

Innovation in the postwar British building industry: a historical view

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There is a tablet in Leeds Town Hall in memory of Joseph Aspdin, stonemason, 1779-1855, whose invention of Portland cement, patented 21st October 1824, 'followed by a century of improvement in its manufacture and use, has made the whole world his debtor.' Let Aspdin's achievement remind us of the numerous inventors and innovators who served the progress of building before our time. Yet notwithstanding the undoubted evidence of progress Henry-Russell Hitchcock could observe in 1954 that even by the middle of the present century most kinds of building contained a lower proportion of factory-made parts than had gone into the Crystal Palace a century earlier¹. But times were changing and the postwar construction boom, by then well under way, was the setting of attempts at innovation far more varied and wide-ranging than anything that can be seen in earlier periods of expansion, such as the 1930s². (If this is thought to be an extreme view, then perhaps the two or three decades preceding the Crystal Palace of 1851 will bear comparison). Hitherto, change in construction had been evolutionary, now it was becoming revolutionary. The concept of innovation, developed in economic analysis, is particularly apt for use in our attempts to understand the history of such a period³. But to suggest its usefulness is not to imply that historical explanation of the great postwar building boom which came to an end in the 1970s can be reduced to the terms of an economic analysis centering on innovation. We are of course aware of other aspects, in the history of politics, particularly as it involves land use, and in the culture of society, especially in respect of architectural design and social preferences. However, one probably does not need to spend much time contending that cost, and therefore questions

of economy and choice, are very important aspects of building history. Decisions to build are among the most expensive that we make and they have some of the longest-lasting consequences.

The concept of innovation

Innovation in the economic sense takes place whenever a more productive use of economic resources — capital, labour, and land — is achieved by means of one or more of various new ways of utilizing them. The obvious example is a machine which, expressing an advance of knowledge and technique, makes an article or provides a service at lower cost per unit of output or provides a superior quality of output. Much though not all of the goods and services of a modern economy appears to be susceptible to innovation in this sense, in a process which is closely bound up with economic growth and increase of real incomes. But economic innovation may take forms which do not depend on technological advances. A new kind of business organization which is more productive, that is, economical, in use of resources is also an innovation. If, for example, design-and-build contracts pass the test of economy taken with quality, then they should be counted among successful innovations. One can widen the identification of economic innovation still further by including the opening-up of new markets, often an important source of reductions of costs, either through cheaper inputs or by enabling larger sales which in turn sustain economies of larger scale production and may facilitate other cost-reducing economies such as more productive plant and equipment. Another direction in which innovation may take place involves government, with such developments as the Building Research Station after the First World War and the Na-

tional Building Agency in the 1960s.

A point to notice is that economic innovation is distinct from invention. Although some sort of invention, technological or otherwise, must underlie an innovation, it is by no means the case that all inventions, even all patented inventions, lead to innovations, still less to obviously durable and successful innovations. In the case of technological innovations it has recently been suggested that they and the inventions from which they derive can be studied usefully as two steps in a sequence of phases which systematically widens the context in which they are explained. There are six phases, as follows:

- (a) fundamental science
- (b) scientific discoveries
- (c) invention
- (d) development
- (e) innovation
- (f) diffusion of innovation⁴.

While fundamental science goes its own way, so to speak, not being obviously determined by the needs of society but providing knowledge which influences subsequent inventions, scientific discoveries are defined as advances which are concerned with society's needs, for instance in medical or industrial research. Although the scientific background is clearly important in technological invention and innovation, one will not expect to find that all technological inventions have a strong, direct dependence on science. Many no doubt arise from creative imagination applied to practical experience. But the influence from science is clearly too important not to be recognized in the systematic study of innovation.

Obviously some innovations are more successful than others. The more extensive and enduring the diffusion of an innovation, replacing some earlier established feature of the economy, the greater is its success (however much some of us may regret the changes involved). But all inventions, if they are to become innovations, must enter the economy to some extent, in a search for commercial profit or for some other form of benefit, such as a decrease in the cost, or an increase in the quality, of public investment

in building. This latter aspect reminds us that innovation also raises questions about who controls the industry and takes decisions to innovate, or not to do so, and about the relations between government and industry.

It is not too difficult to identify innovations individually in the setting of these definitions. We can all recognize the portable cement mixer of the interwar years in its spread on the building sites, or the tower crane in the postwar years. What is much harder is to estimate comprehensively how much innovation is going on from time to time. Probably most of us will agree that the postwar period has been a scene of busy innovation in construction, at a higher rate than before the war. But one must acknowledge that this impression cannot be readily supported by appropriate statistics, very desirable though these would be. Not only do the innovations evidently fall into a variety of categories. But even if one considers only the very important class of technological innovations — which contains of course great variety — there is no ready measure. Inventions officially patented are an obvious measure, despite the fact that so many are never put to economic use, since they do have a connection with innovation and it might be fairly steady over time. Other approaches to measuring innovation may be found in its relation with the volume of production attributable to it, the rate of supersession of an older product or process, or the stimulus to further innovations. But these various possible measures scarcely produce a clear, simple record of innovation. Some clarification can probably be achieved by ranking innovations according to a judgement of their 'radicalness', in the following manner, to which I have added some tentative examples:

- (a) basic innovations (iron and steel framing);
- (b) radical innovations (pre-stressed concrete; design-and-build contracts; large panel industrialized building);
- (c) very important improvement innovations (Fletton bricks; the tower crane);
- (d) important improvement innovations (ready-mixed concrete);

- (e) minor improvements;
- (f) minor product or process differentiations⁵.

As one would expect, in an application of these categories by experts the frequency rose substantially from the first to the last category. In the case of construction, one may speculate whether there has been any innovation that would be categorized as 'basic' in the period since 1945. If measures of the characteristics and extent of innovation in the industry can be made, this aspect can then be compared with others, such as, for instance, capital investment and productivity.

Costs, investment and innovation

Investment in buildings has always featured prominently in the process of capital formation in this or any other advanced industrialized country. One might therefore expect to find construction all the more prominent in total capital formation during the postwar decades when, as was recently said of the remaking of our cities, 'restructuring and growth required a building effort of unprecedented speed and scale'⁶. It turns out however that the proportion of total capital formation in the shape of all kinds of construction work was lower between the 1950s and 1970 than it had been in the 1930s⁷. In that remarkable era of growth since the war, probably faster than at any time since the Industrial Revolution, the growth of building was outstripped by growth of capital in other forms, especially machines of all kinds. What is the significance of this?

The most obvious, straightforward answer is that the economy was showing our response to the attractions of production and consumption of all those goods and services which were the result of, and most fully expressed, the innovative progress of science and technology, with its capacity to reduce the relative cost of products and sometimes enhance their qualities. The modern motor-car is the obvious illustration. Or the passenger aircraft. Implicit choices were being made in a situation in which capital equipment other than buildings was increasingly preferred. We might have behaved after all in accordance with Disraeli's advice that

while 'We all eat quite enough, and some of us drink a great deal too much ... no man can be too well housed'⁸. In that case we would have been more willing to spend a rising proportion of our increasing national income on construction. Instead the postwar building boom was marked by keen and enduring concern about levels of costs and the sums needed for investment in building, a concern expressed particularly clearly in government policy and administration. It was as if we were saying, if we are not very careful we shall feel ourselves unable to afford the buildings we know we need, let alone a touch of luxury. An early expression of concern came in 1948 in an official report on the cost of housebuilding which concluded that there had been a very large rise in costs since before the war and that a significant part of that rise reflected a fall in the productive efficiency of the industry which had been reduced by the circumstances of the war⁹. The decline in productivity took a long time to remedy and official concern continued unabated. The record is summed up in a recent study of British economic growth: 'The fall in productivity in 1937-51 was so great that notwithstanding a historically high growth rate during the postwar period, the absolute level of productivity in construction prevailing before World War II was not regained till near the end of the 1960s'¹⁰. It seems likely that the state of full employment which came about during the war and, of course, continued to the 1970s proved to be unfavourable to the ways of organization and working that had sustained the historically high levels of productivity during the 1930s. If so, the construction industry was exceptional in this respect, as other industries' records show no comparable setback. Meanwhile comparison with other West European countries, covering 1954 to 1960, showed that we were devoting lower proportions of our gross national product to construction as a whole and to housing¹¹. This of course can be explained in different ways. Our stock of buildings at the end of the war was certainly in better shape, less damaged by war and by previous economic stagnation than that of a number

of the Continental countries. So our need may have been less. But other plausible conjectures are less encouraging. In particular, other countries' building activity may have been sustained more strongly by higher standards and expectations, with consequent greater readiness to meet the expense, and by greater success in reducing costs by means of innovations. In short, by a benign interaction of demand and supply. In this country the concern about costs and productivity is more evident than any recognition of the possibility of raising the proportion of public and private spending devoted to building. In the latter respect there was instead the possibly damaging practice of varying investment in sectors of building as part of the process of managing the economy to sustain full employment and check inflation and balance-of-payments crises. By one means and another, probably consisting mainly of improvements in management and the cost-reducing effects of innovations, productivity did rise from the low postwar level and, as we have noted, return to the prewar level by the late 1960s. By that time the industry, and its products, were recognizably different.

The case of high-rise housing

The situation and prospects of the building and civil engineering industries comprising construction were thoroughly assessed midway through the boom, in 1962, on behalf of *The Builder*. 'The basic problems for the building industry' (it was said) 'are therefore, to increase its output with a virtually static labour force, to meet the demand for improved standards of accommodation and amenity, and at the same time to avoid increasing — and if possible to reduce — the price of its finished products, buildings, when land values, material costs and wages are rising'¹². The report then set out 'to analyse the technical and organisation changes which may need to be considered in order to meet this challenge and ways in which Government departments, public authorities and other institutions may help the industry to do this.' The emphasis on innovation is clear and the

arguments in favour are persuasive. Demand was forecast to rise by between 30 and 50 per cent during the next ten years, and the industry's labour force was unlikely to expand materially, so if rising prices were to be avoided new methods would be needed. Among these, as was being increasingly recognized, was industrialization of the building process, economizing in the use of labour by substituting more intensive use of capital equipment and raising the proportion of output made off the site in factories. There was, as we know, particular interest in its utilization in connection with another innovation of the period, high-rise housing for local authority tenants. This conjunction of two innovations illustrates a not uncommon feature of innovation, the clustering of several developments which, if all goes well, reinforce each others' advantages. The history of the drive to meet housing needs increasingly by these means provides a case of innovation which illustrates another of its features: that is, the possibility that control of the innovation will pass through the hands of a succession of different groups with distinct interests in the process of its diffusion. High-rise housing also of course shows with distressing clarity that an innovation raises the risk of failure and is by no means invariably carried through until it becomes a successful routine. But we need not harrow ourselves further on this occasion by looking more closely into the extent of failure. It is unlikely to be found to be total, even though high-rise housing is no longer being built.

The experience of seeing control of the high-rise innovation pass to other hands surprised and in the end dismayed its originators. These of course were the designers, the architects, who as heads of the building team (a frequent description at the time) were the appropriate and most likely source of new thinking about the form of building and, less emphatically, its methods and materials. By the 1940s a substantial number of British architects appear to have assimilated the innovative thinking of Continental architects in the interwar years about the feasibility and advantages of high building on a large scale.

The concept of industrialization had also been proposed. The scene was set for a major adventure in creative change in response to the evident and pressing needs of urban reconstruction at the end of the war. A notable moment in the diffusion of the high-rise form is generally recognized as the establishment of control of London County Council housing design and building within the Chief Architect's Department in 1950. Progress in London and elsewhere was from then on increasingly rapid, stimulated partly by the example provided by the estates in the metropolis which were visited by large numbers of architects, councillors and council officers¹³.

While the architects and town planners were hoping that high-rise housing would free land for other uses as well as improve the appearance and social utility of residential areas, central and local authorities were becoming at least as much impressed by the possibility that it would restrain urban sprawl. Local authorities such as Liverpool, Birmingham and Sheffield were short of building land within their boundaries. Legal, administrative and financial complications, as well as social and political losses, might be avoided if ill-housed citizens could be rehoused satisfactorily within the city boundaries.

Central government in the 1950s and 1960s, wishing to conserve the countryside by containing the cities within green belts, was willing to pay exceptional subsidies for the additional costs of high-rise housing. By the mid 1950s the scene was set for the great boom in that particular kind of housing, set of course within an even wider building boom. Aware of the restrictive implications of those high costs for the future of the innovation, architects continued and intensified their interest in industrialized building. If it was not obvious that the new techniques — many brought in from the Continent — would immediately mean lower costs it was possible to justify their use on inner city sites where labour was particularly scarce by pointing out how they facilitated work by removing it to places where labour was in better supply. The culmination of this search for means to

stimulate industrialization came with the setting up of the National Building Agency in 1964 to advise on innovations, including those adapted to high building.

Architects of course were prominent in the Agency, as elsewhere in the institutions and agencies of the boom. But their position was being overshadowed. Not only was government, central and local, adapting the innovation to its own purposes by emphasizing its conservative rather than radical, innovative, potential. But another group, the contractors, were in effect taking control of the design, marketing and production of high flats for local authorities. It is unlikely that any building firm would have thought about high-rise housing in the way in which the architects of the Modern Movement had done in the interwar years. Nor were the building firms so prominent in the high-rise innovations during the first ten years or so after 1945. High flats on an average town site, intended for people of relatively low income, were not a sensible commercial proposition. Nor was there anything in experience to suggest that they would provide the sort of homes such people preferred. The conception of the innovation therefore had to come from those whose cast of mind, training, and professional situation, allowed them to think in general and abstract terms about an ideal future. But once the programmes were under way and contracts were to be had, and once the architects' and government's interest in industrialized methods was evident and seemingly likely to be sustained, there was strong reason to seek a share of what could, if all went well, be profitable business in support of public policy. But, as we all now realize with the benefit of hindsight, these endeavours to mass-produce high-rise housing by industrialized methods led to buildings which were in a number of cases and various respects unsatisfactory. On the whole they do not seem to have been the equal in qualities to the earlier high flats which had been built with more conventional, well-understood methods and materials. The failure of Ronan Point in 1968 highlighted questions about the type as a whole and accelerated a withdrawal of government sup-

port which had already been indicated by a reduction in the special subsidy. The subsequent report showed the difficulties of maintaining professional standards of architecture and engineering in the context of innovation in the product, and in this case also in the organization — the package deal contract¹⁴. In addition to technical problems and high cost, there was growing evidence of the family and social problems of living in buildings which had never been intended as homes for families with young children but had nevertheless come to house them in considerable numbers. In this situation many people stood appalled at the outcome of a well-meant innovation, and none more so than the architects who had promoted it twenty years and more earlier. The risks of innovation were sharply in evidence in the later 1960s. What was not quite so obvious was the difficulty of transforming an innovation, conceived and initially carried out by people of exceptional talents and resources, to a routine which could be adequately performed by those of average abilities. There was also, particularly alarming for the pioneering architects, the demonstration that an innovation could slip from their control into the hands of others without however absolving them from public criticism and complaint. The idealism and undoubted talent which they had brought to a bold innovation had not saved them, and those they sought to serve, from disappointments and discomfort.

The package deal contract was a secondary innovation which supported high-rise housing. Its appearance provides another illustration, with industrialized production, of the tendency of innovations to form clusters and thereby magnify their total impact on the economy and society. Like industrialized building, it was not, we know, devised simply in response to the advent of high-rise housing. But the contractors, facing the opportunities, uncertainties, and risks of innovation and in many cases wishing to feature a particular system, correctly realized the potential advantages of the relatively new form of contract. They could reasonably feel better informed than either local authority architects and

engineers, or even outside consultants, about the most efficient utilization of their materials and methods. One must admire their enterprise and commercial courage and only regret that in some cases departure from cautious adherence to more traditional practices of collective consultation seems to have led to failures and loss to all concerned. But that is the way with innovation: the more extensive it is, the greater are the chances of profit and benefit, but also the greater the risks of loss and inconvenience. The innovation of the package deal was not only a sign that control of the high-rise innovations was slipping away from the architects — notwithstanding their employment by the contractors — but it also pointed to a more general conclusion about the potential for change in their role and place in construction. They rightly realized that their leadership of the building team was threatened. What they perhaps did not so readily appreciate was that this came not from the new form of contract as such but from the consequences of technical and other innovations.

As long as the building industry was subjected to no more than slow technical changes of the kinds it had assimilated during the nineteenth century and the earlier part of the present century, the division of labour and of organization between the architect's practice and the contractor's firm worked well enough. But innovations made demands on both the design and the organization and carrying through of building work that ideally required more highly integrated teamwork, cutting across the customary separation and of course raising questions about the leadership of such a team. It would appear that these questions, although by now well recognized, have not received a unanimous answer. Nor perhaps is a single solution necessary or even desirable. Perhaps it will be found that the present variety of contracts is itself an effective innovation in response to the needs of construction in the latter half of the present century.

Conclusion

The case of high-rise housing considered as

an innovation suggests that the concept of innovation can be fruitfully applied in the history of construction. It is, indeed, no more than a generalization from common observations and commonsense, not a highly technical application of economics. What it offers most importantly is a framework of simple forecasts of the context in which decisions will be made, probably varying according to the extent of the innovation. If it is illuminating when applied to high flats, it should also be useful as part of the set of ideas which we as historians can use in the study of other cases, ranging from particular sites and their buildings, to whole types of buildings, and including methods and materials, forms of organization and markets. In approaching a particular case one could, perhaps, initially identify it as either radical or conservative in terms of innovation. If conservative, then of course the expectations based on innovation will not arise. But if radical, one would be likely to find them useful.

Associated with innovation is the question of cost. Building is an expensive business, not usually approached lightly by those responsible for deciding upon it. There may sometimes be episodes of euphoria when funds seem to be readily available and costs are not thought to be a particular problem. But the postwar decades were not often, if ever, like that. The pressure of concern about costs was generally in evidence. If the cost of building relative to the general level of costs and prices tends all the time to rise — and that in the long run has been the historical tendency — it may stimulate efforts to try to check the rise by means of cost-reducing innovations, if possible without loss of quality. Only if we were as unreservedly committed to building as Disraeli appears to have been, might we perhaps acquiesce in a process whereby it would consume a rising proportion of a rising national income. But our postwar history tells a different tale: a record of efforts by both government and industry (and indeed by the private citizen with his 'do-it-yourself' activities) to contain the pressure on costs that was bound to arise in an

economy in which the rewards required by labour of all kinds were determined by the productivity of industries, and, latterly, of services, whose output was rising with unprecedented rapidity by means of innovation.

So it came about that an industry which was still essentially Victorian in character in 1939 responded at last to that commonplace of Victorian everyday wisdom, 'You can't stop progress', by embarking on rapid and extensive innovations so that today it surely presents a very different face to the world, no doubt for better and for worse.

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