it, a department or group hoarding it despite low use, in case they need it in the future.

Shelling can work for research as well as office space. The Genetics Institute built a three story 115,000 s.f. pre-clinical biology research building, with research laboratories, offices, and laboratory animal facilities, to bring together researchers

from five separate buildings. To minimize future disruption, the facilities team left 14,000 s.f. on the first floor (where subsequent construction would least affect the rest of the building) and 4,000 s.f. on the third floor as shelled space. Additional initial construction and ongoing maintenance costs were justified by having easily convertible space within the same building once the best use for it was determined. As it turned out, half of the first floor shell space was left as temporary office space; the rest was converted into animal holding areas. The third floor was converted to primarily office space, with about 1,000 s.f. for labs, less than was originally anticipated but which was easy to convert when the actual need was known in the future this space could be converted to labs should needs change.

Shelling Considerations

- Useful when future demand for additional space is predictable; but not precisely when and where or for what the space will be needed.
- Distributing the space within and across buildings increases flexibility.
- Additional cost results from providing infrastructure that can accommodate different and uncertain infrastructure loads (lighting, HVAC, power, water).
- Projecting sufficient excess space 1-3 years *after construction is completed* is important, so that excess space is still available at the end of construction.

Time vs. Event paced Construction

Intel, the world's largest computer chipmaker, drives the shelling concept to new heights. Intel builds new fabrication facilities every nine months before the chip to be manufactured in that facility has been designed (19). In their business, competitive advantage is lost if one starts construction at the point demand actually occurs. Most organizations wait until the event has occurred (whether it is the design of a new chip, the start-up of a new program, the launching of a team) and then start to consider how to house them. Intel starts with the facility, which is waiting, ready for use, when the need arises.

Copy Intelligently

Another aspect of Intel's overall IPS is what they call "copy intelligently" (21, 33). By this they mean that each new building is a clone of an original standard, with exceptions possible but having to be justified on a case by case basis. The "copy intelligently" policy grew out of frustration with long design times, and the fact that who would actually occupy a building was often unknown. Intel had standards for workstations, but not for floor span or overall design. Since local architecture firms were used in different locations, construction of new buildings became a process of reinvention for each case, adding time and cost.

Today the standardized plan is a four story, 80,000 s.f. per floor building, using open plan workstations of 8'x 9'. The result is a cookie-cutter layout with very little differentiation among workstations or floors. Additional technological infrastructure is incorporated so the space can serve as general office areas or as electronic laboratories. Using this approach Intel reduced construction time from about 20 months to about 15 months on a 320,000 s.f. building, and did it for $120/s.f. compared to between $125-135/s.f. for buildings built earlier. The prime benefit is time saved to become operational, not cost.

Time vs. Event-Paced Planning Considerations

- Highly predictable demand necessary.
- Significant competitive penalty must exist for being slow to market or for a group or team to become operational.
- Few other zero-time space approaches [e.g. leasing/tensile] are available , because of the specialized nature of the facilities (e.g., like a clean lab).

Swing Space

Swing space, also known as flex space, bridge space, surge space, or staging facilities, is temporary space. It is generally located fairly near the original work environment, and used during renovation or construction to accommodate the employees who will occupy the new space.
The drivers of this approach include:

- allowing construction workers full access to site (speed).
- protecting employees from building hazards.
- allowing quick remodeling of existing interiors.
- minimizing disruption to employees from construction.

The scale of swing space projects can range from small groups of employees making a one-time short-term move to thousands of employees involved in staged moves over a decade or more, as is occurring with the renovation of millions of square feet of space at the United States Pentagon outside Washington D.C.

In itself, swing space is not novel. What makes it so is when the space used is constructed or procured in an innovative way. UCLA's Powell Library, for instance (see Tensile structures below), was housed in a 36,000 s.f. tensile structure while a permanent building was under construction. The unconventional structure served its ostensible purpose while providing a unique building form that was

well-liked by many people, in a location close to where the permanent facility would be. The space could be moved and used for other university departments when the library's need for it ended, or sold.

Swing Space Considerations

- Space can be in a single location, used to house on a temporary basis different groups over time as space elsewhere on a campus, region, or area is being constructed or renovated.
- With duration of occupancy typically reasonably well-known, space can be below corporate standards if occupancy is fairly short (e.g., about 1 year or less) because employees fully understand the temporary nature of the solution and its rationale. Employees are more likely to accept below standard swing space (or undesirable location) if they also expect to occupy much better space upon leaving the swing space.

Fully Serviced Space

HQ Offices, Regus and other providers of zero-time office space have understood for years that there is a need for fully-serviced or turnkey office space; that is, space that comes fully ready to use, from furniture to computers, telephones and a receptionist. Sign a lease or rental agreement and the office can be occupied and used immediately. Originally serving primarily very small professional firms (e.g., legal, accounting, marketing) and start-ups, large companies like AT&T, Andersen Consulting and Hewlett-Packard have in recent years formed alliances and special relationships with such providers on a national basis as one way of helping provide space on demand to their mobile workers. Companies like HQ, which started in San Francisco in 1967, are now part of what in 1996 was estimated to be a $2 billion industry.

Regus

Regus is the world's largest operator of fully-service business centers. With a network of more than 225 prime locations in 43 countries, it offers firms fully furnished and equipped offices with short term, flexible leases. Driven by global business that continually pushes into new territory, from China to Brazil to outposts of the former Soviet Union, Regus opens an average of three new centers per week. In 1999 150 new locations were planned in Western, Central and Eastern Europe; the Middle East, Asia Pacific, and the Americas (25).

Organizational Conditions Driving Fully-Serviced Office Solutions

- *New market entry*
- *Temporary office expansion*
- *Special projects*
- *Regional and branch offices*
- *New business start-up*

Driving this dramatic expansion are companies that want to set up an exploratory program in a new geography, the success and growth of which is uncertain; that are involved in a short term consulting project for less than a year; that experience a sudden increase in employee population and need office space immediately, until more permanent accommodation can be found; that launch a new product team for which no space is available in existing premises. For each of these kinds of situations, from a virtual link to long time space needs, Regus offers a workplace solution.

IT Services

Regus clients, depending on what level of service they desire, can purchase, on an as-needed basis:

- *LAN and WAN*
- *Printing*
- *Internet access*
- *File server and firewall protection*
- *Desktop and laptop computers*

Space comes fully-fitted out, as first class office space using high quality office furniture and finishes. Included in a single cost package are rent, local taxes, utilities, security, maintenance, cleaning, building insurance, furniture, decorations (plants, artwork), staff kitchen, and reception area service.

Regus—Moscow office

Regus' underlying premise is not that their space is less expensive than conventionally procured office space. It is that you only need to pay for exactly what you need, where you need it, for as long as you need it. Companies needing space for four months, starting tomorrow, are not forced to lease space for six or twelve months or longer. Nor are they forced to delay operations for anywhere from several weeks to several months while space is being constructed or fitted-out.

Regus' goal is not to eliminate conventional lease and ownership of offices. They estimate that most client organizations will continue to procure about sixty percent of their total space requirements in such arrangements. They are interested in the remaining forty percent (25).

PERCENTAGE OF SAVING - FOR HIGH COST CITY CENTRE AREA

The use of fully serviced business centre offices over conventional office leases for the City of London.

NUMBER OF MONTHS FOR WHICH FACILITY IS NEEDED

# OF PEOPLE TO BE ACCOMODATED	1	3	6	12	18	24	36
1	69%	52	46	39	36	34	32
5	56	33	21	11	6	1	1
10	57	33	33	9	4	-3	-6
15	51	23	9	-7	-13	-21	-25
20	51	25	12	-4	-9	-17	-21
40	42	10	-6	-26	-32	-43	-47
60	43	11	-5	-24	-30	-40	-45

Source: (48)

As a study by the Chartered Institute of Purchasing & Supply for Regus shows, the larger the number of people to accommodate, and the longer the time the space is required, the less savings accrue from using Regus (48). That is, Regus is best-suited for office space needed in lower cost central city areas for a relatively small number of people for less than a year. The data show, for example, that a fully serviced business center in a lower cost central business district for ten people over a period of six months provides a 55% cost saving over conventional office lease. In a higher cost business district the calculated savings are 33%. Should the space be needed for 12 rather than 6 months, the savings drop from 33% to 9 percent.

The key to the Regus business model is not lower cost per se. It is uncertainty risk Insurance.

One pays for only what one uses and only for as long as one needs it. You pay a premium for that flexibility, but for many companies that flexibility is well-worth the premium. Regus also argues that normal lease cost analyses underestimate the total cost of operations, including start-up costs (professional fees, fit out, telecommunications and IT, recruitment, removal, and management time); monthly maintenance and operations costs (e.g., rent, taxes, cleaning, insurance, utilities, furniture, maintenance, security); and variable monthly costs (e.g., personnel, telephone, fax, postage, copying). Few organizations, in fact, can readily produce in a comprehensive and accurate fashion such data in order make a fair comparison.

Regus has expanded the amount of space available considerably beyond the original concept of small office suites. Regus, today, will set up a business center for a specific company. The major innovation is billing clients on a price-per-head basis, instead of the traditional price per square foot. Netspace, for example, is a relatively new, longer-term Regus offering for firms needing a minimum of 50

workstations for three years or more. Unlike the shorter term packages, with Netspace, Regus offers clients the opportunity to choose the furniture and fixtures they want, as well as complete connectivity of the client's choice. In the UK, for example, where leases typically run for 25 years, this is a major departure in how space is procured, even though the cost per s.f. or employee may be higher than with a conventional---but unwanted and burdensome—lease. However, if one considers total cost of occupancy for the desired period only, the costs may well be lower.

Fully-Serviced Space Considerations

- Best for relatively short periods of time (<6 months) and small groups of staff (<50) when accommodated in a single location (in contrast to true "drop-in" office space that may involve hundreds or even thousands of employees and dozens of sites regionally or nationally).
- Makes sense when either very certain about how long will need accommodation (for example, no longer than 3 months for a project team, so willing to pay higher costs per month cost, but only for 3 months); or very uncertain (for example, when entering a new overseas market where no clear idea of extent of market demand and success of new venture).
- Useful when stiff penalties for taking a long time to become operational or enter a market; or for staying longer than work demands or market bears.
- Most available in major urban areas, and for conventional types of office space.

Excess Capacity Space

Digital Equipment Corporation (before being acquired by Compaq) hit on hard times several years ago. To reduce costs, they sold their building on the outskirts of Newmarket, England and renovated and moved into what had been a warehouse space less than two miles away. Then their group grew, so they forged a deal with an alliance partner located nearby to occupy some of its surplus space at below market rates. Both firms benefited. Space was available immediately and below market rates for DEC; its alliance partner reduced its fixed space costs and gained a prestigious co-tenant.

Pacific Telesis

Another example of two organizations finding mutual benefit by exploiting excess capacity is Pacific Telesis and a Marriott Suites hotel. Pacific Telesis sends 20-30 person sales teams to communities in California for 3-4 months each year to sell yellow page advertising. Typically, the sales staff leased and fit-out office space in the community, even though even the shortest leases were longer than the expected sales campaign. Sales staff traveled to the community each week from wherever they lived, and during the week stayed in whatever hotel they chose, using a per diem living rate. In a pilot project, rather than leasing conventional office space and providing a living per diem, Pacific Telesis contracted with a Marriott Suites Hotel with excess capacity at certain times of the year to provide all employees with accommodation. Exclusive use of its conference rooms as a sales campaign headquarters were part of the deal. Both the individual rooms and conference rooms were hard-wired by Pacific Telesis to connect employees' computers to the main system in the office (conference room). The arrangement was that Pacific Telesis would return each year at the same time, and have use of the same facilities they had upgraded. Pacific Telesis had no office real estate costs; just the costs of IT and office furniture and reduced room rates.

In IWSP surveys and interviews we found that the sales staff appreciated having their own workspace within their suites rather than in an open plan office (9). The biggest drawback for staff was the loss of their per diem living allowance, which eliminated the potential to increase their effective salary by staying in inexpensive lodging and keeping the difference between the per diem allowance and actual expenses. Some staff also felt that by not sharing an office with their coworkers they lost opportunities for learning and morale building; and some felt lonely and isolated, though this diminished over time. Pacific Telesis concluded that the pilot saved money without hurting productivity. The employee union argued, however, that the savings to the company came at the expense of the employees, who lost income because of the new per diem arrangement.

Excess Space Considerations

- Whoever is providing the space must not be seen as a competitive threat.
- Corporate security (information) needs to be considered but should not *a priori* be used as a justification for why such an arrangement would not work.
- Cost of adapting another firm's excess space can make sense, if use will be repeated, is relatively long term, and is reflected in other aspects of the lease arrangement.
- Space does not need to be proximate, depending on the intended uses.

Outsourcing

Several of these zero-time space policies imply some form of outsourcing The kind of dilemma that Monsanto faced when considering whether to invest in a new animal research facility that could take five years to build, including the permitting process, and cost upwards of $500 million dollars—while operating in a market where it was ripe for acquisition or merger with a company that might have excess capacity or need capacity in a different location—is harrowing. Companies like Intel and others in the semiconductor manufacturing business face similar challenges. "Talk about a gamble. Invest $2 billion and spend the next couple of years building a plant without a guaranteed demand forecast. That's the foundry business" (53). The enormous uncertainty surrounding some facility decisions is one reason companies that would not have considered outsourcing a few years ago are today. "Given the rapid rise of contract manufacturing, equipment, and maintenance, it's possible that some chip companies will never build another fab" (53). Dealing with this kind of uncertainty is redefining the nature of core competencies. Tom Starnes of the research firm Dataquest predicts more and more companies will outsource manufacturing capability. In the process they will generate whole new highly specialized businesses in which the core business is manufacturing, testing, or design—but not all three. The same underlying principle is leading companies to consider outsourcing reproduction services to Xerox, customer services to Call Centers Inc., facilities to Sydexo-Marriot, and payroll to EDS. This is a significant mind-shift. Writing about the semiconductor industry, Blaise Zerega notes that the until recently the industry's attitude has been that "real men have fabs" (53).

Motorola

Motorola's Semiconductor Products Sector (SPS) plans to outsource the production of half its chips by 2002. In 1998 just 6 percent of Motorola's chips were manufactured by third-party foundries. For Motorola, the cost and risk of building and operating their own foundries in an uncertain world has led them to rethink what their core competencies really are. And the answer was not making chips. It is the development of the architecture, software tools, and design support needed for "systems on a chip" and other next generation technologies (53).

Two concerns about outsourcing quickly surface. One is whether an outsourced company will provide quality at the necessary level. Performance contracts go a long way toward addressing this issue. As does accepting the fact that owning and operating one's own plants does not guarantee quality. The second concern is that

when demand picks up the outsourced firm will not be able to accommodate one's needs—or will charge an exorbitant premium for doing so.

Motorola addressed the second concern by building a close, trusting relationship with their suppliers. "To minimize the foundries' cut of the profits while still guaranteeing itself access to manufacturing capacity when demand picks up, Motorola plans to provide them [suppliers] with proprietary manufacturing or "process" technology specific to Motorola products but possibly applicable to entire classes of chips. By all accounts, this strategy is smart; when chip demand rises and bidding wars for capacity erupt among chip developers, a preferred relationship with a foundry will really pay off" (53). This reflects a significant change in supply chain relationships, discussed in more detail at the end of the report.

At least in the semiconductor industry, what one outsources depends in part on the profit margin for particular chips. Cypress Semiconductor also has a similar arrangement to Motorola's. They, too, would rather invest R&D dollars in proprietary design and development processes rather than in a manufacturing foundry. But they only outsource those chips whose gross profit margins are roughly 60 percent, while continuing to manufacture internally memory chips whose gross profit margins are closer to 30 percent (53). Zerega writes that "In general, where chip companies see little added value in controlling the manufacturing process…. they will begin to hire foundries. Where value is added in manufacturing know-how, particularly for low-margin, workhorse products like memory chips or where design and manufacturing are tightly integrated, companies will keep production in-house" (53).

Not all companies believe Outsourcing's benefits outweigh the disadvantages. Intel believes that ownership of their fab is part of their strategic advantage, given their requirement for state-of-the-art process technology to get high volume and high quality output. The desire to more closely link production and design innovation is another reason companies avoid outsourcing. There seems little doubt that at the bleeding edge of design innovation, tighter connection between design and manufacturing pay off. But that still begs the question of whether you have to own these facilities yourself. Companies like Toyota, pioneered and perfected the concept of lean manufacturing by integrating engineering design with preferred vendors who participate as true partners in the design process. The key question is what uncertainties companies are willing to absorb into their own cost structure as a means of coping with large unpredictable swings of overcapacity and under capacity.

2. Construction Approaches

Mobile, modular, and tensile structures are three types of "pre-engineered" building construction approaches that have the common value of being transportable, relocatable, and reusable. What makes them "engineered" is that they start their life in a factory, and then are transported to the site where they are erected. Each approach is different, but modular, mobile, and tensile structures are typically viewed as of poor quality, and simply ugly. The reality suggests a more complex picture.

Mobile structures

Mobile structures have a long and illustrious history, from Native American teepees to the nomadic North African Turkoman "ger". Early in this century, houses on trailers were used after the San Francisco earthquakes of 1906. And for many older baby boomers, the library if not the ice cream store rolled into the neighborhood once a day or month, bringing the service to the customer. New businesses like WebVan, the internet service that delivers groceries to one's door are, in fact, an old concept updated. Since at least the 1940s, mobile office units have been used as field offices for contractors and builders on construction sites. This zero-time space solution allows a construction team to be housed on the project site as soon as construction starts and then leave as soon as the project is completed. The office follows, on wheels, to the next construction site. From circus to traveling art exhibitions, from truckload sales to chuck wagons and the glitzy 18-wheelers selling golf paraphernalia at PGA golf tournaments, *places* on wheels are a familiar concept. New uses continually evolve.

Kaiser Permanente

Kaiser Permanente, the largest HMO in the United States uses a mobile MRI unit to serve an immense area in Southern California. Like all HMOs it strives to provide quality medical service while rigorously controlling facility costs. Rather than building a separate facility in Los Angeles and San Diego, they bought one MRI and made it mobile. Now it simply moves from one site to another, where it plugs into an existing medical facility. To allay patient anxieties about the treatment, which might be heightened by being inside a "temporary" building (with its connotations of being makeshift), the inside of the mobile unit was designed to be indistinguishable from the inside of the permanent building. Attention to this level of detail captures the need to go beyond meeting technical requirements to making the space *acceptable to the end users*.

The "School Industry"

By far, the greatest application of mobile buildings is in the school industry. In 1997 Florida schools, for example, which have been using portable classrooms for more than 40 years, had 300,000 students housed in one of 18,000 portable, relocatable, modular, or temporary classrooms (52). The popularity of trailers comes from their relatively low cost and speed of delivery.

A particular benefit of mobile places that makes them an outstanding zero-time space solutions is that one needs only pay for the exact time such units are needed and used, unlike a more conventional office lease. William Scotsman is the nation's second largest lessor of mobile offices. With 65 branch offices the company has more than 12,500 customers in 450 industries, including education, utilities, health care, chemicals, engineering services, and construction. Products include classrooms, construction trailers, real estate and automobile sales offices, temporary offices and storage containers. In effect, such mobile solutions share the same concept as fully-serviced offices; namely, pay for only that space when and where you need it.

Companies like Mobile/Modular Express, Inc claim that their units can be provided fully-equipped and installed on site within three business days for stock products. Mobile classrooms can be built for about half the cost of permanent classrooms, with even the most durable modulars, built out of concrete and steel, selling for about $50 per square foot ready to use (29). Installing a modular or transportable classroom is far cheaper than building a school from scratch, which costs about $40,000 per student. The cost to buy a transportable unit is about $5000 per student, while a modular unit costs about $18,000 per student.

Sustainability and other Benefits

Less obvious benefits of portable (and other types of modular and transportable) architecture is that they have a less invasive environmental impact, can respond easily to changing needs, give a large volume of building for a small amount of material (in the case of tensile structures), and are, to a great extent, recyclable (12).

Lighter weight also makes portable buildings far easier to move. Mobile communications systems buildings before equipment is installed weigh between 10,000 and 30,000 pounds, while a permanent concrete shelter can weigh as much as 80,000 pounds; and no foundation is required for a mobile system. Thus they can be put up quickly when there is sudden decision to add service to an area. Because they can be moved, they can also be used to test whether demand is high enough in a particular area before putting up a permanent building, or as swing space (37).

Trailers represent simply one component of an Integrated Portfolio Strategy, used in conjunction with conventional owned and leased space, and innovative policies like time-paced vs. event-paced construction program (where new facilities are building on a predictable time table, in advance of a clearly defined need, rather than in response to a particular organizational or market event).

Mobile units may also, in some cases, be acceptable precisely because they can be moved, and because they can be architecturally unique. Powerhouse: UK was placed without objection in the middle of House Guards Parade ground, in the heart of historic London, because it could be removed at will when it was no longer needed (Glasgow had already, in fact, put in a bid for it for its 1999 festival of architecture and design) (42).

Image and Acceptability.

Nowhere, however, is the gap between what is technically feasible and socially acceptable as glaring as with portable buildings. According to Glancy there is a tendency for all "'decent' people to look down their impeccably clean noses" at gypsies and others who make their homes in caravans or have a mobile lifestyle (24). He notes that, "we tend to think of temporary structures as not quite proper." In 1997 a "portable architecture" exhibition at England's Royal Institute of British Architects focused on temporary, transportable structures, and their origins in earlier human societies. In response, London's "The Guardian" wrote:

> *At no other time [in history] have we had the technology to build for most of our needs while touching the ground lightly…Why is architecture so heavy? Why do we insist on littering the earth with ugly piles of brick and stone, concrete and steel, when we could build gently and lightly? Why do buildings have to be permanent? There have been, and remain, many societies for whom the home itself need not be solid. Let the Englishman have his castle; Mongolian tribesmen have their felt-covered yurts, and snails carry their houses on their backs. So many buildings…date so quickly that we are in danger of littering our towns and cities with redundant hulks (24).*

This attitude is captured by many parents and teachers in Florida, where trailers are common. They think of them as "trashy monuments to the state's school-overcrowding crisis" (29). Given the condition of many portable school units, this is not surprising. Older units are typically cramped, dingy, and prone to leaks. A major reason is that such units are kept in service far longer than intended, without commensurate maintenance. The Florida state legislature determined in 1997 that 75 percent of Florida's portables classrooms should be counted as permanent classroom space (29). About a fourth of portable school units in Florida have been

in use for twice as long as manufacturers intended (29). What was viewed as a short term low-cost solution becomes a long term high cost (maintenance) problem because the solution is in appropriately applied.

This says more about the way such units are managed, maintained, and kept in use than anything about the fundamental concept or potential of portable architecture. Adding architectural details ranging from exterior finishes such as brick or wood to exterior lighting, walkways, and landscaping which unify the classrooms with their permanent school structures helps transform their image. It is also worth noting that despite the poor image of portable school units, a study by Florida's Department of Education in 1993 showed that most teachers found portables to be adequate learning environments - a conclusion supported by national research (29).

Intel Trailer Offices

Intel, the world's largest manufacturer of computer chips, uses a variety of zero-time solutions to cope with its constantly changing and unpredictable business environment. These include "copying intelligently" (basically pushing standardization as far as possible to minimize design time as a factor in getting new space on line), compressing workstations to increase density, and using trailers.

Intel uses trailers 1) when occupancy is shorter than what is available in a standard building lease; 2) to avoid the costs of compressing office size to increase density; 3) to improve synergy from on-campus adjacency to existing buildings. Cost is not the primary consideration. Time and flexibility are.

Intel attaches trailer modules to each other to form an open bay structure to which restrooms, conference rooms, access ramps/stairs, lighting, and an overhead sprinkler system and open plan system furniture are added. All utilities (electricity, voice/data, water and sewer) are brought to the trailer site underground and distributed within the modules. Appearance is similar to the standard Intel office environment, except in two critical respects: the absence of windows and the perceptible bounce in the floor (factors which the Dutch manufacturer of modular units, de Meeuw, has eliminated. See ABN/AMRO Bank, below).

In Oregon, for example, Intel erected 28,000 s.f. of trailer spaces at approximately $55 s.f. for site work and fit out. They rent the units for $4.75 s.f. a year, plus maintenance and operations of about $6.35 s.f. The time from construction to oc-

cupancy was three months. The primary benefit was the ability to keep the design engineers on the same site with those they needed to interact with and to accommodate their need for this space quickly. The costs are much higher than might be expected for trailers, due to the technology infrastructure, that goes beyond what would be found in typical leased office space. However, the final cost was still lower than for owned or conventional leased office space.

Mobile Office Considerations

- Permitting may take longer and encounter more resistance than conventional construction, depending on the location (how visible it is to surrounding community) and duration of expected use.
- Mobile units are generally of lower cost than other conventional solutions, even with specialized features (e.g., more robust infrastructure, telecommunications capability).
- Mobile units main value is speed: to occupancy and to exit.
- "True" mobile units typically are not terribly attractive. However, if they are moving regularly (e.g., like a mobile medical unit), this may not be an issue. It is also possible through clever design both of the units themselves and through devices such as fences, plantings and the ancillary support facilities such as entrance lobbies, cafeterias, restrooms, etc. to change the drab "trailer-like" appearance.
- As much as possible, the interior should be comparable to conventional construction in appearance and feel and level of services.
- Mobile units create opportunities to obtain temporary proximities (e.g., for project teams) on an existing site where any other type of space (leased, owned, constructed) not feasible or available.

Modular structures

The concept of building prefabrication has been around for centuries. Legend has it that a house on the Hampshire coast called "the hut" was constructed in one day in the summer of 1795. Applications range from press boxes for the Olympics and exhibition space to providing refugee housing and replacement buildings and housing following natural disasters like earthquakes and floods. Other building uses include containerized banks, clinics and health facilities, site offices, field kiosks, work camp accommodation, and commercial offices.

The defining characteristic of modular building is that construction utilizes pre-engineered, factory-fabricated structures in three-dimensional sections that are transported to and assembled on site.

Prefabrication construction techniques encompass a wide range of methods but they all attempt to gain an advantage related to cost, speed or quality. Modular prison cells, for example, cost $20,000 per cell, as opposed to $90,000 per cell for permanent structures. Cost savings derive from lower initial construction costs and faster construction which reduce the term of high interest construction loans.

In cases where the revenue-generating potential of facilities can be accurately forecast, each day construction is prolonged can also be directly converted to revenue lost. For banks, retail space, and casinos this can range form tens of thousands to millions of dollars a day. To leverage revenue potential while reducing initial construction costs ESSO, for example, builds modular service stations off site and then assembles them in three days, resulting in a minimal down time for the station. Sears leased a 7,140 s.f. "Clamshelter" to maintain its retail space (and revenue) while renovating its Santa Barbara, California department store. McDonalds builds 600 new sites in Europe each year, 90% of which are built off site (12).

Cost is important; but the key is speed. For example:

- A 5,000 square meter press center for the Bosnia Peace Implementation conference in London in December 1995, including 250 telephone lines, 50 km of electric cabling for faxes, photocopying, video editing suites, and satellite links as well as power, catering, toilets, drainage, security, accreditation and trash handling was built and installed in three days (44).
- A German industrial group with a telecommunications subsidiary wanted to have a significant presence at Telecom '95 in Geneva but was too late to rent a stand in the hall. Instead, they built a temporary structure outside the hall in ten days, with a restaurant and full office facilities, including a switchboard, ISDN lines, satellite facilities and meeting areas on two levels (32). The structure was also portable and was planned for use in future exhibitions (44).
- Less than one month after a major earthquake at California State University at Northridge damaged nearly every building on campus, 24,000 students returned to class in 480 classroom trailers and more than a dozen "Desert Storm" domes. This was just two weeks later than the scheduled start of the spring semester. There were 5400 classes held in temporary buildings on the campus and more than 25 "borrowed" classrooms at neighboring institutions (51).

Factors Driving Speed and Cost

- Speed derives from the fact that components can be constructed independently and/ or simultaneously with other systems. The foundation, for example, can be poured while the building is under construction in a factory. This also reduces the likelihood of "chain reaction" delays in other construction areas. Modular construction typically requires only a third to half the time required for standard construction.
- Improved quality control is more likely in a factory setting than in onsite construction. Better working conditions for the workers, including more comfortable temperatures and more safety precautions can also reap benefits related to quality. In areas where demand for construction workers exceeds their supply, factor-based prefabricated modular units minimize this problem by convening a more stable workforce in a fixed location.

Hedging Bets

There is another benefit of modular and other types of temporary structures indirectly related to cost and speed: they allow one to hedge one's bets. That is, as a form of zero-time space, they allow one to test the viability of a location, getting in quickly but also being able to exit quickly if the market conditions or other factors prove unfavorable (39). In some cases the company manufacturing the modular will repurchase and move it. Moving can be expensive but still is less than 20% of the replacement costs of the total structure.

One week restaurant : Checkers and Rally

Checkers restaurant, a rapidly growing fast food chain plans called for 1,000 drive-thru restaurants, of which the majority are 14 by 54 foot modulars. They are delivered complete with computers, freezers, fryers, lights and even the kitchen sink installed. They are trucked to the site and are typically operational within two weeks. The building itself costs about $140,000, the equipment another $130,000. Typical total opening costs run around $600-700,000. A traditionally constructed fast food unit constructed on-site runs around $1 million and requires more real estate. In an intriguing twist, to meet their own demand for modulars, both Checkers and Rallys restaurant chains have acquired their own modular manufacturing companies. Checkers modular sales to franchisees now makes up to 10% of their revenues (12).

Low cost and speed in response to demand captures portable buildings' potential. The problem is that for the most part, mobile modular units are viewed, and often have been, of poor quality compared to conventional structures. They get the job done, but are rarely liked. This has to do as much with the length of time they are used, and the absence of maintenance they receive over that time (minimal, since they are never expected to be around for much longer). But there is no reason modular units can not look indistinguishable from or function like "regular" office buildings.

ABN/AMRO Bank

ABN/AMRO Bank, established in 1824 by King Willem I, is one of the world's largest and fastest growing global financial services companies. Headquartered in Amsterdam, The Netherlands, ABN/AMRO operates 3,500 branches and offices in 76 countries and territories. The Bank, like all other financial institutions, faces unprecedented change, ranging from national and international regulatory environments and the development of the EURO and the European Common Market to sweeping changes in information technology and e-commerce. Managing uncertainty is today simply a matter of everyday operations.

In this context, the Bank currently builds flexibility into every aspect of their property strategy. Elements of the overall portfolio strategy range from a shift from largely owned buildings to more leased facilities with more flexible (i.e., shorter) leases, typically five years with a five years renewal. Because it is no longer possible to accommodate the Bank's scale of operations in a single building, or even a single center city location, the goal today is "to be together, but spread out." Sophisticated telecommunications is a bedrock of this goal, but so are locations. The Bank is locating its newer facilities outside the Amsterdam center (even outside the relatively recent Southeast Amsterdam business zone, where it built a second new headquarters about a decade ago), near railroad terminals, airports, and major roads.

Views within the Bank about the best or "ideal" strategy regarding location are in transition. Senior management believes the Bank HQ facilities need to be in a (relatively) central area, near the main infrastructure of roads and public transport. Yet locating HQ facilities as close together as possible in a central location generates higher facility costs, which all agree must be reduced. At the moment, a new policy of charging back premises costs to branch banks, who pay an internal market rent, is helping reduce facility costs in the branch bank network.

In general, the ideal real estate strategy for branch banks is much more uncertain because of fast-developing e-

A campus in a year: the Middlesex Community College-Bedford Campus

Middlesex Community College is one of the largest community colleges in New England serving 9,000 full time students. In 1988 they were able to purchase land that would enable them to set up a permanent campus. The site had some existing buildings but they required six additional buildings to provide administrative, classroom, laboratory space as well as a student union. The plan was to provide a "state of the art" campus that also matched the existing neo-Georgian architecture. According to Jim Mullen, Dean of Planning, Research and Development, "Modular construction seemed to offer the only alternative - the college simply could not wait five years for standard construction. " Four and one half of the six buildings were modular including the two story 15,100 sq. ft. central administration building comprised of 26 modular sections. The entire campus was completed within a year. Much of this speed was attributed to the use of modular technology (16).

commerce, with its unclear property implications. The ABN AMRO Bank is a front runner in e-commerce in the Netherlands. With e-commerce becoming part and parcel of everyday life, the position of the branch-based delivery system is being reconsidered. To meet this challenge, the bank has launched a new E-Commerce Directorate to explore new opportunities of electronic commerce in its broadest sense.

Against this shifting business backdrop, the Bank today is willing to consider, and implement, workplace solutions, that would have been unthinkable as little as five years ago. For instance, "hoteling" and home-based telecommuting brokered no interest. Today, several facilities employ hoteling and telecommuting and several others are considering it. It is becoming just another tool in the overall corporate real estate toolkit.

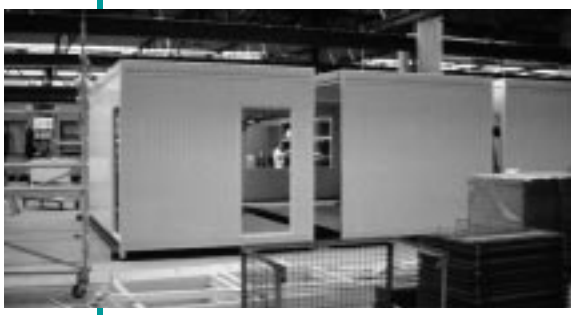
Uncertain business conditions are driving changes in the planning process as well as workplace solutions. Scenario planning, first developed and popularized by Royal Dutch Shell several decades ago, has been adopted to try to anticipate a wider range of potential conditions, problems, and opportunities. Until recently, for example, the Bank paid little attention to exit strategies. Today, as part of new construction, more attention is paid to how a building might be designed to shift use over time from bank to multi-tenant offices. As a result, buildings (not including the huge new HQ, of course!) are becoming more generic, easier to sublet, and more market-oriented in their design. Design characteristics like raised access floors, higher ceilings, standard modules, and programmable HVAC—all of which cost more initially but generate higher residual value because they provide longer term flexibility and the potential to accommodate different functions and users—are being incorporated into the Bank's evolving IPS.

The barriers to more rapid adoption of these various zero-time space strategies are, in part, technological. Information and communication technology (ICT) makes remote communication and the storage and access of vast amounts of information feasible. But it is expensive to install, maintain, and continually upgrade; and it does not always work perfectly. As critical a barrier is mental mindset. Changing mindsets about what is acceptable socially, culturally, and personally is, at heart, what scenario planning and other approaches to helping companies better anticipate and cope with an unpredictable future must change. The Bank has come a very long way in a short time with respect to mindsets about modular buildings.

Modular Construction: A visual primer

De Meeuw Construction Company

Assembly line construction...



Staging areas...

Exploring different façade treatments...

The origins of modular construction...

Foppingadreef (ABN/AMRO)

Three years ago, the Bank found itself needing space, in about six months time, for 600-700 people in southeast Amsterdam. No such space was available to lease. Preferring the additional space to be as close to the existing headquarters as possible, the Bank looked at space next door that had been given to the local council for a playground, but was still zoned for commercial office space. They requested it back, but conventional design and construction would have taken about three years, far longer than the Bank could accept. They proposed building "containers"; people laughed. No one wanted the Works Council (union) up in arms. Whatever was provided had to be "up to standards." No one thought "containers" (modular construction) could do that.

But the corporate real estate management pushed on; they invited five companies to bid for the work. It had to be fully occupiable in 6 months from the start of construction, with very high standards of construction, fit and finish; and it had to be fully ICT wired. The size of the building also increased from 8,000 s.f. to 12,000 s.f.

Ultimately De Meeuw was selected to construct the building. In its final form the building consists of four floors and a total gross area of 11,500 square meters (approx. 115,000 s.f.). It was constructed using 675 prefabricated modules to create 710 workspaces that are a mixture of cellular, group, and open plan offices. Every 1.80 meters there is a fancoil. The floors are made of concrete and the ceiling height is about 2.70 meters. The data infrastructure is state of the art; and the building includes entrance, reception area, meeting rooms, computer room, restaurant, kitchen, and coffee corners.

Foppingadreef *- Exterior view*

The contract is structured as a sale and guaranteed sell back; De Meeuw will buy back and remove the building after five years should the Bank want to do it. The building can be written off for tax purposes after five years, though it is designed to last anywhere from 10-25 years or more with proper maintenance. (The modules can actually be dismantled and returned to the factory for refurbishment). The total project costs were about 31% lower than leasing conventional office space (including rent and refurbishing).

The design process lasted for three months; the permit process for two months; and construction for six months. As De Meeuw, the manufacturers of the modular units notes, a major reason for the reduced on-site construction time was the use of stock components, construction of which could start during the permitting process, rather than waiting for that two months process to end. The total cost was 35 million guilders [$17 million dollars] for design, construction, and ICT infrastructure (not furniture). The modules are designed to the same level of fit and finish as a conventional Class A office building, including all systems, the cafeteria, rest rooms, and support spaces.

One important feature of the design to make modular construction more acceptable to employees was setting the two blocks of modular office units at an angle and to design the link between them containing the lobby, a spiral staircase, elevators, toilets and other common facilities to look like the entrance to a well-designed conventional office building. In addition, the cafeteria included in this linking structure had a very high sloping ceiling and large glass walls that would not be possible within the confines of a modular structural system. Other features included making the floor-to-floor heights higher than normal, which in turn enabled larger window units and higher ceilings than normal for modular installations. The structural module on one wing was also varied to obtain slightly deeper office space to accommodate larger open plan installations. The floors are concrete, which makes for a more solid feel than is typical for modular construction. Finally, the exterior cladding,

The goal was clear: a building that once constructed was essentially indistinguishable from a well-built conventional office building.

In IWSP interviews with representatives of the departments occupying the modular building, including senior management, the building was simply viewed as "just another" office building.

designed to conceal the strict modular pattern, is of the same quality and appearance as the adjacent high quality conventional headquarters office building.

IWSP Survey

Ninety-two percent of employees responding to an IWSP survey agreed that they could "work effectively" in the modular building; 91% rated the modular building "as good as" or "better than" the previous work environment in terms of work effectiveness. Factors that those interviewed reported making the building look and feel like a conventional building included:

- Stone floor in the main entrance
- Spiral staircase in the main entry
- A 'proper" lift (elevator)
- The look and feels of walls, and finish materials (like a conventional building)
- The solid feel of the floor; it was not springy or squeaky
- Normal, solid doors
- Regulated temperature (HVAC system)
- Normal windows (high quality and operable)
- Well-maintained and clean
- External cladding that disguises the modules; looks conventional

The Bank, in the end, met all its objectives: the right amount of space, in the right location, at the right time, for less cost than conventional construction, with the opportunity to stay in, lease to the market, sell, sell and remove in five years time, when the Bank's way of doing business and associated needs may have changed dramatically. The technological achievement by De Meeuw was significant; but the greatest breakthrough was in senior management's mindset.

IWSP

Modular Office Considerations

- Permitting can take longer and encounter more resistance than for conventional construction, depending on the location (how visible to surrounding community) and duration of expected use.
- Modular buildings are generally lower cost than other conventional solutions, even with specialized features (e.g., more robust infrastructure, telecommunications capability).
- Modular units can be designed to be visually indistinguishable from conventional design and construction; they do not have to be "ugly" or totally standardized in appearance.
- Modular buildings create opportunities to obtain temporary proximity (e.g., for project teams) on an existing site where any other type of space (leased, owned, constructed) not feasible.
- It is critical to properly maintain the interior and exterior of modular units.

Tensile structures

Some of architectural history's most influential and best-loved structures, like London's Crystal Palace built for the Great Exhibition of 1851, were designed for only a few month's use. In the more recent and less grand past, about thirty years ago Sym Van der Ryn and his colleagues at the University of California at Berkeley designed and built migrant labor housing from cardboard. The houses folded, accordion style, and could be transported on the back of a truck to the field sites where they were needed; and then be erected quickly. When they wore out, they could be easily recycled. Sustainability meets expediency.

From circus tents to Olympic villages, airports, casinos, churches, exhibition space, offices and scientific laboratories, tensile structures are a familiar part of our built environment landscape. They share with mobile and modular buildings an ancient and admired history integral to nomadic tribes from the Bedouin to Native Americans. Many contemporary images are less appealing: the discomfort typically associated with temporary shelters for refugees and military personnel.

Because tensile structures, unlike modular buildings, also house upscale events ranging from cricket (Lords in London) to posh executive hospitality suites at major tennis and golf tournaments, tensile structures engender a wider range of images than other types of portable and temporary architecture. Many tensile structures are startlingly beautiful because of the quality of light and fluid forms that

translucent fabrics allow. Like some of their more modest portable building brethren, their impermanence provides a form of zero-time space that can be used in a variety of sophisticated ways when permanence is unnecessary:

- The tent-like, 34,000 square foot "Phoenix Pavilions" constructed to take the place of the Pacific Garden Mall in downtown Santa Cruz which was ruined by an earthquake reportedly gave the devastated town a special, community feeling and bustle in part due to the "feel" of the structure itself (41).

Tensile structures—a quick technical primer

The major breakthrough in tensile fabric structures is the fairly recent development of high strength fabrics that can withstand exposure to sunlight, high winds, snow loads, pollution and have extended life expectancies. The three types of structural fabric are vinyl coated polyester, fluorocarbon resin (Teflon/coated fiberglass, and silicone coated fiberglass.

Vinyl-coated fiberglass was initially developed in the 1950s and 1960s for temporary air supported structures. Most recently, silicone coated fiberglass coated with Teflon or Tedlar films give the surface a hard nonstick quality that sheds dirt and pollution and yet can be fabricated with translucency's of up to 50 percent with a life span of 20 years or more. In a tension structure the fabric is stretched in a tent-like fashion from a mast or frame which together with cables forms the structure.

Some of the fabrics are classified as noncombustible and most of the major building codes now have provisions governing tensile structures. Services such as electrical and IT cabling, lighting, HVAC and other mechanical systems require special design and detailing as they will likely be exposed to view as well the cable elements, joints and attachments.

Structural fabric buildings have many advantages. They have shorter construction times than conventional construction. The lighter loads mean there are savings in the construction cost of the building walls, structural systems and foundations. They provide optimal delighting qualities because of the translucency of the fabrics. Fabric roofs reflect light well and spread diffuse, balanced light inside, enabling indirect lighting to be used. The quality of the light is excellent in that there are no heavy shadows, glare is reduced and natural colors are rendered. Because of their reflectivity and their good insulating properties they can save on both lighting and air conditioning costs. The translucency can also produce a glowing signature building at night. Structural fabric is almost self-maintaining. Rain washes dirt and pollution away from the non-stick surface. Tears are easily repaired. Should the fabric wear out, the cost of replacement would probably be about one-third the original cost (46)

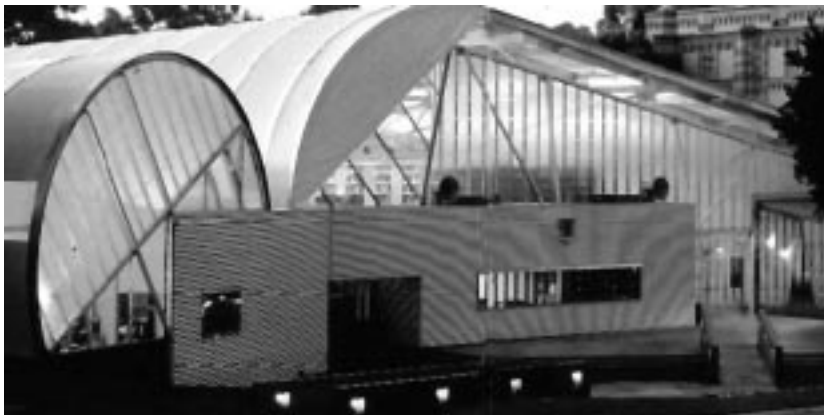
- Plans for the long-term use of a small parcel of land belonging to the Royal Opera House in the northeast corner of Covent Garden were uncertain, so the land was let on a short lease to Clifton Nurseries for use as a retail outlet on the understanding that the site would be revitalized and the surroundings landscaped. The structure was designed as a temporary building but seven years later it is still in use, though not as a garden shop but as a café (1).

- Tensile structures were used as temporary additions to the Georgia Tech campus for the Atlanta Olympics in 1996, including a 24 hour/day dining tent capable of seating 3,500 people at a time and tents for VIP receptions, media interviews, information booths, security checkpoints, and refreshment stands (20).

The UCLA Library

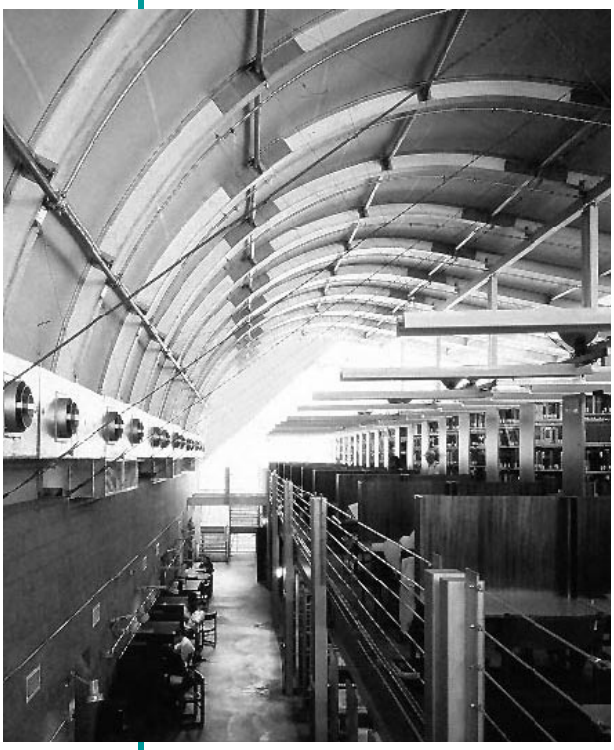
In response to buildings dating back to the 1920s that cannot withstand earthquakes or meet current building codes, UCLA finds itself constantly moving people around while buildings are renovated. These "temporary" moves, as in the case of the Powell Library, can be up to 4 years in duration. During the construction period for renovation, which was to last for several years, the brief called for building a temporary structure to house the roughly 210,000 books, special collections and ancillary activities of UCLA's undergraduate Powell Library. The temporary building was 36,000 square feet, and had to be finished in less than nine months in order to open for the fall 1992 term. With a five-year minimum lifespan, it was also expected subsequently to accommodate other university departments, giving it greater longevity than some of its tenants (33).

The use of tensile structures for everything from construction tents and warehouses, agricultural buildings such as green houses and dairy barns to exhibition halls and sports arenas is hardly novel. What is more unusual is the use of tensile structures to house corporate office and research facilities.



The final design was essentially a modified stock tensile structure. The university planners had considered a Butler building or somewhere off campus but decided the library simply could not be located off-campus, and serve its intended function. The required large floor plate and long span structure was also better served by a tensile building.

The tensile structure built turned out to be a stunning piece of architecture. Built in about 8 months at $70 s.f., (compared to 18 months or longer at $140 s.f. for conventional construction), the structure deliberately creates the impression that it is only a temporary invader of the red brick campus. University planners did not want whatever was built to look "rooted" because they understood the university community would resist its placement in previously open space (11). The tensile system was designed by Rubb Building Systems of Maine, and is similar to that used to cover everything from waste disposal sites and tennis courts to lavish weddings. The tent fabric is "a woven polyester substrate covered on both sides with a vinyl compound. The outside surface is coated with urethane for weathering, abrasion resistance, and cleanability. A separate inner skin supports insulation. The material was wrapped over extruded-aluminum ribs" (11). The library is actually four discrete "buildings", comprised of the administration tent and east and west reading rooms, all linked to the main library tent.



Not everyone loved the building, but most people, according to the project manager, liked it, especially initially. Over time it lost some of its appeal, in part because with heavy use it literally became frayed and old. In terms of acceptability of an unconventional structure, an interesting comment was that the structure was viewed as a "thoughtful" attempt to solving a difficult problem, in contrast to trailers that are widely viewed as reflecting disinterest about what they look like or how they fit into their surroundings. Its architectural characteristics made it possible to keep this temporary structure in a desirable location, something that would not have been likely had the structure been a conventional "stunningly ugly" modular building. In fact, the community embraced the library's offbeat spirit combining the "celebratory bravura of a circus tent with the didactic grandeur of a Gothic cathedral" (11).

Common perceptions that a tensile structure might be unstable also had to be overcome, particularly since the driver for it in the first place was the need to do extensive seismic renovation of the existing conventionally constructed building. To withstand natural disasters the temporary Powell library at UCLA was designed so that the structure could undulate during an earthquake (11).

As is the case with other kinds of portable architecture, an additional benefit of tensile structures is that their potential for reuse and relocation provide a form of sustainability increasingly valued. Much of UCLA's tensile library building could be reused, including the fabric walls, the metal ribs, and the 21 water-source heat pumps tied to the central university plant (11). In fact, when the renovation of the original building was completed after four years, the temporary structure was dismantled and sold to California State University at San Luis Obispo, a short distance up the coast north of Los Angeles. Of the original total cost of approximately $3 million, about half (that portion in foundations, toilets and other conventional portions of construction and infrastructure) was not recoverable. They can and did disassemble aspects of the infrastructure like mechanical systems and support system and the building fabric.

UCLA Integrated Portfolio Strategy (IPS)

The decision to build a tensile structure came from a careful analysis of other options, and was part of an integrated portfolio strategy that, depending on circumstances, considers other zero-time space and conventional solutions, including:

- *Shelling*, although UCLA's experience (and many other organization's) is that by the time the approval process and funding is done, and before the building is completed, whatever excess capacity had been planned is taken. So shelling never actually occurs; the space is fit out from the beginning.
- *Trailer "villages"* are used frequently because they are fast. They're not necessarily cheap, however, when one overlays all the more sophisticated infrastructure needed to make them work in a university context. UCLA's experience is that they really only last five years and then just fall apart, leaving nothing to show for the initial and ongoing costs (essentially the same comment applies to leasing, of course).
- *Prominent Buildings.* The concept here is to build conventional, if not prominent, buildings which are designed for an ultimate end user, but which for the first several years will be used for 1-2 different uses/populations as swing space. The objective here is to create buildings with residual value. Flexibility comes from how the buildings are used and managed rather than from their construction per se.
- *Tents.* A tensile structure was used for the library, and is now seriously being considered for scientific incubator space. A concern is that scientists will not really like it once they have to live in it (not necessarily founded, as the Monsanto case, below, suggests). But the university is getting to the point of seriously considering this option

as the number of university-business partnerships seeking to launch programs quickly increases.

- *Modular.* UCLA had one building erected on site in 8 days, and ready for occupancy in 7 weeks. It was built in a factory 60 miles away months prior to being moved to the site. Minimal disruption on site and getting it there just when one needs it, are attractive features of modular units. But they are not necessarily low cost; and construction tends not to be as robust as for conventional buildings.
- *Pre-Designed.* The idea is to have detailed designs done, so that this stage of the process essentially short circuited.
- *Systems Components.* This is a new idea, more of a goal than an active solution. Because each building has a unique set of requirements, whole prefabricated buildings rarely work. Having a kit of parts that are truly standardized and that could be mixed and matched would enable planners and designers to reap the benefits of both speed and "custom" design at an affordable cost.

Monsanto's "Bridge"

The Monsanto Corporation, a major player in the biotechnology and pharmaceutical fields, has two campuses about 14 miles apart in St. Louis, both serving the research community. One also serves as the corporate headquarters. Like other life sciences companies, the nature of the research being done has been transformed over the last decade. While traditional wet laboratory space still predominates, considerable genomics and analytical chemistry research is now conducted on computers. In this changing research context Monsanto management wanted to launch a new bioinformatics group of about 30-40 researchers. And they wanted them operational in as short a time period as possible, preferably within a few months, maximum, from the time the decision was made to launch the group.

The dilemma Monsanto faced in finding space is a familiar one. They had no available space on the St. Louis campus where they wanted to locate the group, and they felt this was important to in terms of the potential for communication with other related research groups. While space was available on the preferred campus to construct a new building, a conventional building would simply have taken far longer than two months and was more space than was needed. Security concerns and specialized high-tech needs made leased space an unattractive option. Space was available on the other St. Louis campus, but the distance was seen as undermining desired communication. And creating space in the preferred campus by moving groups around would simply disrupt a great number of people. Adding to the complexity, it was not clear how long, beyond one year, the new group would exist, and whether during or after one year they would be smaller or larger.

The solution selected was the “Bridge,” a 7,200 gross s.f. (7,000 usable) tempo rary tensile translucent “bubble-looking” structure using high technology tenting material stretched over a steel frame.

The structure had to meet all the same building codes as a permanent structure. Construction, including all infrastructure costs, was $264 s.f. This figure includes site work, foundations, structure, HVAC, plumbing, general electrical power and lighting, and standard interior finishes, as well as furniture, movable partitions, workstation wiring, telephone and IT. It also includes the permitting, project management, and occupant moving costs, as well as the premium costs for the accelerated schedule. It was not cheap, but it was fast. A conventional building was estimated to cost $211/s.f., and a pre-engineered metal building $200 s.f., (these are estimated costs, not the actual costs, which are often higher. The original tensile estimated cost per s.f. was $202.) From snow-covered ground to being fully operational took 25 days

The interior, with lots of windows, exposed steel frame, and a high curved ceiling gives the “Bridge” a pleasant, light, airy feeling. Systems office furniture arranged both in private offices and small team spaces creates a conventional office working environment. Runs of thin colored fluorescent lights that continually fade from one color to another, run like colorful translucent waves the length of

the structure in the ceiling, creating a lively and dynamic environment. A fish tank in the center of the space adds to the sense of this being a special place, different from the rest of the standard laboratory and office space found throughout the campus.

The Bridge received a one year permit initially. The year elapsed, the group still required the space, and an additional year's permit was granted. Monsanto is now considering extending this approach to accommodate wet laboratories, with their highly specialized requirements for fume hoods and safety systems. When the space is no longer needed, the Bridge can be dismantled and much of it reused at another Monsanto site, or sold to another user. This has an associated cost since one pays for disassembly as well as re-assembly, but many of the systems can be recycled and reused. The building has not experienced higher than usual maintenance costs.

IWSP Survey An IWSP survey conducted about a year after initial occupancy found, in fact, that the Bridge was generally well-received by employees. Sixty-eight percent agreed that they were able to work as or more effectively than in their previous conventional work environment. Eighty-nine percent rated the appearance of the building as the same as or better than a conventional building; and 92% rated the interior environment of the "tent" that way. The tensile structure performed least well with respect to noise (79% rated this aspect as worse than in the conventional building, primarily related to air-handling not people-generated noise). Seventy-one percent rated air quality as the same or better; and 58% rated temperature the same or better than their previous conventional work environment.

Building a tensile structure was a radical departure for Monsanto, a company that has a Midwestern pride in the quality of its campus and facilities. There was a lot of concern about whether scientists would find a "tent" an acceptable work environment, but the pressures of needing to accommodate a new group quickly and near others with whom they worked overcame the risk that researchers would hate working in the building. As it turned out, these concerns were unfounded.

For Monsanto, a tensile structure became a very small addition to a quite conventional portfolio strategy. But it represents a way to cope with chronic uncertainty about what research teams will be launched, how large they will be, how long they will exist, and with whom they will need to interact. The experience has helped Monsanto better understand both the upsides and downsides to this kind of workplace solution.

The building satisfied all the requirements for high-tech and secure space proximate to other associated research teams. Most occupants like the space, especially given the alternative of being split up and squeezed into different places across both St. Louis campuses. The structure has residual sales and use value, in St. Louis or elsewhere.

Most local permitting agencies have little or no experience with unconventional building structures. And if they have, it is often with examples that are poorly designed or maintained (much like the experience with mobile school "trailers"). As a result, Monsanto had difficulty getting building approval initially and eventually had to agree to leave it up for just one year (even though the life of the structure can be twenty times that). This was subsequently extended with little debate.

The Bridge cost more than other options, largely because of the speed of construction, which could not be achieved with the other options. Speed more than cost will not drive decisions for all companies or even for different parts of the same company. But in today's business climate, there are times when speed per se counts. An integrated portfolio strategy with a variety of zero-time space options makes it possible to meet those needs when they occur.

Tensile Office Considerations

- See Modular considerations, above.
- Vandalism is a concern; however, tensile structures can be repaired easily.

Warehouse

In the *warehouse* example, zero-time space comes not so much from the speed of initial construction, as from the potential to easily and relatively inexpensively convert use and reconfigure space, should that be necessary.

Pre-engineered buildings are distinguished, in the context of this report, by virtue of their application to corporate office settings, not because of their inherent design characteristics. The same is true of warehouses and other high bay, long span factory-type structures. They're hardly a new building type. But their modern adaptation for office accommodation makes them worth revisiting.

Orange Call Center

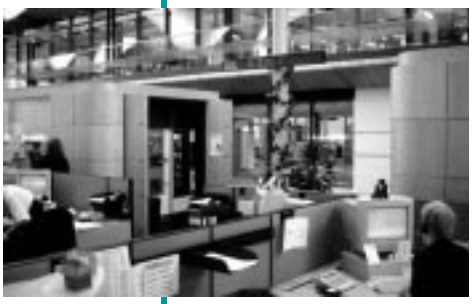
Nexus is one of the Orange cellular telephone company's call centers. Located in Darlington, England, about two hours north of London, the building is a remarkable warehouse cum office building.

Most "white collar" workers find the idea of going to work in a modern warehouse or factory (unless it is a renovated older structure with lots of "character") as appealing as a hand-cranked engine. Yet done with foresight, such structures have the potential to provide a special kind of zero-time space solution.

One of the UKs fastest growing companies, Orange challenges behemoths like BT (British Telecom) by providing more innovative products and services, and better customer service, than its competitors. (For two years running, the J.D. Power and Associates Survey on the UK mobile market ranked Orange number one for customer satisfaction, with its customer satisfaction score 16% above the industry average.) The average age of its employees is 26 years. Costing 8.5 million pounds ($15 million dollars) to build, not counting furniture and design fees, the warehouse-type building has a gross area of about 63,000 s.f. It has four hundred and fifty workstations support approximately 520 staff (across two shifts) working with both individual and corporate clients. As a call center, jobs include a first line help desk, business/account support, and customer relations. All are dependent on sophisticated telecommunications and computer technology.

Why a warehouse? The answer derives from both the nature of the business, (cell phones), and the economic health and prospects of the region. This part of the north of England is, compared to the South of England, economically depressed. Orange selected this area because a) they had other call centers in the area; b) there was an eager and available work force with a strong work ethic; c) and wages are generally 10-15% less than in the South of England. Management wanted a building not only to reflect the Orange values but also to be at the forefront of call center design. Financial institutions would fund, and the local planning authority would approve, a warehouse building; or more precisely, a building that could be easily and inexpensively converted to a warehouse should its use as an office no longer be economically viable.

Nexus is, in fact, just that: a warehouse fitted out with rather extraordinary lighting, standard modular office furniture, and more windows than one typically would find in a warehouse. But should it be necessary, the building could be converted to a factory or a warehouse in short order because of features such as a standard warehouse floor throughout the building at the same height as the parking area; access for trucks and materials from the parking area to the rear of the building; and external wall construction easily converted to accommodate large doors for warehouse use. The building took 12 months to design (in large part be cause design features like the unique lighting "trees" had to be designed and engi



neered from the ground up). It took 12 months to construct. Thus what makes Nexus a "zero-time" space solution is not the speed of construction, but the speed and ease with which the building can be converted to an alternative use should that be necessary.

Workplace Feng Shui in Northern England

Designed by Nicholas Grimshaw Partners (NGP), Nexus is unique on a number of counts beyond its warehouse chassis. The company is part of the Mannesmann Group—and a firm believer in Feng Shui. To create a building with "good Chi" (energy), the building followed the advice of a Feng Shui master to incorporate:

- A "gold mine" under the computer room, represented by a pit filled with Chinese coins and golden sand to "feed" the computer and bring the company good luck and profit.
- Placement of gold coins under structural columns, a row of coins at the entrance, and lucky coins in the managers' offices, all of which symbolically "walk money into the building."
- Tiny elephants a few inches high placed inconspicuously at the corner of the roofs and near the entrance doors to keep evil spirits away. Brass tortoises are buried under the ground outside.
- A South-facing glass wall to allow energy to flow into the building.
- A Budda in the catering manager's office to promote good eating.
- A fish tank in the entrance, with golden coins and model turtles buried under the tank to ward off evil spirits.
- The use of bamboo, which is believed to bring good luck. Trees and plants in corners keep evil spirits away, which are thought to collect in these dead-end locations.

While Feng Shui characteristics might seem far afield from zero-time space solutions, they are relevant because management's mindset, specifically initial resistance to the idea of a "tent" or "container" or a "warehouse" being a first class kind of office, can inhibit consideration of workplace solutions that might, in fact, under some circumstances make sense. Our interest in Nexus was understanding design characteristics, including Feng Shui features, that might influence employees' acceptance of a warehouse as first-class office accommodation.

Over two days we interviewed a broad cross-section of employees, from senior managers and floor supervisors to Call Center Representatives. We quickly realized that most staff knew about both the potential for converting the building into a warehouse or factory and the Feng Shui characteristics of the building. Whether believing in them or not, their presence and underlying thought gave the building a sense of being a little exotic. Staff also appreciated how Nexus House had carried through the strong concept of branding associated with Orange as a whole. The colors, graphics, and words adorning the building were all instantly recognizable to anyone familiar with Orange's print, TV, retail, and billboard advertising. Staff were proud to be part of this well-known company with its hip reputation.

The building itself generated mixed reviews. Staff we interviewed recognized and frequently commented on the value of the building as a selling tool to prospective clients who appreciated its professionalism, the sense of order and energy, and the commitment to quality and innovation that that carried over from all the other branding activities (e.g. advertisements). The building's character and image was, in fact, aligned with and reinforced by all the other messages the company communicated to the public. Prospective employees who were often taken on a tour of the building by employment agencies reportedly found the building light and airy, professional but not intimidating, despite its size. The building sent a consistent message that reinforced both staff's and client's initial largely positive impression of Orange and its reputation as being forward-thinking if not "hot". The wonderful light fixtures, the first-class canteen and chat areas all contributed to this impression.

The warehouse character of the building, then, made a dramatic and positive impression on both clients and prospective staff. However, for several staff, Nexus was known as the "aircraft hanger." This had something to do with the structural character of the space (i.e. its huge volume); but it had as much or more to do with the fenestration, finishes, and colors; that is, with the feeling of the space. The south-facing window wall resulted in some heat gain and glare on computer screens, necessitating drawing blinds across most of the South wall large portions of day. At the same time, the North wall was a solid, gray steel wall, without windows. The other two sides of the building let light in through a single narrow band of windows about six feet or so off the ground. This window band permitted staff to see outside from anywhere in the building, but with a restricted view.

The industrial aesthetic deliberately designed by the architects, with its exposed metal steelwork, gray industrial character, and limited palette of colors (consistent with the overall Orange brand) made the building feel "not quite finished, at least for some staff; more like a factory production line. The contrast with the reception area, with its sleek, blond-colored polished wood surfaces was quite stark. Staff also noted that as a business, Orange is quite colorful. The gray steel walls did not, at least for some of the staff we interviewed, reflect the fun side of the business. Several staff commented that how the building felt was dependent on where one sat in it. Looking north, to the gray steel walls, the building was cold and industrial. Looking the other way, with windows and more wood visible, the building felt warmer and more pleasant. Given the building's volume, many staff noted their surprise at how calm and quiet the building was. The normally quiet conditions that are so surprising given the hard surfaces and warehouse feeling of the building are a result of the very high ceilings. The sound energy decays almost completely by the time it travels to the ceiling and is then reflected back to the workstation level.

As we have found over a decade of research into AO, the physical reality of the building interacts with other social and organizational factors to create the system known as the "workplace." In Orange's case some of these extra-environmental factors were the provision of free (and good) coffee, subsidized vending, and good health care insurance. These kinds of perks and benefits are not always typical in a call center environment, and so carry extra meaning when present. Likely even more important was that as one of the UKs fastest growing companies, opportunities for rapid advancement abounded. Several staff noted that Orange recognized and rewarded talent. As one young man said, prior to coming to Orange he "had done nothing." He had no education beyond high school, and came to Orange essentially asking for a second chance. They gave it to him, and with hard work he has "shot up through the ranks." In the context of an older British social system, the merit-based focus of Orange was a welcome change—and highly motivating.

Nexus works at several levels. As a building that can be easily converted to industrial or warehouse use, it meets its first and primary criteria; the potential to accommodate radically different use at any future point in time should that be necessary. It works well as a call center and office building, providing a calm and quiet environment in a business that is often frenetic and chaotic. It has a distinct architectural character that, for the most part, staff appreciate. Aspects of the building such as its gray metal color, limited color palette, south-facing window wall and limited windows elsewhere reflect conscious management choices, and are not inherent characteristics of the building type. While neither management nor architects want to consider adding mezzanine space to Nexus, this could, in fact be

done, generating considerable additional capacity at relatively low cost. The internal layout of offices and workstations could also, should management choose, be radically reconfigured with minimum disruption to accommodate different work functions, or different management philosophies about how to organize work.

IGUS Factory

Over the past decade corporations in the service sector have borrowed considerably from practices originally developed and implemented in factory settings. Work practices like cross-functional teams, employee involvement, and ergonomics, started life in manufacturing settings. As part of our exploration of zero-time space approaches, we looked at the IGUS factory in Cologne, Germany, to see what insights we might gain from how a leading-edge manufacturer of injection molded polymer bearings/bushings and flexible power supply chains used an innovative factory to accommodate a changing and expanding business.

Started as a family job shop business in 1964 in a garage in Cologne, Germany, IGUS today has 600 employees and 200 million DM ($100 million dollars) in sales, with point of sale offices in fifty countries. Two product lines, chains and bearings/bushings represent the core business. Still a family business, today led by Frank Blase, the son of the founder, the goal is sales of 1 billion DM ($500 million dollars) by 2013. The sense that a company manufacturing bearings and bushings would be fairly staid and dull rapidly disappears when talking with Frank Blase.

Frank Blase has continued the progressive approach with which his parents launched the company almost forty years ago. From a hiring process that includes a “schnuppertag” (a “sniffing” or snooping) day for employees to come and look over the factory where they will work, to an architecturally renowned building designed by one of England’s leading firms, the Nicholas Grimshaw Partnership, IGUS does things differently—and has prospered as a result.

Even how one gets around the factory conveys core organizational values. Employees whizzing around on electric scooters capture the sense that IGUS is a dynamic, fast-paced organization that expects people to work hard and have fun in the relentless pursuit of exceeding customer expectations.

What is different about the IGUS factory? Foremost, is that it is an integrated headquarters and factory building that was designed to allow any function, from human resources, marketing, and information technology to product design, testing, quality assurance, manufacturing, and warehouse to be located, or relocated, anywhere inside the same building shell with minimal cost, time, or disruption. The original brief called for the shell to accommodate anything from a factory to a supermarket, and to be capable of accommodating new product lines or internal reorganizations and expansions in as close to zero-time as possible. With 2,500 new products this year alone, this kind of flexibility is fundamental. Aspects of flexibility incorporated in the building include:

- *Building skin*
- *Building height*
- *Clear span structural system*
- *Building systems*
- *Furniture and equipment*
- *Space allocation policies*
- *Site with adequate room for expansion*
- *Semi-portable mezzanine system to accommodate office functions*

More specifically**,**

- *The clear span structural system provided by tensile cables from structural columns (masts) in the courtyards allow for totally open floor areas where uses can be located or relocated anywhere without obstructing columns.*
- *Any panel can be quickly and easily changed from a solid, to a window, to a door simply by removing bolts.*
- *"Pods", self-contained mezzanine level rooms within the building shell, are not easy to move, but easy to add.*
- *Exposed building systems, including the electrical, HVAC, water, plumbing, and power/data organized in easily accessible cable trays and "drops," make it possible to locate services anywhere in the building without restriction.*
- *Modular systems (furniture and interior panels, as well as interior and exterior cladding, are bolted rather than welded on. The bolts are exposed and easily accessible, minimizing the need for special tools or labor.*
- *The furniture is freestanding.*
- *Demountable internal wall systems.*
- *High bay mezzanine, making possible the Pods and other multi-level space within the same building shell.*
- *The absence of space/workstation standards (function-based allocation), so that can reconfigure and allocate space needed and available.*

The factory/office today occupies three 70x70 meter modules, each with a 18x18 meter courtyard in the center, plus a 1,925.s.m. temporary addition which will eventually be removed for construction of a fourth module. In addition to providing outdoor break areas, the courtyards contain the structural towers to which the cables supporting the clear span roof are attached. Office pods on a mezzanine level are 10x10 meters. There are currently fourteen of these, with plans for two more in the near future.

Fifty major changes have been made to the building in the past four years, ranging from completely shifting manufacturing lines from one part of the building to another to installing a 4,000 s.m. expansion module adjacent to the existing building. Expansion into the new space was accomplished by simply disassembling the wall by unbolting and removing the formerly exterior wall panels while the factory continued to operate.

Building construction took nine months. An exterior polyester-coated aluminum panel, simply bolted on, can be removed in ten minutes; an interior panel takes from 1-2 hours. The modular bolt-on panel system makes it possible to convert a solid panel to a window or to install a door at any time, with minimal cost and disruption. Whole new pods, a kind of building within a building, are not easy to relocate, but adding new pods is easy and has occurred several times. Because cabling lies in exposed cable trays, setting up a new computer takes 1-2 hours. A new workstation can be installed in a day, including telephone, computer, power, and air pressure (if needed). It took two weekends to change the tooling department, with all its machines, to offices. The bearing department, growing between 40-60% each year, has completely moved locations five times in five years.

Because the building is so flexible, decisions about relocating work groups or departments are made quickly. As one employee put it, "We don't worry about change—only that it will work better." Thus organizational requirements drive how the building functions, not the (too familiar) other way round. Achieving this level of flexibility cost about 15% above conventional construction. The open plan is not perfect. Despite locating as much noisy product testing equipment as possible in a closed room on the factory floor, noise on the factory floor from production machinery and other machines is a problem for those doing more office-like engineering work (inventory, quality assurance, telephone).

But the factory is used to do more than just accommodate internal change. It is also used to attract customers and staff; that is, as a form of branding and an expression of corporate culture. The single company cafeteria and open plan offices and engineering and manufacturing areas stimulate serendipitous and informal communication, something not regularly found in German companies. As a new employee in the accounting department noted, one reason he came to IGUS was that he found it interesting and unusual to *see* people working at 6pm on a Friday. He liked the idea that the culture emphasized being productive, not being status-conscious.

It is a culture where what counts, not unlike the Orange call center described earlier, is what you produce, not who you are or where you were educated. A very good bonus program, unusual in Germany, in which one can earn 20-30% of one's

annual salary based on individual performance and company profits, reinforces the focus on being productive. The absence of any status-driven facilities, whether toilets or dining, conveys more strongly than printed material or a video presentation the company's core values. The impact of the building on employees' work effectiveness was also positive.

IWSP Survey

An IWSP employee survey found that 73% of the employees responding to the survey agreed that they were able to work "more effectively" in the IGUS building than in their previous workplace.

It is not a place for everyone. Prospective employees watching staff and management, including Frank Blase and other senior managers, zoom around the factory floor on electric motor scooters makes visible the value placed on being innovative, aggressive, dynamic, and hard-working. There are few places to hide and the pace is fast. For some people, especially older employees, this is not attractive. That is the point. IGUS uses the building to promote self-(de)selection as well as attraction.

Organizational Culture and the Flexibility Aesthetic

At IGUS, management worries about the overall look and feel of the factory, but not about perfect alignment of workstation panels, cable drops, or adhering to a predetermined perfect module. That, in itself, saves considerable time, effort, and money. The aesthetic is about flexibility and getting the job done. The corporate value is *utility;* building-in-use, capable of quick change to support virtually any imaginable type of work activity, from engineering design and product testing to product manufacturing, warehousing, accounting, sales and marketing.

Warehouse Office Considerations

- Initial cost is lower than for Class A office space.
- Relatively easy and cost-effective to convert to other uses.
- Highly flexible interior, allows fast and easy reorganization of space as needs shift over time.
- High bay and open space makes it possible to integrate office and manufacturing functions together in a highly visible and interactive way.

3. Cyberspace

It is impossible to discuss many zero-time space solutions without considering some facet of cyberspace. Policy approaches like hoteling and home-based telecommuting, or even the use of modular or mobile units placed wherever they make most sense, are "virtual" workplaces that depend on telecommunications and computers to make remote communication and the storage and access of electronic information possible. All work in cyberspace exists in real time in physical space.

As even fully Web-based companies like Amazon.com, WebVan, Toys-R-Us, E*TRADE , Giftcertificates.com and other firms with no physical retail presence have discovered, one still needs warehouses and back office facilities. The past Christmas shopping season also saw companies for the first time moving back and forth between physical (retail) space and electronic space. The initial fear that the Web would kill the shopping mall, for example, has proven unfounded. Instead, we see companies using their physical locations to advertise and boost their Web presence; and visa versa.

The ultimate exploitation of cyberspace, however, is to substitute electronic for company-controlled space by, for example, outsourcing one's manufacturing to a firm specializing in computer assembly or chip manufacturing, or contracting to use another firm's excess capacity, whether for manufacturing or office work. Here, cyberspace takes the form of information transfer and electronic communication, among both end-use customers and/or business customers.

Why build a warehouse for inventory when you can build computers on-demand, using just as much inventory as you need?
Why ship computers to a distributor who puts them in a warehouse until the retailer needs them; and who then puts them in another warehouse until they are actually sold?
Why not just ship the computer directly from the manufacturing line to the customer?
Why should a manufacturer like HP or Compaq assemble their own computers?
Why not just shift that part of the manufacturing process—and related facility needs—to another company by shipping orders to another firm that will put yours—and your competitors-- together for you.

In terms of flexibility and cost, the most flexible and least expensive type of office space is not having it; or significantly reducing how much of it you need.

Flow-through technology, now common in the manufacturing sector, eliminates the need for considerable amounts of warehouse space by linking the demand for product directly to the manufacture, shipping, and distribution of it—a model made famous and profitable by Dell Computer.

Approaches like hoteling and compressing workstations, both of which increase density without a commensurate increase in space, or using another firm's excess capacity space, reflect the same principle. Use - and pay for - only what you need when you need it. Reduce the slack in a system by intensifying the use of each place where activity occurs. Essentially, cyberspace simply shifts where work can be done and who owns or controls the places where it is done; it does not eliminate the need for space. Cyberspace solutions are dependent on being part of a larger system of loosely-linked workplace settings connected by the physical movement of people and the electronic movement of information. The radical departure from past practice is accepting that using space does not invariably mean controlling (leasing or owning) it oneself.

Cyberspace Considerations

- When the technology works, cyberspace is terrific. When it fails, it is hell. It is getting more reliable and easier to use. It is still is not as reliable as your washing machine or your telephone.
- To the extent that cyberspace means less predictable physical contact and face-to-face communication with co-workers, suppliers, and partners, it increases the potential for loss of tacit learning, for short-circuited communications, for a sense of social isolation. Formal and informal work policies and practices need to be developed to maintain and help new social systems flourish.
- Working in cyberspace depends on more than technology; it requires trust between management and employee; between corporation and supplier.
- More, not less, information is needed, and it must be instantly accessible in real time to make approaches like shared services, space, and equipment work (whether for conference rooms in a building or across a companies regional offices or shared equipment in a laboratory environment).
- Because cyberspace is less reliable and less familiar than conventional ways of working, it requires more energy and higher levels of social as well as technological maintenance.

Gaining Competitive Advantage

Just as alternative officing was widely viewed as having limited application five years ago, many of the workplace solutions briefly described above seem that way to organizations today. Portable, relocatable, mobile buildings, for example, are not widely accepted as *desireable office and research space*. This is despite the fact that technically they may perform as well as their more conventionally constructed counterparts, but with far more speed and agility in terms of how long they take to be erected, dismantled, moved, leased, sold, or recycled.

Such portable architecture also has far greater technical capacity than many senior managers, including those in corporate real estate, may realize. GE Capital Modular Space, for example, offers modular buildings with customized HVAC systems, sprinkler and fire alarm systems, and the capacity to house hazardous equipment. Customized exterior designs and interior and exterior finishes render these buildings essentially indistinguishable from conventional facilities.

They are fast and inexpensive to build; but they are not widely appreciated, primarily because innovative applications of these approaches are still fairly rare. When done well, as it was by Monsanto, a "tent" can be a more interesting space to work in while providing comparable functional workspace to any other on the campus. Yet even here, the idea of *regularly* using sophisticated tent-like or other portable and temporary units or space the company does not own or control, has until very recently been given little consideration.

The concept of "alternative" in the context of **Integrated Portfolio Strategies** is not that employees necessarily work differently. In most cases the goal is to make an alternative form of constructing or procuring space indistinguishable and transparent to those working in it. The benefits flow to the company in terms of speed, flexibility, cost, and usability that maximize options about where and when space will be needed, given chronic uncertainty about a variety of market and organizational conditions.

The Organizational Ecology Perspective

Most companies understand that whatever workplace solutions they adopt must meet not just basic cost, timing, and functional requirements. They must simultaneously be *acceptable*, if not *inviting*, to employees who are extremely talented and highly trained and whose demand in many sectors, as we enter the 21st Century, outstrips their supply. This is especially true in the case of

industries such as information technology, biotechnology, and pharmaceuticals.

Just as AO needs to be understood (i.e., planned, designed, and managed) as a complex ecological system in which issues of organizational culture must be considered along with technical and design issues, so, too, must IPS consider the broader organizational and professional context in which physical solutions are developed and implemented.

Our examples suggest that attention to user-friendly design, and design that defines "function" to include creating highly-pleasant, if not architecturally distinct *places* (not just space that accommodates a function or is fast to erect and easy to reconfigure) benefits companies on multiple levels, from greater flexibility and less cost to attracting and retaining the workforce and acting as a sales and branding vehicle with customers.

Cost Implications

The kinds of zero-time space solutions described in this report suggest that "reasonable" cost in some cases may mean comparable or *higher* costs than for conventional leasing and construction, at least for the time the space is actually used, as in the case of fully-serviced office solutions. Or, it may mean higher costs for a particular type of solution than with more conventional applications. Intel's experience with trailers and ABN/AMRO Bank's with modular units reflect the fact that building a *better* module or trailer costs more than lower quality and less user inviting construction of the same type, but less than comparable conventional construction.

Organizations are coming to understand that under certain circumstances it is worthwhile to pay a premium for zero-time space because the opportunity cost of failing to acquire that space when it is required, or keeping it past when it is needed, can be enormous.

In the pharmaceutical industry, for example, delays in bringing new products to market can costs millions of dollars a day in lost revenues. Getting a key development team up and running in 3-6 months rather than 12-24 can have a real competitive advantage. Monsanto's tensile "Bridge" captures this equation perfectly. They paid a premium to erect the Bridge in 25 days time; the cost of construction was secondary *in this instance*.

Zero-Time Space and Interdependence

In our review of the literature, we have found little empirical research systematically examining *over time and in use* different approaches to developing zero-time space. This report scratches that surface. Whether using a competitor's space to house one's own work processes or building a village of temporary buildings, organizations, vendors, and consultants need to invest in broadening and deepening their understanding of what constitutes an Integrated Portfolio Strategy and the individual workplace solutions that comprise it. Such knowledge will help organization's build confidence in the concept of an Integrated Portfolio Strategy. The learning process mirrors that which transformed Alternative Officing from a high-risk cutting-edge approach to just another tool in the corporate real estate toolbox. It is a tool that supplements and complements conventional solutions rather than replacing them.

Key Drivers:

An Integrated Portfolio Strategy with zero-time space solutions must work on four levels simultaneously:

- *Cost*
- *Flexibility*
- *Acceptability*
- *Speed*

Cost, flexibility, acceptability and speed are highly interdependent, despite the fact that containing or reducing costs often gets top billing in today's corporate world. Reducing costs at the expense of slowing the speed and flexibility needed to accommodate a new project team, or to exit space no longer needed, or to house a completely new group as part of a reorganization or merger can impact how fast new business plans are implemented. These ultimately affect sales, revenue, and service-levels. Integrated Portfolio Strategies understand the dynamic interplay among cost, speed, flexibility, and acceptability. Putting up a structure that no accountant or scientist wants to work in, or can work in effectively, is like buying a car for $1,000 to commute to work even though it only runs occasionally.

IWSP research suggests that there are no simple answers to questions of what is faster, cheaper, more flexible or acceptable *at a generic level.* People typically will say they hate modulars and find them ugly and uncomfortable; yet ABN/AMRO found very high acceptability levels when a modular building was finished to a high standard. The same could be said for Monsanto's Bridge or the UCLA Powell Library. These are "tents", but utterly unlike the tents the same manufacturer sells to cover construction sites or serve as warehouse space. The idea of working in someone else's space, whether an alliance partner or a provider of fully-serviced offices like Regus, may be viewed as undermining a sense of corporate identity. But why, if that space is indistinguishable in form and function from a thousand other offices, including one's own corporate facilities?

The difference between an unconventional solution being acceptable or not, lies in both imagination and a clear sense of what counts, from a business perspective.

De Meeuw, in the Netherlands, worked closely with ABN/AMRO to produce a first class office building that happened to be constructed from modular units. Strung, the company that manufactured the Bridge for Monsanto, works with clients to apply known technologies in new ways. Getting buy-in for zero-time space solutions takes imagination on the client side: the vision to see how a conventional solution could be adapted, with effort and imagination, to create a more interesting hybrid. In simple terms, our research over the past two years shows that virtually *any unconventional workplace solution*, from non-territorial office or an "office" warehouse and flexible "factory" to outsourced space, tensile structures and modular buildings can work well as part of an IPS, as long as the individual solutions are conceived as part of a highly interdependent overall strategy that continually evolves over time. That means changing both management's and staff's mindset about what constitutes acceptable and feasible office accommodation.

IPS and Organizational Culture

Workplace strategies do have, of course, technical underpinnings. From under floor ducting to sophisticated telephony, getting right the engineering aspects of a workplace strategy is critical. But these factors *follow* values; they rarely lead them. And even when technology seemingly does lead, for example when much more powerful servers at much lower prices seems to drive a cyberspace rather than physical space solution, it often still reflects management values. One manager trusts the technology to work; one does not. One believes customer relations can be forged electronically; another believes that face-to-face contact or a physical presence is a prerequisite for a business relationship. Sometimes these views are grounded in statistics on cost savings, feedback from customer focus groups or sales figures. Data can help shift these views, but in the end, it is the mindset that counts.

Workplace strategies are not technical decisions, per se, despite their grounding in engineering, architecture, finance and other technical disciplines. The nature of the workplace portfolio reflects management's mindset over time.

The primary obstacle to new workplace strategies is not so much technical limitations as cultural ones; that is, management, community, and employee views about what is acceptable, if not preferable, rather than what is technically feasible.

The Integrated Portfolio Strategy (IPS)

In *Manufacturing and the Lean Portfolio,* we introduced the concept of the "lean portfolio" (4). Its essence was that companies needed to develop a broad portfolio of real estate options. Some of these could be quite conventional; others might substitute electronic space for physical space or a competitor's or suppliers space for one's own space. Not just the nature of the space, but who offered it was also changing.

"The goal is to change management's mindset. With that change, comes a willingness to consider options and strategies previously rejected" (47).

Companies were looking to vendors like Kinkos, that started as a copy shop and has become a full-service off-site office provider, to provide its mobile workers with office space wherever they happened to be working. No longer did one necessarily go to a real estate broker or an architect or construction firm when space was needed. One might turn to an exhibition design company, as did the Bank of America when it wanted to erect branch banks in a matter of *days* rather than months. Or, as in the case of the Checkers restaurant chain, one might go into the modular construction business after discovering that costs could be reduced from around one million dollars to six to seven hundred thousand dollars by using modular construction.

Conventional boundaries for constructing and procuring space are disappearing.

Understanding what the nature of an Integrated Portfolio Strategy should be for what kinds of industries and jobs, and under what set of circumstances different zero-time workplace solutions are best applied, will create new business opportunities for those firms and individuals that learn how to deliver IPS with zero-time. It will also enable organizations, frustrated by the inevitable gap between how long it takes to bring a conventional building on-line, by conventional lease periods, by the unavailability of acceptable space in the desired location at the right time to create an IPS that uses the scarce resources of the organization with greater imagination and to better effect.

Robust Adaptive Strategies

All companies would like to operate in a simple, predictable world. If it ever existed, which is doubtful, it no longer does. In a world populated by companies like Amazon.com, Dell Computers, E*Trade, and ToysRUs.com, conventional business approaches to marketing and selling are becoming obsolete. That is no less true in the realm of workplace strategies. Our focus on "managing uncertainty" reflects this fascinating, and sometimes frightening, world.

No business arena is more uncertain and characterized by more variety and change than the software industry. Eric Beinhocker, whose work we have drawn on extensively, uses the principle of requisite variety and the emergent complexity of a complex adaptive system to explain Microsoft's unparalleled success navigating the swirling waters of the software industry (10, 31, 32, 40, 49) . At the 1988 COMDEX computer and electronics showcase in Las Vegas, Beinhocker noticed something curious about the Microsoft booth. It was neither the largest nor splashiest. He described the booth as more middle Eastern bazaar than trade-show booth. In effect, Microsoft's booth was a mini-marketplace of its own. In one corner was its just emerging Windows system, with little market share. In a second corner the company was showcasing its latest release of DOS version 4.0. In a third corner it was displaying OS/2, which it was co-developing with IBM. And in the fourth corner was prominently displayed the latest releases of Word, Excel, and other applications for the Macintosh.

Charting a course in today's business world means navigating the enormous complexity and interdependence of uncertain systems. Trying to wrest control, force order and eliminate chaos with simple and standardized solutions is unlikely to succeed. A better approach is to fight uncertainty with variety and complexity.

The word around the complex was that Microsoft had lost its way and that Gates had no vision. Beinhocker writes that "…whether it was by intent, instinct, or luck, Bill Gates created a very robust strategy for securing Microsoft's position. Clearly, his preferred outcome was Windows' success, but he could see that this was by no means certain. His strategy was aimed at those uncertainties" (10). He could win no matter which way his customers turned. The same approach is occurring with Microsoft and the Internet today.

Beinhocker argues that "strategy development inherently requires managers to make a prediction about the future. Based on this prediction, managers make big decisions about company focus, the investment of resources, and how to coordinate activities across the company. Yet developing strategies based on narrow predictions about the future is like trying to put out a fire with gasoline" (10).

We should take a cue from nature, Beinhocker argues, and change the way we develop business strategy, relying less on our ability to make accurate predictions and more on the power of evolution. He sees biological evolution and business evolution as complex adaptive systems, in which case it makes sense to use some of the same tools scientists have used to better understand biological evolution to understand business strategy.

An *adaptive* population of strategies keeps an array of options open over time, minimizing long-term and irreversible commitments. Robust, adaptive strategies

Recent scientific work underscores the fact that "our intuition about uncertainty may be understated, and that the business world is even less predictable than we think—and that our minds are even worse at forecasting than we might hope."
Beinhocker 10)

willingly sacrifice the focus, apparent certainty, efficiency, and coordination that traditional strategies provide for the sake of flexibility and a higher probability of success. "Microsoft's population of operating system strategies was neither focused, certain, efficient, nor always coordinated. Nor is its population of Internet strategies today. But the first represents the greatest business success since Rockerfeller and Carnegie, and the second may prove greater still" (10). The key, for Beinhocker, is to cultivate and manage populations of multiple strategies that evolve over time. In terms of this report, that is an IPS.

Elements of an Adaptive Strategy

For thinking about the key characteristics of an adaptive strategy, Beinhocker suggests a metaphor of an Alpine hiker whose goal is to reach and stay on the highest peaks. The challenge is to do that when its foggy and you cannot see far ahead; when there might be an earthquake; when the food is only at the peaks and if you stay too long in the valley you could starve; and you have no map of where you are going. How do you survive in such a landscape?

Keep moving

In the biological world, species respond to a constantly changing environment and relentless selection pressures through mutation and sexual recombination, "constantly reshuffling the genetic deck in search of higher fitness" (10). In other words, create a dynamic, continually evolving mix of workplace solutions, some of which will survive over time and some of which will disappear or be modified. Because fully-serviced or non-territorial offices may not survive in a decade, or new construction techniques may make it possible to significantly reduce construction times without building modular units is not a reason for not exploiting their potential today.

Deploy a platoon of hikers

The more places you are simultaneously exploring, the more likely you are to find a new higher peak or to know where good spots are when your peak begins to collapse. Parallism in experiments increases the odds that one or more will work out. A population of strategies allows for diversity (requisite variety). Parallelism allows you to take a few risks without 'betting the farm" (10). In the context of IPS this means that one might explore the use of more sophisticated modular *and* tensile structures, along with using another firm's excess capacity space for a defined period while using conventional space in more imaginative ways.

Mix short and long jumps

An *Adaptive Walk* is a process of incremental upward steps in the landscape: a short jump from what is familiar. *Pogo Jumps* are great leaps into the unknown, where you can jump off a cliff or land on a much higher peak (10). The key is mixing conventional approaches (e.g., leasing class A office space), minor adaptations (e.g., compressing space) and radical departures (e.g., a tensile structure or leasing space with a competitor or relying on cyberspace).

Bombardier, the Canadian aerospace, transportation, and recreational vehicles high growth company mixes conventional with more radical initiatives. Current initiatives include a new class of ultra long-range business jets, military aircraft maintenance services, and electric vehicles for neighborhood transportation. Bombardier does not invest in all initiatives equally, but they do invest in the whole range.
Beinhocker (10)

The underlying metaphor for complexity is biology, not physics.

"*In nature, genetic diversity is critical to species survival. If a species has a diverse portfolio of genetic experiments, and the environment changes and reduces the fitness of typical members, the existence of atypical members, some of whom have a quality useful in the new environment, makes the species survival more likely. By mixing short and long jumps, the population of strategies will include a greater diversity of experiments, which will undoubtedly produce some unfit mutants; more importantly, however, the diversity may contain the seeds for success in an unknown future" (10).*

Value Strategies as Real Options

Fundamental to the concept of a robust adaptive strategy is choice, or options. Most companies emphasize the financial value of potential strategies. But most of these measures, like NPV, payback period, return on capital, and the like have a common flaw: "They fail to account for the uncertainty of the future and the probability distribution of different potential outcomes. One option may open up entirely new avenues of exploration and another might be a dead end, but traditional analysis gives them the same value" (10). Taking space in a fully-serviced office complex, for example, may look less financially viable than leasing one's own space. If, however, the less expensive lease not only commits the company to a location it may no longer need during the life of the lease, and perhaps even more importantly, if sharing space with other companies generates opportunities for staff to make new professional contacts and to broaden their understanding of a market or new technologies or identify new business opportunities, then the seemingly straightforward financial analysis underestimates business value.

"Not only is there value in having lots of choices, there is also value in having a choice available over time, as it provides flexibility in an uncertain world."
Beinhocker (10)

In the financial world, an option is a right, but not an obligation, to buy an asset within a certain time at a certain price. Options have value because they create and preserve an opportunity to do something in the future (34). As the example above suggests, "A strategy also has option value because of what it *could* lead to, as well as what it is intended to lead to. The strategy may open *future possibilities* (not certainties) that the company did not have available to it before" (34).

Workplace solutions that solve today's problems while buying future time are an important component of a diverse and continually evolving Integrated Portfolio Strategy. Maintaining the right to build a conventional structure in the future, should the organization require significantly more space then, while erecting a temporary or mobile structure on the property immediately, may ease a current space crunch and still preserve future flexibility.

The goal is to create real options that preserve flexibility at a cost that recognizes the value of flexibility.

Is there a cost to this? Yes. The cost of money and/or construction may increase over time, and taxes must still be paid on undeveloped land. Is it worth it? It depends on the degree of uncertainty associated with future growth and with the real estate market. If taking these factors into consideration one does decide to build now, then one can build a generic building, or as Apple Computer did with its R&D campus in Cupertino, California, develop buildings that can be easily sold or leased or sub-divided, each with their own identity and security, to continue to hedge against future uncertainty.

Our objective is not to urge every company to build a tensile structure or sign a contract with Regus or HQ offices for fully-serviced space or to allocate 15% of their next new building to "dark" space. Nor, however, is it to rely on a limited array of familiar workplace solutions unlikely to help a company prosper in an uncertain future.

Relationship and Knowledge Options

In terms of corporate real estate strategies, the options concept can be extended to include the nature of the workplace supply chain. This might mean, for example, developing working relationships with companies that manufacture modular and tensile structures so that, should this type of solution be needed at some point in the future, the time, energy, and information needed to make it work quickly has already been invested. The option, in this case, becomes the relationship, not the specific product.

One might also think of options not only in terms of workplace solutions, but in terms of "knowledge options." That is, investing in gaining experience and knowledge about different workplace options, in advance of needing to actually select and implement them. In the event that at some time in the future one or more of them make sense to employ, they are likely to be much more quickly and intelligently selected and implemented if one understands their critical success factors.

The military exploits knowledgeable options continually in the training exercises it runs to develop a deep working knowledge of, say, how to erect a temporary bridge under adverse weather conditions or in the shortest span of time. It is not known exactly when or where or why the bridge will be needed; only that at some time it is likely to be. At that point, being able to just get it done is what counts. The time invested in training exercises (in options terms, the knowledge and experience gained is the "right" to deploy) implies no obligation to use that knowledge, but it is there at any time in the future should it be necessary.

Thinking of options as the right but not the obligation to apply knowledge or call on a relationship should, as a natural outgrowth of the learning process itself, change the way management thinks. At its most effective, it may lead to reinventing one's business or one's role within the enterprise.

Corporate Real Estate as Supply Chain Management

Most corporate real estate managers know the business they are in, or do they? Many real estate executives see themselves as managing real property assets. It may make more sense to think of themselves as managing customer-centric supply chains (13).

Real Time and Historical Knowledge

Exploiting supply chains to manage uncertainty and increase flexibility requires information. Think of car rental agencies. What greater uncertainty is there? Avis or Hertz have no idea what person will want to reserve a car at a particular location for what length of time. But they have to have a car available *right now* whenever that request for service occurs. In effect, they are absolutely dependent on two types of information. One is historical. Over time, what has been the demand for rentals in a particular location at particular times of the year. The second type of information is in real-time: What cars do we have available in this location right now, when are cars expected to be returned, what cars do we have in

other nearby locations that might be transferred to this location? The combination of real-time and historical data allows car rental agencies to match supply with demand.

In most organizations, neither good historical data nor accurate real-time data exists. Few companies can provide in zero-time (i.e., on-line) a comparison, for example, of projected with actual headcount, to see how accurate the demand projections have been and whether, and to what extent, they need to be adjusted. This kind of data is the bedrock on which modern logistics systems depend.

Retailers, for example, use routing and load-planning systems to create plans that result in less mileage, shorter routes, and heavier loads. After a driver's tour of duty, onboard computers download the data into a host computer system, and from there it is fed into the routing software. With information about what should have happened and what did happen located in the same database, a retailer can refine the routing process (43).

In our experience, few companies have access to a real-time data system that shows where space is located and what its occupancy and density patterns are; or how many job offers have been made, for what specific groups, in what locations. Fewer yet have data available that shows how long a group or team is expected to need space (like a rental agreement that says the car will be returned in a week's time), and whether these projections are accurate. That is, they have no model of basic business processes such as how long teams engaged in particular types of projects typically stay together, how many people join and leave them throughout different phases of the project, and so on.

What most companies do have is experience that tells them they will need more space at some point in time, but that exactly where and when is uncertain. That is why options and zero-time space are so important.

If you don't know exactly where and when you will need space, but that it is highly predictable that *some group* will need it, then having a variety of workplace solutions at your disposal to respond quickly when demand is known becomes very important. Being proactive in this context can mean building space in advance of known demand (the Intel time-paced planning model); or it can mean having mobile structures on-call (from a manufacturer who can keep a supply on their premises), or having a policy and information technology infrastructure in place to allow hoteling or home-based telework or a satellite office in an alliance partner's excess space.

"*Microsoft pushes for flexible, short term leases. It is spurring developers to build "hold' space. Microsoft has expansion options on that space over several years, but not on a must-take basis. They are also looking at establishing common landlords in multiple locations. That would allow Microsoft to have a flexible space "bank" account, expanding in some locations, contracting in others … Microsoft looks at the cost of not having real estate on-line" (2).*

The key characteristic of an IPS is that these workplace solutions (options) are developed and ready to be implemented *before they are needed.* They are an insurance policy to hedge against uncertainty. The key element of an effective strategy, from this perspective, is not the solution per se, but the right information and experience about demand, on one side, and how to implement different solutions on the other. The goal is agility: "the ability of an organization to thrive in a continuously changing, unpredictable business environment" (18). Dove argues that key enablers for an agile organization are knowledge management and change proficiency, "a competency that allows an organization to apply knowledge effectively…." (18)

Knowledge management and change proficiency are hardly new concepts. What is new is the "need for more formal and conscious understandings about these practices, raising them to the level of a recognized competency brought about by the quickening pace of knowledge development and knowledge-value decay" (18).

These competencies, in turn, are linked to a much better and closer development and management of the supply-chain relationships. Companies need to learn how to cooperate in order to compete. For corporate real estate executives, the supply chain will become more diverse, involving manufacturers of modular and tensile structures, fully-serviced office vendors, real estate brokers, information technology and human resource experts. The focus shifts from managing real property assets to simply providing the space needed, where and when its wanted—not necessarily owning or controlling that space exclusively. That means more outsourcing, more use of shared resources within and outside the company. And that requires managing these resources, which demands far better information than exists today.

Within supply-chain partnerships this commitment to sharing information ratchets up considerably. Peter Haapaneimi describes this changing mindset, in part, as a shift from the traditional supply-train, where the focus is on the product and how to make and deliver it as efficiently as possible, to demand chains or "customer-centric" supply chains. Here, the starting point is the customer's needs, and the focus is on delivering tailored products when and where they customer wants them (26).

The supply chain may also include competitors who share the same challenges and dilemmas, and who may be able to help each other. In the attraction-retention arena, for example, high tech firms in the Albany area of New York State have formed an informal but strong pact to cooperate in attracting and keeping staff. That includes finding your own best employee a job with a competitor if that means keeping the person from leaving the area altogether.

Why? Talent in an area attracts other talent. The same person may come back to work for you in two years time, but with knowledge and experienced gained from working somewhere else in the area. And what talent you give up today you may gain from your competitor tomorrow. Industry benchmarking partnerships, in which competitors share information about workplace metrics and workplace approaches reflects this principle.

Customer-centric approaches rely heavily on information technology, and the sharing of relevant information. "Networks, shared databases, the Internet, and extranets make it possible for trading partners to quickly share information about customer requirements, production, delivery schedules, and so on" (18). Information travels up and down the chain almost simultaneously, making it possible for actions to be taken more proactively.

As companies like Dell Computer have so brilliantly demonstrated, with a customer-centric view the goal is not simply having a generic computer available when the customer wants it. It is having a computer *configured to the customer's exact specification* available. This flys in the face of much of the thinking about delivering zero-time space solutions today.

Standardization and Customization

Standardization, making everything the same, fitting as many different people doing different jobs into the same workstation, in the same building type, and with the same equipment is widely viewed as the best way to both cut costs and speed the provision of space. It makes sense - on the surface. Yet much of the rest of the product and service world is heading in the opposite direction, toward mass customization.

Office "manufacturers" need to seriously consider the potential for mass customization. It takes the right kind of information, linked to a web of cooperating suppliers working together to solve a customer problem. The real competitor is not

Several years ago the company that provides Walmart with weather stripping did so based on three zones across the country. Then they went to 20 zones, and then to a state-by-state basis, and now they supply weather stripping on a store-by-store basis. So instead of selling to one chain with 2,300 stores, they are selling to 2,300 chains, each of which has one store. It took new information tools, and a new mindset.

the individual company, but the supply chain itself, "the interconnected web of amoeba-like companies, if you like, whose operations and destinies are closely linked." These groups might more accurately be called "supply webs," according to Gene Tyndall, a senior partner at Ernst & Young.

The idea of a kit of parts, assembled on site, has existed for most of this century, if not before, and continues in the residential building industry today. The modular building industry is based on the same underlying standard components premise, but the difference in practice is that every unit comes out identical, rather than using standardized and universally compatible parts to generate diversity. Bicycle manufacturers, and many other product manufacturers from consumer electronics to industrial machinery, have avoided this approach. Almost all bicycle vendors, for example, have what amounts to global "virtual" products. Frame manufacturers create finished bicycles by selecting from an enormous variety of specialty components manufactured by companies located around the world. "Plug compatibility" means that almost every component and frame will fit together.

Industrialized process are exploited to create a rich variety of customer-influenced choices. And since, in the case of direct sell approaches like Dell Computers, the computer is not made until the order is received, inventory is reduced, products do not exceed their shelf life, and customers get what they want.

The idea of mass customization is directly at odds, of course, with the more widespread trend found in facility and real estate organizations of standardizing as much of everything as possible.

At the workstation level this takes the form of "universal plan" offices (the office footprint being the same size regardless of what kind of job function occurs in the space). At a building scale it takes the form of Intel Corporation's "copy exactly" policy. The goal is for all new buildings to originate from a blueprint of standards based on floor plans that benchmark existing facilities by type (21). As much as possible, the goal is never to treat a project as unique. Every request outside the standard has to be cost-justified. As Greg Meyers, Manager of Corporate Real Estate Strategic Planning for Intel notes, the system is "intentionally bureaucratic to keep project managers from thinking that they've built the better mousetrap" (21).

The irony is that companies like Intel manufacture products going into computers and other information technology devices that increasingly recognize precisely the

opposite: that they cannot force the customer to buy what the company decides, in advance, to manufacture. Dell Computers, now followed by the other major computer manufacturers, pioneered the idea of build on-demand in response to specific, individual, customer requirements.

Why is not the provision of space just another product, with customers as diverse as those who buy computers, jeans, cars, shoes, or industrial machinery?

Standardization makes sense. It can reduce costs, decrease uncertainty, speed planning and design cycles. It can also result in design and manufacture of products no one wants; or will use only because they have no other choice, even if the product undermines performance.

Granite Rock

Because a "concrete" company hardly tops anyone's list of the type of industry that lends itself to or in fact is very concerned with the customer or innovation, the Granite Rock Company, winner of the 1992 Malcolm Baldrige Award, is instructive. Imagine the following: You are a contractor who has purchased a load of mixed concrete and asphalt for a major road-building project. With its delivery you receive an invoice with this note attached to it:

> "If you are not satisfied for any reason…don't pay us for it. This means if any part of this invoice is incorrect or if you were unhappy with the products or service received from this transaction, let us know right now. Simply scratch out the stated line item, write a brief note about the problem, and return a copy of this invoice along with your check for the remaining balance. Someone will contact you immediately to resolve the problems" (27).

Think about applying Granite Rock's level of service standard to the delivery of corporate real estate to its end users. Granite Rock does not make mistakes. If it did, it would to out of business. How does it do it? First, it is obsessed with the customer, conducting numerous detailed surveys and analyses each month and immediately following up on the tiniest of complaints. Its documented cost of resolving complaints is equivalent to 0.2 percent of sales, compared with the industry average of 2 percent. Second, employees participate in highly focused, interdisciplinary quality teams and are involved as expert, in-house consultants on everything from production efficiency to major equipment purchases. Employees are cross-trained and continually educated on relevant advances in technology, human relations, statistical process control and fully-reimbursed for any seminars and university tuition fees. And finally, Granite Rock has developed and exploited sophisticated information systems.

The challenge is to wed the value of standardization with the benefits of individualization; hence, mass customization. The starting point is fanatical concern for the customer; then figuring out how to meet customer requirements in a cost-effective, if not profit-enhancing, manner.

Others in this industry have developed good information systems too, learning from the rapid-deployment capabilities of companies like Federal Express. Cemex, the giant Mexican cement company, now guarantees that regardless of weather, traffic and truck-haul distances of up to several hundred miles that they will make deliveries within 20 minutes of schedule. Equipping each ready mix delivery truck with a dashboard computer linked to satellite communication systems makes this possible (27).

We have barely begun to imagine the ways in which information technology will infuse how we plan, design, construct, maintain and manage every aspect of the workplace.

The technology is already here to enable a building inspector to monitor progress on site by picking up signals from electronic tags on materials, components, and workers' safety helmets. Even wallpaper will be smart, with acoustic sensors that suppress intrusive noises. Scientists at Illinois University have developed a self-repair kit for buildings. Small tubes embedded in walls break if the material cracks due to vibration or subsidence, releasing epoxy glue to heal the crack (14).

The bits and pieces of complex workplace solutions are being radically transformed. But Harari argues that what makes companies like Cemex and Granite Rock special is not their product. It is its knowledge. He uses knowledge to describe: "an organization that is bursting with cutting-edge skills, state-of-the-art tools, creative freedom and business accountability for employees, speed and intelligence in everything it does, turn-on-a-dime responsiveness to emerging trends and a culture of constant innovation—all aimed at doing something truly special that amazes customers. Granite Rock is not successful because it sells a tangible commodity called concrete. Its competitors sell concrete. Granite Rock is successful because it sells an intangible non-commodity called knowledge" (24).

Rethinking supply-chain relationships, working to develop a feasible basis for mass customization for workplace solutions, developing a far more sophisticated knowledge basis and information flow like that found in logistics, developing new vendor relationships that can be exercised like financial options, investing in learning—these are all aspects of developing an Integrated Portfolio Strategy. Unisys integrates the ability to link several databases each using different software makes possible reports that provide a more comprehensive picture of space, headcount, and operating expenses (22). Linking all of this information at an even

more granular level to work effectiveness data, from self-report employee survey data to information on speed of cycle times, and then graphically mapping this information by building (and locations within building), by site, by type of facility, etc. begins to link cost and space utilization data, one part of the total performance equation, to valued organizational outcomes.

Most CRE organizations simply do not have sufficient knowledge of their own enterprise to be innovative. You cannot design a better fly if you have no idea what a fish likes to eat. Corporate real estate managers should be talking to their own logistics experts, learning about the tools they use to gather and manage information to enable them to deliver the company's products and services on-demand, and increasingly at a more granular level of customer preference.

Manage Uncertainty

An IPS with an admixture of zero-time space solutions embedded in a web of supply-chain relationships, and the knowledge and experience of how best to deploy them, becomes the best weapon for gaining competitive advantage in a world characterized by both greater fragmentation of markets, labor force, and service providers and more uncertainty about exactly what will be needed, when, by whom, for how long, and where. Like Cemex and Granite Rock, corporate real estate leaders need to join with those making up their supply chain to literally shatter current conceptions about what is possible. In the end, they may amaze themselves as well as their customers.

References

1. Anon. (1989) *Architect's Journal.* February 1, 49-51.

3. Apgar, M. (1998). The alternative workplace: Changing were and how people work. Harvard Business Review, 76(3), 121-130.

4. Becker, F. (1999). Beyond alternative officing: Infrastructure on-demand. *Journal of Corporate Real Estate,* 1(2), 154-166. (report p. 10, 79)

5. Becker, F., Sims, W., and B. Davis. (1991). *Managing Space Efficiently.* Ithaca, New York: Cornell University International Workplace Studies Program.

6. Becker, F., Quinn, K. L., Rappaport, A.J., and W. Sims. (1994). *Implementing Innovative Workplaces: Organizational Implications of Different Strategies.* Ithaca, New York: Cornell University International Workplace Studies Program.

7. Becker, F., Joroff, M., and D. Stotz. (1997). *Manufacturing and the Lean Portfolio.* Norcross, GA.: International Development Research Council.

8. Becker, F., and Steele, F. (1995). *Workplace by Design: Mapping the High-Performance Workscape.* San Francisco, CA: Jossey-Bass Publishers.

9. Becker, F., and Tennessen, C.M. (1995). *The Hotel as Office.* Ithaca, New York: Cornell University International Workplace Studies Program.

10. Beinhocker, E.D. (1999). Robust adaptive strategies. *Sloan Management Review,* 40(3), 95-106.

11. Betsky, A. (1993). Under the Big Top. *Architectural Record*, March, 94-100.

12. Billington, M. (1997). It's absolutely prefab. *Building Design*, June 6, 18.

13. Champy, J. (1998). Goodbye, info age; hello, age of logistics. *Computer World*, 32(34), 54.

14. Construction Industry Board (1999). Into the robot age, *Building Design,* May 14.

15. Clinton, A. (1997). Flexible labor: Restructuring the American work force. *Monthly Labor Review,* 120(8), 3-18.

16. Cowan, C. (1992). Breaking new ground: A community college sets the stage for one of the most ambitious educational modular building projects in the country. *American School and University,* October, 50-52.

17. Davenport, T.H., and Pearlson, K. (1988). Two cheers for the virtual office. *Sloan Management Review,* 39(4), 51-66.

18. Dove, R. (1999). Agility=knowledge management + response ability. *Automotive Manufacturing and Production,* 111(3), 16-20.

19. Eisenhardt, K.M., and Brown, J.C. (1998). Time pacing: Competing in markets that won't stand still. *Harvard Business Review,* 76(2), 59-69.

20. Ferguson, G. (1996). A city within a city: IEs and the Olympic Village. *IIE Solutions,* 28(7), 26-30.

21. Intel maximizes facility performance. *FM Data Monthly*, July (URL: www.fmdata.com). (report p. 27, 88)

22. Unisys' strategic facilities planning program. *FM Data Monthly*, November (URL: www. fmdata.com).

23. Fradette, M., and Michaud, S. (1998). *The Power of Corporate Kinetics.* New York: Simon and Schuster.

24. Glancey, J. (1997). Arts: Moving Houses. *The Guardian (London)*, June 30, Features section, p. 10.

25. Hale, J. (1999). Changing the way people work. Presentation to Cornell University International Workplace Studies Program, London, England, March 24.

26. Haapaneimi, P. (1998). Corporation 2010. *Chief Executive Annual (U.S.).*

27. Harari, O. (1999). The concrete intangibles. *Management Review*, 88(5), 30-33).

28. Haworth. (1995). *Alternative Officing Research and Workplace Strategies.* Houston, TX.: International Facility Management Association.

29. Hollis, M. (1997). Portables could become permanent. *Sarasota Herald-Tribune*, June 22, p. 3B.

30. IFMA. (1998). La Salle Partners and IFMA study shows traditional workplace takes a new direction. (URL: www.ifma.org).

31. Kaufmann, S. (1995). *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity*. New York: Oxford University Press.

32. Kelly, S., and Alllison, M.A. (1999). *The Complexity Advantage: How the Science of Complexity Can Help Your Business Achieve Peak Performance.* New York: McGraw-Hill.

33. Lamprecht, B. (1993). Biliotheca temporaria. *Architectural Review*. CXCII (1156), 38-43.

34. Leslie, K.J., and Michaels, M.P. (1997). The real power of real options. *The McKinsey Quarterly*, Summer 1997 (3), 4-23.

34a. Jack Lyne (1998). Galloping Gazelles: Unorthodox Strategies fuel their Mercurial expansion. Site Selection, June/July, p. 494.

35. Melchiomo, R. (1999). The changing temporary work force: Managerial, professional, and technical workers in the personnel supply services industry. *Occupational Outlook Quarterly*, 43(1), 24.

36. McMillan, L. (1993). Earnst & Young calculates a high return from hoteling and high-tech. *Facilities Design & Management*, 12(4), 32-37.

37. Moore, C. (1992). The right choice. *Telephany*, 222(6), 38-41.

38. Munro, N. (1998). The new deal. *National Journal*, November 21, 27.

39. Palmer, B. (1974). Modular bank buildings—an avenue for expansion. *The Magazine for Bank Administration*, March, 22.

40. Pascale, R.T. (1999). Surfing the edge of chaos. *Sloan Management Review*, 40(3), 83-94.

41. Pepper, J.E. (1990). Post earthquake placemaking in downtown Santa Cruz. *Places*, 6(3), 92-93.

42. Pearman (1998). Upwardly mobile. *Sunday Times (London)*, March 15, Features section.

43. Purpura, L. (1997). Making routes compute. *Supermarket News*, 47(13), 37-39.

44. Rines, S. (1996). Peace work. *Marketing Week.* 18(47), 70-74.

45. Roberts, M. (1997). Future in store for ATM. *The Banker*, 147(855), 88.

46. Rush, R. (1986). *The Building Systems Integration Handbook.* New York: Wiley.

47. Schwartz, P. (1991). *The Art of the Long View.* New York: Doubleday.

48. Shelly, T. (1998). *Breaking Down Barriers To Entry*. London: Chartered Institute of Purchasing and Supply.

49. Waldrop, M.M. (1992). *Complexity: The Emerging Science At The Edge of Order and Chaos.* New York: Simon and Schuster.

50. Walter, K. (1993). Breaking with brick: Pre-fab modulars blast open new markets with low cost alternatives. *Restaurant Business*, September 1, 132-134.

51. Wilson, B.J. (1996). Shaken to the core: Change and opportunity in crisis. *Educational Record*, 77(2-3), 70-72.

52. Wyatt, J. (1998). 'Portables' play valuable role in meeting demand for classrooms. *PR Newswire*, January 19.

53. Zerega, B. (1999). Real men hire fabs. *Red Herring*, March, 72-74.