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Scenarios for changing work (organisation and location) and the built environment

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Abstract

The aim of this paper is to examine which factors in energy systems and the built environment could influence the future of work. In addition, it looks at trends in relation to corporate demands for space and its specifications, and considers what the scope is for integrating business and industry within the dwelling landscape. It seeks to consider these questions on a 50-year time horizon.

The paper begins by discussing the challenge of prediction of future trends, especially in a field apparently so reliant upon technological change and innovation. Because of these problems, the paper concerns itself not with picking technologies but rather with questions about the social adoption of technologies and their applications. It highlights a spectrum of coordinating mechanisms in society that are likely to be critical in shaping the future implications of built environment forms and the consequential use of energy. The scenarios discussed arise from the intersection of two tendencies: concentration versus dispersal, and local versus globally focused growth of city regions. The challenges identified in this report are associated with 'lock-in' to past governance modes of the built environment, exacerbated by rapidly changing demand structures. Demand is not simply changing in volume but also in character. The shifts that will need to be dealt with concern a fundamental issue: how activities are coordinated in society.

Keywords: energy demand, centralisation, decentralisation, lock-in, working patterns

Introduction

The aim of this paper is to examine which factors in energy systems and the built environment could influence the future of work. In addition, it looks at trends in relation to corporate demands for space and its specifications, and considers what the scope is for integrating business and industry within the dwelling landscape. It seeks to consider these questions on a 50-year time horizon.

The paper begins by discussing the challenge of prediction of future trends, especially in a field apparently so reliant upon technological change and innovation. Because of these problems, the paper concerns itself not with picking technologies but rather with questions about the social adoption of technologies and their applications. It highlights a spectrum of coordinating mechanisms in society that are likely to be critical in shaping the future implications of built environment forms and the consequential use of energy.

Methodology

The approach adopted in this report is rooted in scenario building rather than simple extrapolation. Future outcomes are based upon a combination of past trends in outcomes, and – critically – are informed by an understanding of the key processes driving these outcomes. Although the context of this paper is technological and resource utilisation, it assumes that there are non-deterministic relationships between supply and demand and between technology and action. On the basis of this methodology, we identify a key issue: the changing nature of the coordination of human activities.

The objective of this paper is to inform debate about society 50 years hence. This is difficult to do, for a number of reasons. First, it is problematic to ‘predict’ the future on the basis of past trends, especially where one of the characteristics

of such changes are non-trend events such as the development of new technologies. Second, as long-term analyses of business cycles and technological innovation show, 50 years is the average cycle length. Thus, regardless of where one considers economy and society to be in the current business or technological cycle, any prediction or forecast must be based on the following cycle (see Dosi, 1983; Hall, 1985; Marshall, 1987; Schumpeter, 2006).

To illustrate the nature and degree of transformation that we are faced with, we first review some relevant transformations that have occurred in the last 50 years (ONS, 2000; Young, 2002). We use this exercise to pinpoint processes that may be expected to shape the future adoption of new technologies. We argue that such an approach is more effective and insightful than one that seeks to pick winning technologies. A key concept of the recent social scientific analysis of technology usage has been the degree to which technology use and take up are socially shaped. Technologies are adopted by users on their own terms, or at least in ways that are related to their current concerns, rather than being determined by designers or being somehow inherent in the technology (see MacKenzie and Wajcman, 1999).

On the basis of these principles, we will discuss ways in which processes may impact upon both current and future social change in the field of economic development and location. In the final section, via a scenario exercise, this paper examines the potential consequences for the future nature of the built environment, and finally considers the challenges and opportunities this throws up for energy systems.

Past processes

Themes

A survey of the past can be divided into four themes: Production, Employment, Communications and the Built Environment. The period under consideration begins before the ‘information age’ and stretches back into the early ‘oil economy’. One of the key meta-themes to emerge from this overview, beyond particular technological changes, is the changing nature of relationships between the technologies and their use, and in particular the way in which the previous macro coordination of activities has broken down or fragmented. There has been a massive shift in modes of governance from more central and command economy to a neo-liberal, minimal state where little strategic guidance or effort is put into ‘market steering’ except by regulation.

These changes should not be interpreted as being predetermined. They are mediated by communications technologies for physical movement and for telecommunications. Moreover, this shift marks a transition from public or collective controls to private and individual control. It is possible to argue that the current and future challenge of social and economic integration will be hampered by the reliance on – or more seriously the ‘lock-in’ to – particular communications technologies which are more or less energy inefficient or polluting. The main issue is not the headline figures for fuel consumption, or absolute increases in travel and demand for energy, but rather the increased reliance on carbon and non-renewable sources and the consequential lock-in to increased greenhouse gas emissions. This aspect of the resolution of past energy problems will become a major shaper of future energy usage, even if carbon-based fuels become less significant in the whole economy. An example

of past change is the shift to car-based transit, or more generally to individual transport as a ‘sticking plaster’ solution to broader problems.

Production

There has been extensive analysis of past changes in the organisation of production and its consequences for business location and employment. It shows that there has been a shift from the norm of large-scale mass production to flexible production; moreover, the location of production activities has increasingly been outsourced to the peripheries, first of the UK, then of Europe and later the world. The UK economy has undergone a dramatic economic restructuring in the last 25 years and now focuses on service sector activities. Some of these activities are low-skill and routine, while others are high-skill and specialised. This change has been exaggerated by the massive concentration of economic growth in London and the South East. Previous regional policy had sought to ‘re-balance’ growth across the country.

Employment

The changing organisation of production has led to massive shifts in the workforce. Generally, the proportion of the population that is economically active has increased, especially for women, and activity rates are now almost equal for men and women. More people are working, and women make up about half of the workforce, although female employment is still dominated by part-time working. But part-time or fractional working has become increasingly common for a large proportion of the workforce, as has the rate of switching jobs. Finally, self-employment and freelance work have increased dramatically, not only in traditional industries such as construction, but notably in one of the fastest growing areas of the economy: the creative sector (Beck, 2000; Leadbeater and Oakley, 1999; ONS, 2000; Pratt, 2007b).

Communications

In transportation, there has been a substantial modal shift in favour of car ownership and use. There has also been a massive increase in air travel in the past 15 years. These changes have been enabled by the growth and deregulation of low cost airlines and tourism, by the internationalisation of service business activity, and by the development of new retail supermarket demand (Wrigley and Currah, 2006) for imported fresh food (Sustainweb, 2001).

The development of cheaper phone tariffs, the introduction of mobile telephones and the development of the internet have made many types of communications much cheaper and made it possible to conduct many activities on line, in effect, in a distributed workplace. It is important to note that instead of the expected 'death of place' that new technologies were initially expected to usher in, empirical trends point to the reassertion of place and to close location, or clustering, in the new economy (Pratt, 2000). Remote or online shopping may appear to be placeless, but it still requires a massive delivery infrastructure based upon road transport (Fernie and McKinnon, 2003; Pratt, 2007a).

Research also points to ways in which new technologies have allowed users to sidestep the otherwise crippling problems of coordination and congestion. It is these modes of technology use that now underpin and enable our spatial and organisational structures. As has been noted (Jarvis et al., 2001), this burden of investment is socially regressive. The poor are less able to literally buy their way out of the problem, usually by using a private car. Demand for movement – especially in cities – is quickly outstripping supply. The congestion charge is one stopgap solution to a mismatch between supply and demand where total capacity is limited.

Even if new technologies were developed tomorrow, they would be adopted and used in the context of a built environment and transport infrastructure that have been developed for quite different needs and requirements. They will continue to need enormous retrofitting in order to function in current and future conditions.

A good illustration of these problems and their current short-term solution is the emergence of ‘hypermobility’ (Adams, 1999) among many urban dwellers who have to quite literally rush around to make the connections between the diverse components of their lives. This lifestyle clearly stimulates demand for private transit. It also begins to explain why the average annual travel distance for individuals is increasing dramatically.

The built environment

Generally, people travel further to work, to do their shopping or to visit their friends and family than in the past. This has led to an increased demand for transportation infrastructure, most of which has been supplied by private and individual solutions. Some public infrastructure has been developed, but demand outstrips supply, which results in congestion. Demand is more complex and flexible than supply, and demand is increasingly for complex network travel than simple point-to-point travel. Even if it wanted to, public mass transit could not satisfy such a demand. Moreover, there is a positive relationship between road supply and usage, so congestion is always with us (Banister and Berechman, 2000). The only escape from this has been the use of congestion charging, where the cycle has temporarily been broken by massive investment in buses and the temporary freeing-up of road space (Banister, 2003).

As we noted above, the reorganisation of production has led to the outsourcing and relocation of particular functions, usually seeking out lower-priced labour. However, there is a parallel and opposite move whereby some functions, those

based upon non-programmed, face-to-face communication, are more susceptible to co-location and clustering. A particularly striking example is that of the cultural and creative industries clustering in city centres (Pratt, 2004, 2006).

At the same time, regulatory changes have led to land use planning controls being relaxed for out of town supermarkets and retail centres. This helps consumers buy larger goods and make more infrequent shopping trips. It has also encouraged the development of big stores selling big goods such as home freezers (Lowe and Wrigley, 1999). This is efficient for retailers, but requires consumers to bear the cost of distribution to their home from a regional centre (McKinnon, 2003). These changes have had a massive impact by eroding inner city retailing, the so-called ‘hollowing out’ of city centres, and has stimulated car usage. These centres are not well served by public transport, and the nature of the goods they sell means that public transport is less attractive or practical for people visiting them.

A consequence of these new forms of manufacturing and retailing is that more transport of goods occurs across long distances, increasingly on a just-in-time basis. The amount of local warehousing and factory storage has decreased as a result of lower stockholding, as has the demand for factory workspace as production has been relocated. Demand is increasingly for office space. Outsourcing of economic activities has not only occurred in locational terms. It has occurred structurally too. Specific functions of companies have been outsourced to smaller enterprises, or to freelance work. These contracts are renegotiated regularly and there is little stability in terms of contracts. So, workplaces and their location change more rapidly than in the past for many members of the workforce (Beck, 2000; Blair and Rainne, 2000; Reich, 2000; Rifkin, 1996; Sennett, 1998).

Thus people are increasingly switching jobs and employers, or working for several employers (Jarvis and Pratt, 2006). Moreover, many more are nominally based at home rather than a workplace. However, work for these workers does not follow the traditional image of home-working on the kitchen table or in the spare room. Rather the model is that of the nomadic worker, much of whose work-week may involve being on-site at various contractors or employers (Perry and Brodie, 2005).

The connection between land use control and the attainment of lower transport usage in cities has been the subject of much debate. The influential notion of the 'compact city' (European Communities (CEC), 1990), its UK Urban Task Force cousin (Urban Task Force, 1999), and the popular smart growth and new urbanist movements (White and Ellis, 2007) all propose that physically compact development minimises travel and improves sociality. However, as many critics have pointed out, the fragmented nature of housing and labour markets undermines the efficacy of such simplistic propositions in practice (Beauregard, 2002; Pratt, 1996). In fact, it often requires people to travel further. Moreover, other criticisms have been made of the potential for renewable energy generation in compact cities. Open-plan cities are better for efficient energy generation (Breheny, 1992).

Processes and motors of change

A clear lesson that emerges from a survey of the recent past is that technologies never arrive *de novo* in the world. They have to be incorporated into social institutions and an already formed built environment. Accordingly, there is a large degree of 'lock-in' or 'path-dependency' that constrains and shapes new opportunities. Additionally, there is a space for negotiation of how a technology is incorporated, a prospect that can be further modified by regulation. The

implications of any new technology will in part be linked to the ongoing governance of the relationship between social, economic, and physical environments. Moreover, longer-term strategic analysis and interventions based upon these relationships are more likely to be robust and effective.

Accordingly, the following discussion has not been organised around particular technologies, but instead, around the embedding and shaping of technologies by existing urban governance mechanisms. These mechanisms are slow-changing, and will most likely continue to shape communications patterns long after the initial technologies have lost their dominance. For example, the communications infrastructure of London is still substantially shaped by the notions and priorities of its Victorian and Edwardian builders.

The key drivers are broadly covered by private organisational change and individual social changes. Clearly, these processes do not occur in a vacuum. It is the state that provides leverage in balancing these forces through regulation and policy. However, in recent years the state has all but withdrawn from intervention in these fields. It would take a massive change to reverse such a trend, even if the political will were present. Hence, it is likely that the present balance will continue to dominate the future.

Organisational

A key process that can be identified is not so much the changing speed of communication *per se*, but rather the degree of coordination of production and consumption afforded by just-in-time systems using communications and tracking technologies. This process allows the reduction of ‘dead time’ for stock in warehouses and allows direct production for use. It also improves businesses’ flexibility to respond to changing demand, and cuts the wastage associated with over-supply. These trends in logistics have enabled a restructuring of corporate

organisation and supply chains. A key objective has been to drive down costs to producers and shift their exposure to risk, either by reducing stock or outsourcing production via competitive tender. This process also has a parallel in production, where facilities and machines are rented for use (see Rifkin, 2000).

A consequence of this transformation is the development of a hub and spoke distribution system where maximum efficiencies are achieved between hubs. However, local distribution costs are increased and commonly borne by consumers through their absorption into the increasing distance of shopping trips. The consequence is an increase in local traffic flows, and a locational focus on nodes on orbital road networks for retail outlets and offices. Some authors have argued that this represents a new urban form, the Edge City (Garreau, 1991). These new nodes are less suitable for public transit.

Social change

There have been major changes in household composition, from extended to smaller family units, and a huge growth in single-person dwelling. Rising housing costs in relation to earnings have also pushed many into multiple dwelling, and tied some households to multiple earner strategies in order to maintain a position in the housing market. Allied to these shifts are major changes in activities rates, especially among women (ONS, 2007; Wilkinson, 2000). One consequence is an increased demand for childcare in dual-worker households (Jarvis and Pratt, 2006). That demand is, more often than not, close to the home or to transit points.

A shift in the admissions and allocations policies of schools is another important factor in changes. Previously, school admission was based upon proximity. Parental choice is being introduced increasingly and is leading to complex and

wasteful school commuting patterns. Up to half of the traffic on roads before 9am is school-run related (Adams, 1999; Jarvis et al., 2001). The increased traffic, and fears about general child safety, have led to further increases in car usage for the school run.

These extra journeys are not only generated by school ‘choice’ but also by the increased fragmentation of home, school and work locations. In households with two working parents, the degree of fragmentation is amplified. Moreover. flexible, freelance or simply multiple career working patterns leave people in housing locations that require private transit to make them work. This ‘lock-in’ to private transit as a temporary solution for systemic problems generates congestion and wastes energy and time. Even if people want to change their mode of transit, the distance they travel, or their reliance on transport, they cannot.

These social forces are located in available technologies, in past infrastructure provision, and in a new governance structure that is constituted through flexibility. It involves rapidly shifting provision of work, education and home that is not coordinated with needs. The risk and responsibility for easing these tensions has been shifted from the state or collective level to the individual and household (Jarvis and Pratt, 2006). The result is a lock-in to a permanent state of hypermobility.

The consequence is a complete fragmentation of past urban patterns of home and work. To some extent the emergence of a degree of home-working will offset this. But most home-working is only carried on for a percentage of time (see Labour Force Survey data in Banister et al., 2007). ‘Nomadic workers’ might be a better term than home-workers.

Future scenarios

The aim of this final section is to present a range of scenarios that develop the themes and processes discussed above. In order to make the task manageable I have chosen to represent the alternatives along two axes: in principle this results in four outcomes. In the spirit of scenario building we consider them as suggestive of suites of outcomes, each with an internal range. There is not space to more than simply outline these here. The objective is to focus on the character of energy usage associated with each scenario set.

The first (x) axis concerns the issues of organisation and economic regulation. At one end we have placed the extreme case of globalisation and international dispersal of economic activities, albeit anchored in global cities. These cities are the national nodes of a globalised system of production, within which they occupy the highest tier. Such cities are in direct competition with each other for mobile investment. At the other extreme is a form of regionalism, or endogenous development, based upon the establishment of local production networks and tightly integrated subcontracting relationships.

The second (y) axis concerns the density of physical development at the scale of the city and building. Concentration may be represented by the high-rise central business district and lower density in the suburbs. There is a distinct urban hierarchy of cities, and they are separated by gaps such as a green belt. At the other extreme of this axis is dispersal, involving isolated rural settlements.

[[Figure 1: The four scenarios constructed by the two axes of development (globalisation–endogenous; dispersed–density]]

Figure 1 shows the relationship between these axes and the four scenario cells that they define (A–D). The objective in the remainder of this section is to flesh

out the ideal type of each scenario in order to generate a range of potential energy usage implications.

Cell A: High-rise, global city. This scenario represents the strategy of concentrating development to focus on agglomeration economies and the possibility of returns on scale that might benefit competitiveness. High-rise buildings are used to maximise concentration and reduce land use costs. These urban forms rely upon a huge inflow of daily commuting.

The energy costs of this model in terms of building construction, daily use and commuting are huge. Moreover, such costs are exacerbated by the congestion and overcrowding costs of agglomeration. To some extent mass transit options are efficient, but they are always vulnerable to capacity constraints and inefficiencies of alternative, ad hoc, solutions. Moreover, the global city is an international node, and is a significant generator of international air travel. Online communications are unlikely to reduce the need for contact significantly. At this level, trust and relationship management is the objective and this is a face-to-face activity. As high energy users, such cities will be particularly vulnerable to energy price shocks.

Cell B: Networked, endogenous city. This scenario represents an alternative approach to globalisation. It looks inwards rather than outwards. It seeks to use its resources, economic, social and physical, to the best advantage to maintain economic activity. Rather than seeking to attract in development, it seeks to grow its own. The focus would be on quality production rather than low cost, and the emphasis would not be simply on the high-value aspects of a global production chain. Development is still dense, but based upon reuse of the building stock. A potential innovation (this would apply to Cell A as well) might

be if residential development were allowed in the city to reduce the pressure on commuting. This ‘mixed use’ city is more consistent with Cell B.

While the reuse of buildings is positive, the poor quality of most inner city buildings in terms of energy usage means that expensive and energy consuming retrofitting would be necessary (Banister et al., 2007). However, it is logically consistent with this scenario that policy makers would encourage the development of a local energy-efficiency industry to satisfy such needs. Commuting would remain a problem, but one potentially ameliorated by the revival of mixed-use inner city dwelling.

Cell C: Rural survivalists. This scenario embraces dispersed development, which would no longer take place mainly in cities. This may result from an attempt to develop back offices in cheaper, dispersed locations, or by siting core offices in dispersed communities using telecommunications to link into a global network.

Most likely it will be the poor who are forced out of the city by a lack of jobs and high prices. In this scenario the focus is on endogenous development, which reverts to a self-sustaining community based on self-resourcing food and on elements of a cashless economy where skills are exchanged.

Energy use in such a scenario would be low, mainly because of the lack of commuting and congestion. On one hand, space heating costs could be high, as few resources might be available for refurbishment. But the low intensity of development and demand might enable a large take-up of renewable energy.

Cell D: Suburban world. The final scenario is one enormous ‘edge city’ (Garreau, 1991) in the shape of a continuous low-density development. As it is linked into the international economy, one might expect this world to exhibit a

concentration on home-working. High space-heating costs might be a consequence (Banister et al., 2007) but could be ameliorated by new build housing.

Here apparently resource-inefficient suburban sprawl could consist of new carbon neutral dwellings. However, this efficiency gain would be counteracted by the characteristic of urban sprawl that it is inefficient for mass transit, and that it generates much peripheral and point-to-point travel to allow residents to maintain their contact networks.

In summary, we can visualise the energy usage implications of each scenario, and the suite of further possibilities that lie between them, as the surface projected in a third dimension across the matrix of Figure 1; this is represented as Figure 2.

[[Figure 2: A three-dimensional projection of an estimated energy use surface (z axis) on the four scenarios shown in Figure 1]]

As can be gathered from the diagram, the energy usage envisaged runs from high to low in the following cell order: A, D, B, C.

Issues and challenges

The challenges identified in this report are associated with 'lock-in' to past governance modes of the built environment, exacerbated by rapidly changing demand structures. Demand is not simply changing in volume but also in character. A good example of this is the shift to home-working and nomadic working.

The shifts that will need to be dealt with concern a fundamental issue: how activities are coordinated in society. In the past, coordination was carried out through central control and physical movement. The drive for flexibility and for

the relocation of risks has meant that technical coordination has become the norm. Accordingly, physical planning responses are increasingly inefficient on their own. The challenge is to develop new forms of coordination.

New forms of coordination are required because current solutions are exacerbating our energy problems. On the surface, the major problem seems to be congestion and travel. But analysis has shown that a shift to less travel or to a lower increase in travel, via home-working, will place huge pressure on the most inefficient and energy-wasteful aspect of our society, housing. Home-working will lead to a shift from relatively efficient office, factories and communal resources to inefficient individual replication of resources. In any case, much home-working is carried out by nomadic workers who will have individual travel patterns which are often so complex that they can only be served by private car.

New technologies will not mean an end to tacit and face-to-face meeting. For many it will become more important and will be something for which they have to take personal responsibility. This may create demand for local or home-based networking solutions, as well as more demand for workspace at homes. One solution might be to develop community workspaces analogous to flexible corporate workspaces. They would offer hot-desking and easy in and out terms, and offer the possibility of social networking and meeting. We also know that contract or freelance home-work is often carried out by both parents in a family. There will be demand from this group, and from many single parents, for quality childcare close to or linked to these workspaces. All these developments also demand a considered response to the increasingly 24/7 work culture that is related to these new working patterns (Kreitzman, 1999).

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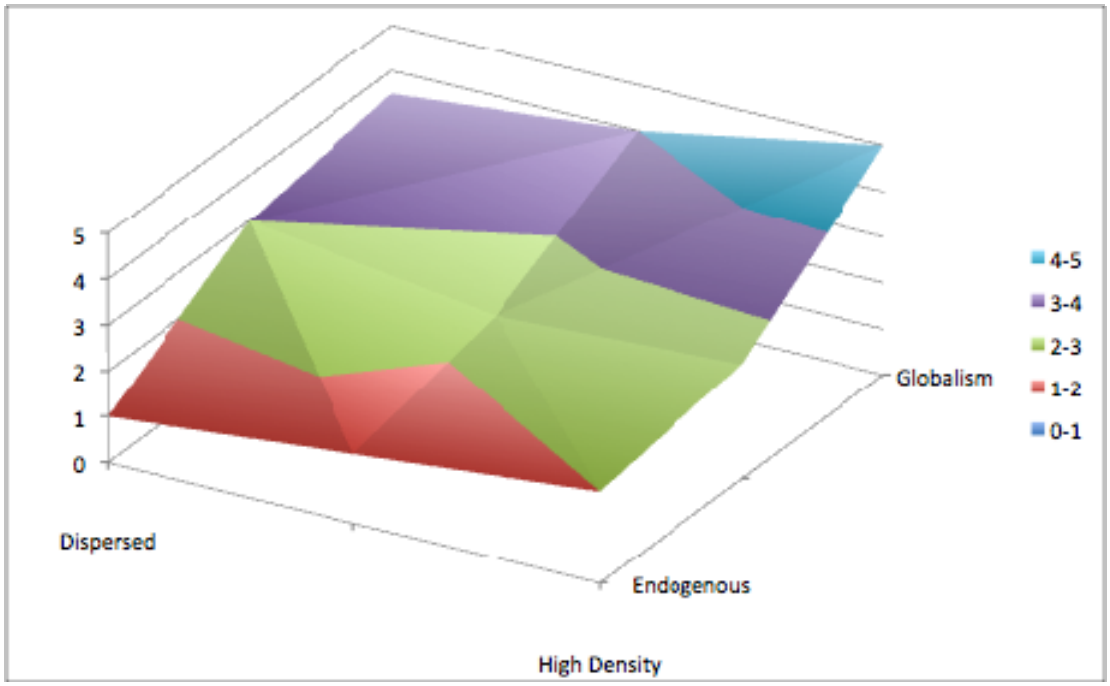
Figure1: The four scenarios constructed by the two axes of development (globalisation–endogenous; dispersed–density)

Figure 2: A three-dimensional projection of an estimated energy use surface (z axis) on the four scenarios shown in Figure 1

	High density land use	Dispersed land use
Economic globalism	A: High-rise, global city	D: Suburban world
Endogenous economic development	B: Networked, endogenous city	C: Rural survivalists

Fig 1

Figure 2


5
4
3
2
1
0
Dispersed
Endogenous
Globalism
High Density
4-5
3-4
2-3
1-2
0-1