The Logistical City

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Chapter 1 of Worthington J (ed), Reinventing the Workplace, Butterworth: London, 1997, 2004

Introduction

This deals with working environments, and how social, technical and organisational changes affecting workplaces are likely to affect buildings in the near future. It says that we are moving into a fundamental new logistical age. It uses "Logistical City" as a shorthand for significant new trends underlying changing settlement geography. These also impact on the workplace and individual behaviours. It draws on a private study of foreseeable changes in the demand for energy in buildings [Reference 1] and the experience gained from post-occupancy surveys of buildings and their occupants [Reference 2]. The conclusions reflect UK conditions, but there are also wider implications.

Approach

In a nutshell, buildings create value (either realised or potential) for human activities which in theory should be greater than the sum of its parts. As complex systems, buildings are organised in functional layers, with large-scale, geographical characteristics like sub-region, urban infrastructure and location setting constraints which influence characteristics at smaller scales - site, shape, size, orientation, form, accessibility, height and so on. These, in turn, set the context for building services, such as heating and lighting systems, which then affect conditions created for users and occupants e.g. at desks and in workgroups. In this sense, buildings have one layer at the largest scale setting the constraints for the next level down, and then so on down the layers [Reference 3]. The layers also map roughly on to the professions that deal with them in the planning and design process e.g. planning at the larger scales, architecture and building services in the middle and interior design at the smaller.

Too much separation between the layers usually means that a building may not work properly as a whole - the integration between different layers is not effective enough. Too little separation creates conflicts between the intended functions of the spaces (affecting the activities carried out in them) and the intended functions of services (such as providing effective heating, cooling, ventilation and lighting in the right places at the right times). Where close integration fails, buildings can become unmanageable, creating vicious spirals of deterioration which are often extremely difficult to put right.

There are many examples of functional failures caused by too much or too little integration or by new constraints introduced unintentionally, including:

- 1950s and 1960s high-rise public housing in the UK, where over-reliance on single technologies such as lifts (which frequently broke down and stranded people) or even something as seemingly straightforward as electric-only heating (which many tenants could not afford) quickly became unmanageable and induced worse slums than the high-rise dwellings replaced, because the high rises were less manageable by their occupants.
- UK office buildings of the 1960s, whose "restricted floor-to-floor heights exaggerate the problem of inadequate building services ..." thereby leading to premature obsolescence [Reference 4].
- Historic buildings, whose "accessibility and ownership may be much more important to their survival than the actual techniques or cost of restoration ..." [Reference 5]. A perfectly

serviceable building may deteriorate beyond repair solely because of e.g. lack of rights of access.

- "Sick" buildings, where chronic performance problems affecting the perceived health of building occupants are often the result of technical complexity in the building systems outrunning the capabilities of occupiers to afford to manage them effectively.
- Vandalism, which may start in a relatively trivial way but will soon escalate if not removed quickly. Often remedial systems are not in place to deal with it.

The layers are important from the perspective of how buildings are both designed initially and then subsequently managed. It seems to be vital both:

- to separate out sub-systems with different functions (thus clearly concentrating on how they function individually), but also and just as importantly… ;
- to integrate them with the lowest achievable functional penalties and side effects …

thus creating stable. adaptive systems which are as failure-tolerant and efficient as possible.

As a consequence of not carrying this out properly, buildings are beset by failures, usually of a chronic (low-impact but frequent) type, resulting in inefficiency and lower human tolerance. This happens because:

- Buildings do not seem to adapt properly to even marginal fluctuations in the underlying constraints, such as the management resources available to maintain them being lower than expected. Premature failure, vicious circles of deterioration, total obsolescence or complete bafflement about why things are not working as they should do may result. For example, newer displacement ventilation systems can be more vulnerable to tenant changes.
- Complexity that has been added in response to calls for e.g. greater flexibility cannot be efficiently managed, unwittingly leading to downward spirals of performance and less flexibility not more. For example, large office floorplates with floor areas which are free of columns may work well in theory on the space plan but may introduce difficult-to-resolve management problems.

The approach here is systemic, looking at the total context within which buildings operate. This obviously includes both cities and settlements at the largest scales, and the individual user at the smallest. By understanding where constraints lie, this helps to make it easier to think strategically both about the future and, in the case of individual buildings, about how best to prepare briefs for their design. In the following section we look at changing constraints at the larger scales and then move on to the smaller scale of the workplace.

The Logistical City

Our main theme is that society is entering a new era, for which we have offered the term "Logistical City" to describe the aspects of it which affect buildings and settlements. In this perspective, time and logistics - organising things to be in the right place at the right time - take over from spatial factors as dominant causes influencing settlement geography.

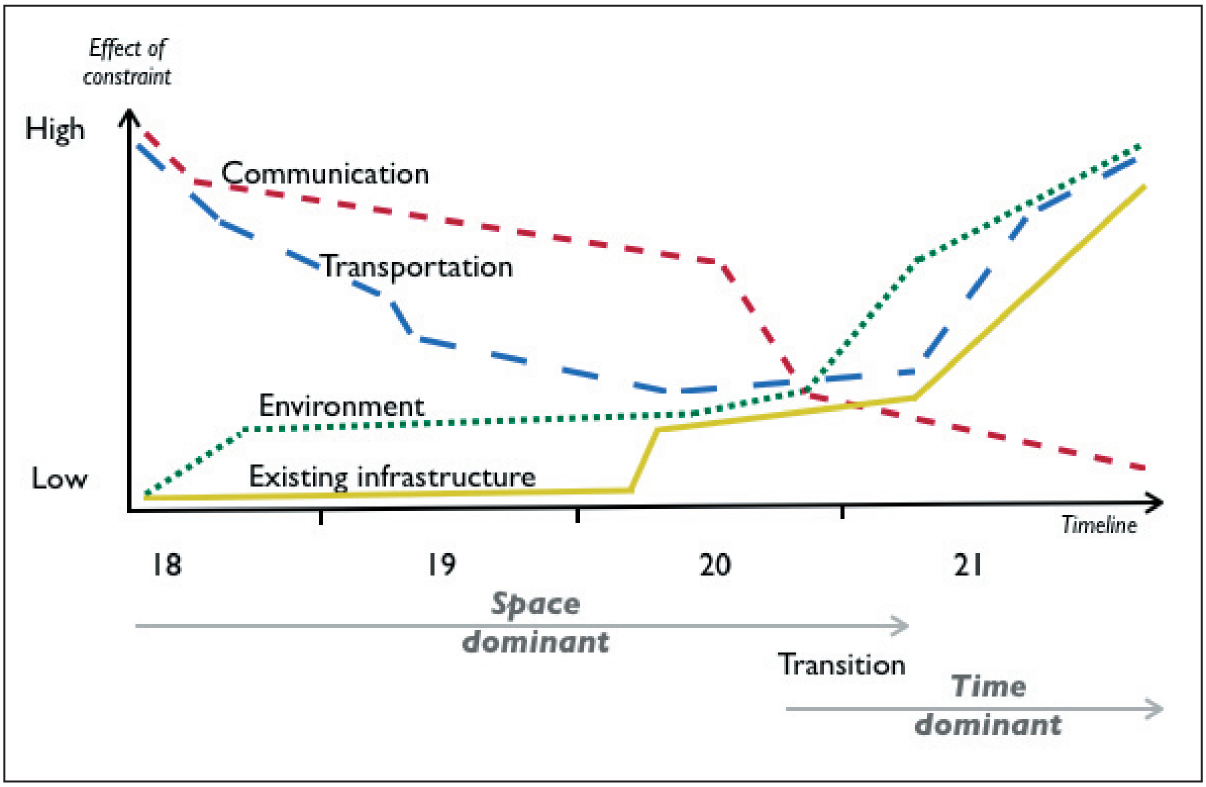
The Logistical City is coming about because the constraints which govern city forms and building types are changing their relative positions.

This is shown in Figure 1, which has four constraint lines:

1. transportation (of physical goods);
2. communications (of information);
3. environment (availability of land and resources);
4. existing infrastructure (buildings, settlements and their services).

Each of the four constraint lines has different degrees of effect at various times, but they are all present at any time. For example, until the advent of canals and then railways in the 18th and 19th centuries in the UK, transportation represented a major constraint on settlement develop-

Figure 1: Main historic constraints time lines



ment. The pattern of cities, towns and villages was relatively small-scale and closely packed. Its geography was dominated by the high cost and difficulty of transportation of physical goods. Similarly, communications were beset by slowness, inefficiency and relatively high cost. There were few environmental constraints: witness the easy availability of land and the relative indifference to pollution prior to public health regulations, for instance. Infrastructural constraints became significant later, in the 1920s and 1930s, when town planning acts were introduced to cope with some of the undesirable effects of rapidly expanding cities like London. Of course, it is preposterous to attempt a settlement history in one paragraph: this is intended to give only a flavour!

Bearing in mind the time line across the bottom of Figure 1:

1. the order of relationships between the constraint lines for transport, communication and the environment has stayed the roughly same throughout the 19th and most of the 20th centuries, but;
2. the lines have been converging, and …
3. the infrastructure line does not impact as a factor at all until the mid part of the 20th century, and …
4. the lines cross at the end of the 20th century, which is the crucial difference.

These created the pre-conditions for, first, industrial cities of the 18th and 19th centuries (better communications, better transport, cheaper energy, cheap land, no real environmental constraints); then, as convergence continued, the 20th century central business district/suburb city (cheap energy, higher densities, contours of land values, intensification of uses, daily patterns of commuter movements from city centre to suburbs). Then, increasingly, the existing building stock and its infrastructure has itself become a constraint, more so in historic city centres and listed buildings, for example.

Constraint lines are factors governing resource deployment. Technological improvements allow constraints to be manipulated in different ways. For example, technological innovation made movement of goods and people much cheaper and more efficient in the 19th century.

More recently in the late 20th century, constraints on communication have been radically relaxed, prodigiously changing the capacities and speeds of information networks. Conversely (because they are connected by a feedback loop) greater accessibility introduced by technical improvements and economic prosperity have introduced increased environmental constraints as a result of the waste, pollution and health risks associated with them. Geographical inertia - the effect of buildings and infrastructure already existing - has also been an increasingly important factor.

Convergence of the constraint lines in Figure 1 is driven primarily by technological development, economic change and environmental side-effects - it is often hard (and probably not relevant) to know which is chicken or egg. The upshot is that constraint lines are now crossing over, which partly explains why so many commentators on business affairs and the environment have dubbed the recent past the “age of paradox”. More importantly, it is this crossover that is setting a new pattern of constraints which underlies the Logistical City.

The characteristic city form known to us now - the central business district (CBD) and suburban pattern - evolved with constraints with these features:

- initially slow but gradually improving communications infrastructures (mail, then telegraph, telephone, radio and eventually television);
- step-change improvements in the speed and capacity of transportation systems (from horse to canal, steam and electric railways, then road and air);
- less environmental constraints (but these began to change with the first public health acts in the UK in the mid-19th century);
- few restrictions on land use.

The horizontal scale of Figure 1 describes a time line from the first development of the industrial city in the 18th century through to the late 20th and 21st centuries. Early city growth was characterised by rapid improvements in transportation of goods and people, extraordinarily rapid demographic change, combined with agglomeration in densely-packed cities and industrial towns clustered around cheap sources of energy (such as coal or water). There were also improvements in communications technologies. This growth tended to be unconstrained by environmental considerations. In fact, dirt and poverty were their hallmark.

These conditions were widely exploited, often ruthlessly. Damaging effects on human society were increasingly evident. These prompted in the mid-nineteenth the first significant environmental legislation concerned with public health. At the same time, model settlements, amongst other philanthropic and utopian initiatives, were founded. By the first part of the twentieth century, evolution of transport technology, first in electric tramways and railways, then in road and air transportation, underwrote rapid expansion of cities into the space and energy-hungry settlement model familiar in urban America (Chicago is the classic example, with Los Angeles the latter-day sub-type) but also around the world (Melbourne is an almost perfect case).

Two recent trends have far-reaching consequences:

1. Innovations in information and communications technology create new potential for the storage and movement of information, with digital data structures increasingly taking over from analogue for many types of media - alphanumeric, voice, video, graphical and so on.
2. As the long-term effects of unsustainable industry and agriculture become socially more destabilising, far more radical restrictions are being contemplated or imposed on polluting and damaging activities, amongst which transportation is the most important [References 6,7].

This is leading to the situation shown in Figure 1 where the communication, transportation and environmental constraint lines are exchanging places, with communication increasingly freed from the tyranny of distance, but also neutralised and countered by likely new, onerous restrictions on activities with high externality costs and risks, such as carbon dioxide and related emissions pollution from e.g. coal-fired power stations. Eventually, these trends form a new stable pattern (which will be much clearer from the year 2010 or thereabouts) - setting the preconditions for the Logistical City. However, at present they can seem contradictory, paradoxical and anomalous.

The Logistical City will have these drivers:

- hugely improved communications infrastructures ultimately constrained by bandwidth spectrum limits and, conceivably, the electricity requirements of servers and their infrastructure ;
- transportation systems with limits and costs imposed by congestion as well as unwanted externality effects;
- significant, sometimes onerous, environmental constraints aimed at e.g. biodiversity protection;
- major restrictions on land use.

The likelihood is that because road and air transport systems are the worst offenders, they will be more severely penalised. However, they present a much greater political problem, as greater costs of free movement are often equated with threats to democratic freedoms. Movement of people and goods will have to be carried out increasingly efficiently, especially when externality and opportunity costs are built into overall cost equations [References 8,9]. For example, the trend towards larger and slower aircraft will be accelerated. However, higher constraints on anti-social environmental damage will be mitigated by much greater freedom to move information around cheaply. As information becomes better packaged, more dynamic, more organised and more reliable to send and receive, the need to be profligate with energy and space-intensive travel (like commuting or international business travel) will be lessened. Although this trend has been obvious since the mid-1990s, it has been slower to take effect than many expected, partly because of the emergence of deregulated, cheap air travel and the continuing, and perhaps surprising, cheapness of oil. This will not last. Wireless broadband, either from fixed hotspots or third-generation mobile telephony, will deliver on-demand bandwidth which will also fuel these trends, perhaps acting as the main catalyst for them in the short term. The energy consequences of the 'weightless' economy are non-trivial: it can sit more heavily on the environment than it appears.

Given more physical restraint, people will be more likely to move shorter distances on a day-to-day basis, cutting out as much regular commuting as they can. However, though they are likely to still spend an average of 1.5 hours a day travelling - walking or cycling or local commuting on a metro or light rail system, perhaps, rather than driving or a longer commute. They will make more recreational, social and family-related trips, but rather less associated with their jobs and non-recreational shopping. In the short-to-medium term, projects such as TravelSmart, dedicated to less environmentally-damaging journeys to school and work, [Reference 10] will reinforce the trend.

Instead of the main constraints manifesting themselves spatially (through friction of distance and agglomeration effects) they will appear much more time-related because logistics become crucial. For example, operations management techniques [Reference 11] like electronic point-of-sale (EPOS) databases (which record shop sales and automatically generate orders for new stock in an integrated supply chain eventually reaching back to the factory) affect many more walks of life, especially where stockholding, warehousing and distribution is concerned. These technologies help ensure that supply chains are run as efficiently as possible, even in situations where catastrophic failures may occur. As systems become more dependent on each other, disaster recovery and risk management strategies are needed to either get damaged systems up and running again as quickly as possible or prevent disaster happening in the first place. The downside is that failures of tightly-coupled systems can be more problematical to businesses in the short term. For example, the UK retailer MFI has experienced serious difficulties with a new system linking point of sales information to furniture production and ordering [Reference 12] thereby endangering its core business.

However, improvements in supply-side economics through value engineering and operations management are not enough. Similar step-change efficiencies are sought on the demand-side, with greater efforts to fit demand patterns to supply, with as little waste as possible. Minimising waste is critical because waste is the common denominator between improved sustainability (involving the elimination of polluting or environmentally damaging outputs) and reduced costs (stripping out inefficiencies). In this light building designers will be forced to juggle risk/value calculations. They will have to justify extra redundancy added in for health and safety reasons (like extra structural capacity or air conditioning to meet worst case load factors), while removing redundancy for value engineering reasons (that is, taking out features which are perceived as too expensive). At the same time, they will be exhorted to reduce environmental impact, which may involve reducing redundancy, possibly for the wrong reasons. The problem for them will be to avoid creating buildings which are too tightly coupled: that is, buildings whose operation is unstable rather than robust in the face of unpredictable inputs.

Thus risk/value trade-offs become more important. This also means that feedback from buildings in use [Reference 13] must also improve, because otherwise designers have no rational way of assessing risk beyond their own anecdotes. For example, do we reduce environmental risk by giving buildings the potential for natural ventilation but, by so doing, reduce the density of occupation, thereby supposedly decreasing the perceived short-term value to the client? We need to know precisely what risks and benefits are involved.

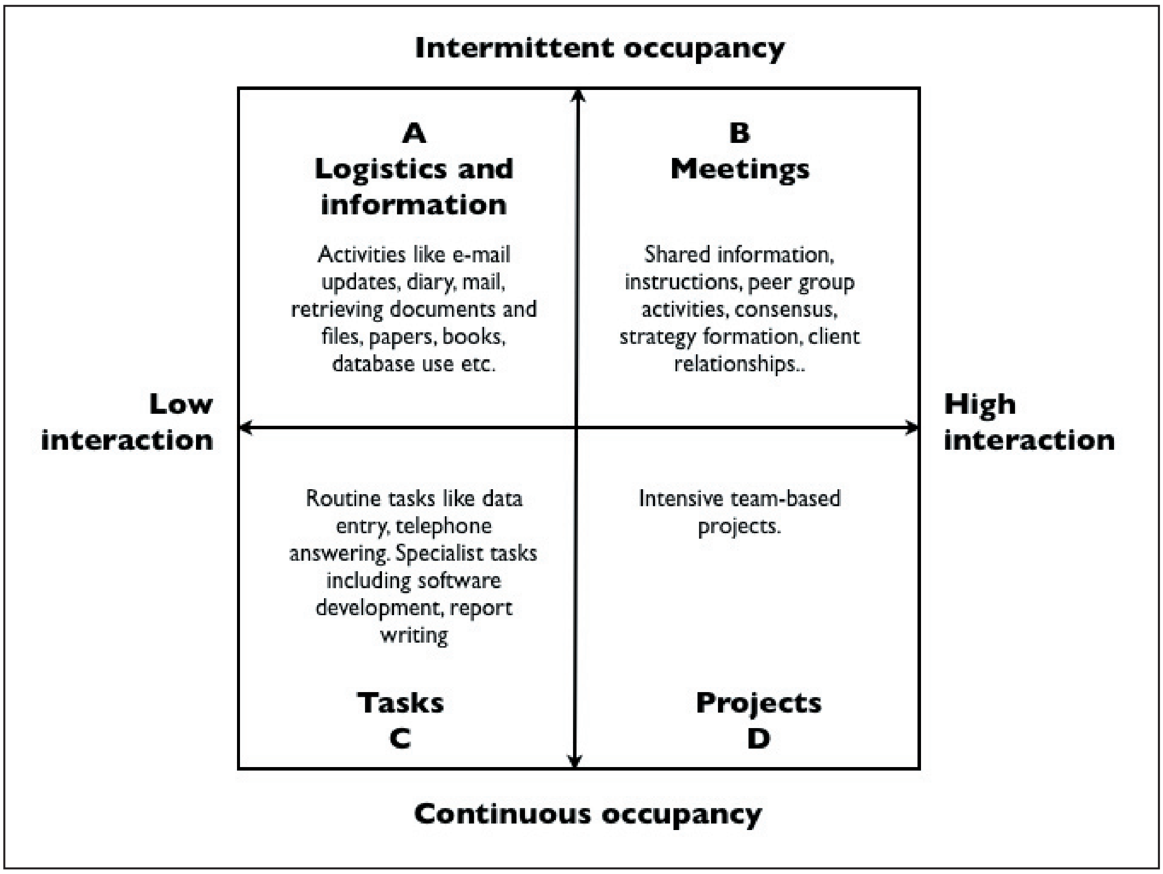
Buildings play a major role in delivering better value, because so many of them are now used inefficiently, with space left permanently under-unoccupied, or with gluts and famines of occupancy, yet still serviced with full capacity energy-hungry lighting and air-conditioning systems to meet low levels of demand. Often conventional strategies for building design (using energy-intensive materials and technologies) displace much of the risk to society at large in the form of pollution, noise and waste.

If a developer tries to adopt an environmentally responsible strategy - perhaps using significant recycling of waste - some of the risk will be transferred to the developer and the landlord and/or tenant. What happens when the waste water management system breaks down, for example?. As yet, because of untried systems and lack of economic incentives, few are prepared to bear the costs of these perceived risks. Thus the risk-free option to the developer is usually the environmentally damaging one. Perhaps entrepreneurial environmental risk capital - where developers take on some of the environmental risk themselves - is the way of the future.

The Logistical City will have:

- time replacing space as the main factor affecting locational decision-making with time-intensive activities becoming the norm 24/7 with much more stress on e.g. time management and space utilisation;
- intensification of critical business and organisational functions in highly serviced, secure locations, working in tandem with diversified functions elsewhere (these trends are obvious now with e.g. teleworking, outsourced information technology (IT) services and risk avoidance strategies especially to the fore);
- less emphasis on CBD functions and single CBDs, with smaller, polycentric CBDs emerging in the main metropolitan areas, probably based on existing transport nodes like airports and railway/metro junctions;
- waste avoidance across all aspects of society, especially affecting transportation as the singlemost damaging pollutant;

Figure 2a: Work settings

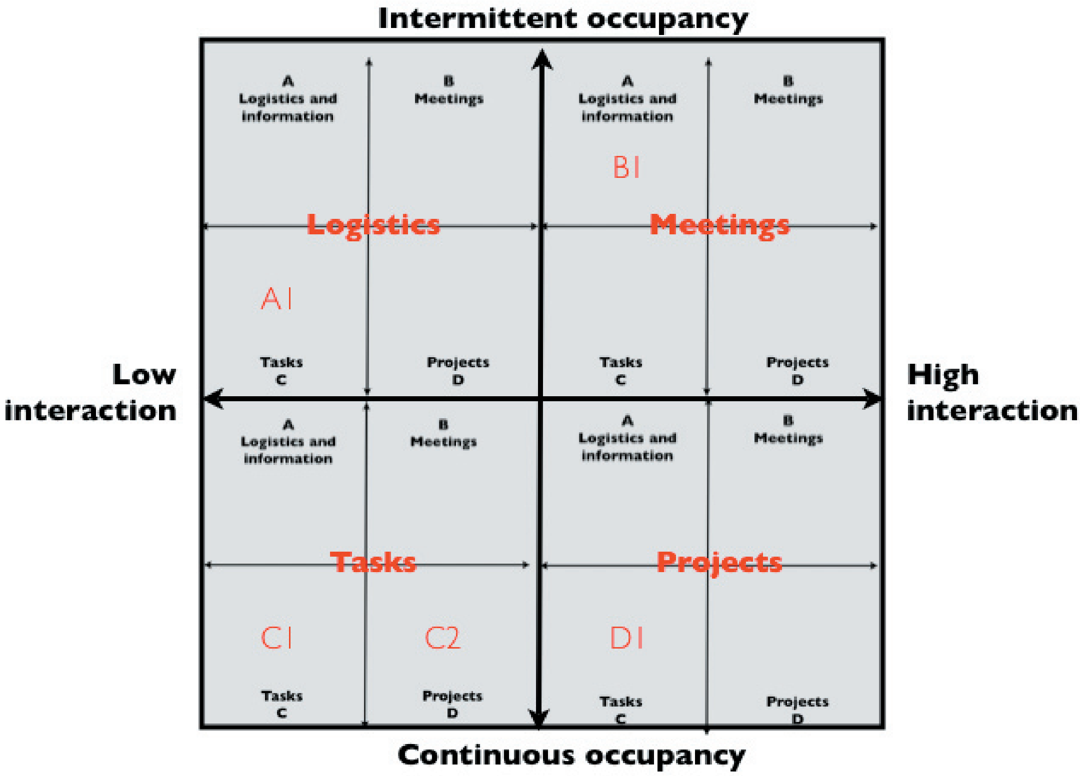


- more emphasis on integrated urban transport, possibly along the lines of the existing Dutch model, especially in areas of high population density;
- less predictable journeys to work, with journeys and habits more aimed at avoiding congestion with its time penalties rather than creating it;
- greater use of the home, but also on safe, well-serviced and well-connected neighbourhoods (which may be in existing village, town and city centres, but may also emerge around e.g. clusters of hotels or convenient shopping centres with public transport access);
- more emphasis on the extended family, but not necessarily based on spatial propinquity or on single-occasion family gatherings like Christmas;
- greater emphasis on re-use and multiple use, especially in existing city centres (e.g. offices to residential) and in areas with obsolete property (e.g. industrial to residential);
- a more dynamic and opportunistic approach to time management, with less emphasis on fixed appointments and more on exploiting opportunities created by e.g. texting and satellite navigation, which offer greater flexibility in time management, but time also becomes an increasingly precious commodity.

Some implications

The Logistical City at the larger scales places far greater demands on building performance at the smaller. Buildings already need to be more healthy, safe, comfortable, energy efficient, adaptable, cheap to run, easier to manage, accessible by people without cars and proven to be such. These factors will become even more important, so that, for example, rental cost or first cost, the staples of the past, will cease to be major factors as they are now.

Figure 2b: Work tasks within settings



The workplace

The accelerating trend towards diversification of workplaces is also connected to increased intensification [Reference 14]. In the mid-1990s British Telecom (who have a vested interest in self-fulfilling prophecies!) forecast that there will be 3.3 million teleworkers in the UK in the year 2000, with one worker in six using the home as an office [Reference 15]. Actual numbers turned out to lower [Reference 16] but the trend is still clear and growing. In 2004, there are probably about 2.5 million teleworkers (perhaps 8-10 per cent of the UK workforce). This has been growing at over 10 per cent per year since 1997, within an overall average growth rate for all employees of 1.6 per cent

Teleworkers utilise their homes more effectively, perhaps stimulating local demand for services close to them. When they travel, they do so less predictably with a more varied pattern, perhaps geared to avoiding peak-hour congestion. However, the environmental impact of their travel is not necessarily less than the average commuter because they may choose to live in less accessible places and use cars more. Their headquarters workplaces will often be smaller and more intensively utilised and managed, often populated by staff who will be younger than is usual at present. Staff who attend their office workplace everyday will be those who need supervising, training and overseeing - those who do not share the same assumptions as their colleagues. For example, project teams, work together for a period, ensuring that they share a common purpose, then split up and work alone or in smaller groups. Those who know each other well may never need to meet face-to-face at all. This fuels demand for facilities which are increasingly seen in hotels - conference and exhibition suites, with office facilities supplied in support. It is also claimed that teleworkers in the main are happier and more productive, but they also work longer hours (usually because they commute less) and they can say that they feel isolated from the social aspects of work, not surprisingly. [Reference 17)

Minimising the costs of wasted time will also be more important, especially with workforces with highly skilled, mobile knowledge workers who are crucial to the core business. This is a key feature of the Logistical City, considerably enhancing trends that are already clear in the growth of time management, for example. More attention will be given to structuring information and knowledge in ways which use expensive staffs' time effectively - rather like the use of consultant surgeons in hospitals. This means greater filtering of information, more reliance on information science, probably more use of knowledge-based systems and more attention given to the value and potential of information.

How does this affect the design of the workplace? Some of the trends are already clear. Figure 2a and 2b are developments of the den/club/hive/cell model described in [Reference 18]. This gives four workplace settings characterised by the relative positions with respect to the axes.

> **Logistics** and information is low interaction / intermittent occupancy. People come in for short periods to check their mail, synchronise diaries, log in and download / upload information, make calls and so on.
>
> **Meetings** are high interaction / intermittent occupancy, with intensive peer group or one-to-many training activities, often time-constrained and goal oriented.
>
> **Tasks** are low interaction / continuous occupancy, again goal-oriented, but more individual in character such as report-writing.
>
> **Projects** are high interaction / continuous occupancy, but of variable duration and intensities.

Most modern office buildings have spaces which accommodate all four of these setting types, so all four types may be found in many office buildings. However, many buildings also use a restricted palette, so to speak. A designer's office may be a mainly a project setting, with most people working in teams, but a few, like the company secretary, having to put up with less than ideal conditions in order to accommodate the majority. Many offices are now like this, with one setting type having to serve for everyone, even if it does not fit individuals task very well.

The same dimensions can also be used not just to describe the work settings, but also individual tasks that are carried out in those settings. In Figure 2b, the diagram has been nested to show how individual work tasks fit within work settings. For example, a logistics setting (e.g. an area of touchdown workstations in a headquarters office) is not the best place for task-oriented, continuous occupancy work (A1), sales-force staff may successfully use a meeting setting occasionally at headquarters (B1) for logistics-type activities, some tasks may be well-suited to a task setting designed for them (C1), but project work in a task setting may not work so well (C2) as may be the case for task work in a project setting (D1). Many more work tasks and sub-types can be added.

The design of an appropriate workplace setting (Fig 2a) depends on understanding work tasks and how they cluster on the diagram (Fig 2b). Many modern organisations do not include all the functions within one building. Low interaction / continuous occupancy tasks, in particular, have higher potential for remote working. A basic analysis of work tasks (from 2b) will show which work settings are appropriate for a particular organisation. Most organisations will have different requirements, depending on their size, structure and work/task mix. The challenge for designers is to create work settings which are sufficiently adaptable to meet changes in work tasks (for example, secretaries are fast disappearing) without imposing unmanageable overheads.

Other building types such as laboratories and factories are becoming more similar to offices. The proportion of space devoted to offices is increasing. For example, over 25 per cent of usable floorspace at the University of York (a small campus university in a low density parkland setting) is given to office space. [Reference 19] Office-like spaces have people plus technology of varying complexity, value and sophistication. Just as the computer has escaped the purpose-built, air-conditioned machine room and invaded the office floor, so also does equipment in laboratories, factories, hospitals and universities. The design and management problem is knowing which of this is specialised, thereby needing more intensive management, and which can safely be treated as generic and placed in relatively simple spaces with domestic-like servicing and support. Special needs have tended to invade everywhere and make buildings much costlier to run and manage effectively, especially when the expectations of the occupants are higher.

Environmental services

As workplaces have become more office-like, they have also diversified. The 16 setting / task variants shown in Figure 2b create an extensive vocabulary for office design, not simply within a single building or cluster, but across the organisation as a whole, perhaps involving many sites, permanent or temporary. As space subtypes are diversifying so too are environmental services, with many more types of heating, lighting and air-conditioning systems available. For instance, mixed-mode systems - hybrids which combine natural ventilation and mechanical ventilation and cooling - are now more common, offering the potential for “tunable” buildings with longer life, greater adaptability, less waste, lower cost and less management overhead. [Reference 20]. These are evolving in response to more stringent requirements from clients, especially with respect to meeting improved comfort, health and energy efficiency standards as well as increasingly dynamic requirements of diversified space types (especially for occupancy changes, zoning, controllability and rapid response).

In theory, environmental support systems are becoming more demand-responsive, switchable, less of a management overhead and more capable of re-configuring at low cost. In reality, they are still surprisingly poor at matching demand to supply. As environmental risks continue to threaten, there may also be the need for buildings to offer potential for far greater energy savings, even if they are not running efficiently at present (say a 50 per cent reduction by the year 2025 in electricity use). There is more scope for technological improvements to bring about efficiencies (through the use of solid-state, low voltage technology in computer systems, for instance).

Organisational change

Organisational change, especially from organisations providing all their own support services (vertically integrated) to those contracting out support services (horizontally integrated), should bring about smaller buildings with higher levels of physical and informational interaction between them (perhaps using just-in-time logistics to organise the interactions more efficiently). As yet there is little available evidence to show that this is, in fact, occurring, although there is plenty of talk to suggest that it might.

Organisations in the UK with large portfolios of sometimes complex buildings, especially universities and hospitals, have been most active recently in re-evaluating their property strategies [Reference 21]. But whether this is leading to fewer buildings or buildings divided more clearly into generic and specialist types is not yet clear. Campus-style developments (for retail, universities, business parks, science parks and hospitals) are no less common in the nineties than they were in the sixties, seventies and eighties, so the attractions of economies of scale and spatial propinquity may still be strong.

The difficulty with predicting how organisational change will affect buildings is the effect of transport. If, as widely expected, constraints on transportation (either via the marketplace price of fuel, government legislation, congestion or combinations) significantly restrict movement of goods and people then logistics will rapidly come to the fore. Companies such as British Airways, which already invest heavily in yield management (I.e. optimising revenue from passenger journeys) may ultimately make more profit from expertise in logistics than from flying and maintaining planes, where profit margins may quickly disappear altogether as the environmental costs of flight become even more onerous. Whatever their fate, companies with global informational infrastructures like BA will be tempted to seek the advantages of low cost, high-skill labour markets like India [Reference 22].

Conclusion

In the first instance, trends in building use and design are more likely to be set by cost reduction drives. These cost-reduction strategies almost inevitably seize on people or buildings, or both. A part-time workforce operating from home, or overseas, carrying their own overhead costs can take an attractive slice off bottom-line costs. However, a cost-based approach will usually miss out the finer nuances of strategic advantage for organisations and businesses. The trends clearly point to buildings which are more intensively used, but also linked to diversified others with much greater responsiveness to change, less risk carried by the building owners and less environmentally damaging.

Where will all that risk go? Increasingly, it seems that a self-employed, perhaps part-time, workforce will carry more of it (in the form of lower incomes, unemployment, stress, illness and unsocial hours). Environmental costs are also offloaded on others - increased movement and interaction creates greater congestion costs which in turn places greater burdens on infrastructure services such as road building. Many view these processes as having finite limits, expressed though congestion costs, but also pollution, waste, lost time and opportunity costs, and for the individual, depression, anxiety and anomie.

In this light, the importance of logistics will become pervasive. Windows in diaries are no longer yuppie jokes but a major factor in organising business and family life. Many of these trends are already visible. For example, it is relatively commonplace to find people spending the working week living from a pied-à-terre apartment and then commuting home at weekends. Sometimes home may be in another country! Such arrangements place severe stresses on people and their families, making it extraordinarily difficult to organise seemingly trivial but life-forming events, like attending a child's nativity play. These events, and the consequences of not being there (absence costs) then take on increasing potency. People benefit in one way from cheap and reliable transportation - giving easier physical access to their job, but suffer in others - their family and relationships, for instance. Trade-offs between career, family, relationships and where they live are increasingly forced on people. Such decisions are increasingly burdensome and, for many, difficult. Only the privileged minority are able to optimise all of them, usually because they have the money, and some good fortune, to do so. Increasingly, people give priority to different facets at different life cycle stages - relationships and careers in their twenties, family and career in their thirties, and perhaps a nice place to live in later life.

Regular routines and patterns of life are disappearing quickly. Additional complexity - more types of job contract, more technology, more consumer choice, less perceived security at work and at home, greater perception of risks (even if risks are misjudged) and more perceived stress are quickly redrawing the boundaries of work and family life to create scenarios which were unimaginable even one generation ago (especially relating to travel and global communication).

Re-inventing the workplace means second-guessing and grasping the consequences of these changes rather than merely responding to them. Organisations are becoming more distributed over wider geographical areas, using smaller buildings. Complexity is managed more successfully, so that generic and specialist building types are increasingly separated by function, with more zoning the result. Services need zoning more effectively, not just to deal with demand patterns which are less predictable and more onerous, but also to deal with greater occupancy over 24-hour periods, such as day/night control centres or night-time, secure car parks. All buildings have to operate much more efficiently in the consumption of energy: energy budgets 50 per cent lower by the year 2025 seem achievable. Better energy efficiency will be fruitless without much greater transportation efficiency, with the ability to convert at least task- and occupancy-intensive work to remote locations thereby offering the possibility of reduced commuting burdens.

End note

Most of the text and references from the first edition have been retained in the second. Much of what was written in 1996 still holds firm. The major difference has been to change tenses from the future to the present, as we appear to be moving more firmly into the logistical age.
AL Sep 2004.

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Further background

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