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D. R. Harper

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Research and development needs

BY D. R. HARPER

*The University of Manchester Institute of Science and Technology,
P.O. Box 88, Sackville Street, Manchester M60 1 QD*

The dangers of forecasting will be obvious, particularly in the light of accelerating change emphasized by many of the previous speakers. In view of these papers by distinguished men, I cannot take refuge in one or two of the more certain of the developments and innovations to which they may have referred. I hope in these circumstances, I may be forgiven if I take something of a synoptic look, knowing that I have no unusual qualifications, except age, for this activity. I will therefore, in advance, apologize for some of my opinions, and understand that I am very vulnerable and can be challenged.

In order to reach my assessment of needs, I shall take a look at the not-too-distant boundaries of technical development, for I share with scientific colleagues, great anxiety, though I retain some optimism. Any acceptable reference to *needs* however does not ensure that they will be met.

Twelve years ago, we were encouraged by the reassessment of architectural education at Oxford (1958) and by a sequence of tripartite conferences which had, as their objective, a collaboration of effort in all matters of the organization of the Building Industry with a view to improved performance of both personnel and the project. In the years that followed we had many outward signs of innovation and development, as typified by curtain walling, the use of the tower crane and other mechanical handling gear, a number of prefabricated systems, and the nearly universal installation of central heating. It may be an oversimplification, but, for the argument, the development of much of this work preceded research, except no doubt behind the closed doors of individual companies. Research has tended to follow these manifestations – *post mortem* in effect – a condition that tends to bedevil the development and innovation of the industry. Much of the Building Research Station's work is concerned with research which has become important due to failure, or simply lack of performance: this is not meant to be a criticism but it does reduce opportunities for innovation. In the considerable programme of work in the B.R.S.'s 50th anniversary year, great efforts are being made to improve concrete and develop plastics, to study jointing systems and sealants as related to accuracy and tolerances, and to portray with more certainty the interrelated problems of environment. Certainly a full programme, but it reveals some of the education, training and control deficiencies of the industry itself, which cannot be ignored.

In the world of technology outside building in these same years, we have witnessed the advent of computers, radio telescopes, outer space capsules, nuclear submarines and electronic remote control devices (these are only a few), but in these cases, the research effort was considerable and mostly preceded the actual production developments. This research work and the repercussions which have accompanied these developments do not seem to have penetrated very far into the industry. The Building Research Station and one or two universities have so far laboured on the unrewarding task of trying to piece together the fragments of relationships and interactions taking place. By this work, we do see certain technical facilities developing – the use of

computers as aids to design decisions as well as book-keeping; improved and more adaptable mechanization of plant and equipment, improved measurement and control of performance. In fairness, it must be said that some sections of the Industry have contributed more to research and development than is credited to them. Considerable effort, for example, has been expended on the design of viable industrial components, but much has been lost for want of recording of information.

So much of this work, including that of the Research Station lacks recognition – for a number of reasons including little enthusiasm in general from the industry, and little status and news value for the public. To make progress we need a new assessment of Buildings contribution. One hesitates to claim for building, a special place, in providing a social service. Yet in the trilogy of the basic needs of human habitat – food, health and shelter – the industry does provide the last. It is an oversimplified view that only profit (or loss) features in building, and there is value, in our concern for future directions of research, in looking closely at a ‘service’ component as part of the research needs (and certainly the research ‘image’). There are signs that too much faith has been placed in recent years on management development. Much of this has been disappointing because the present tasks of building – its resources related to needs – are not well understood, and management must continually encourage the involvement of the rank and file (research worker as well as carpenter) in occupations where innovation is a prime and regular necessity – and I believe management of innovation to be a very difficult and elusive task. It would seem that our research must in large measure be concerned with innovation, not in the narrow sense of profit nor even of technical progress, but directed towards the socio-technological balance which has eluded us in Building for so many years. Not that we can foresee any stability and all our efforts must be directed towards dealing with ‘change’ and obtaining a public trust for so doing.

It helps at this point to look squarely at the world pressures which are causing many of us so much anxiety. I have only time to list the most important. They include:

- (1) The threat, beyond recall, to the world’s ecological balance.
- (2) The expectation among the underprivileged in all countries for a share of present affluence, including better housing.
- (3) The collapse of most real values within our modern industrial societies – the values of our historic and more spacious past. Our heritage of beautiful and magical things are all at risk.
- (4) The imminent population explosion.

I believe these forces all have some focus in building, and must colour our assessment of our future research effort. I would add a more personal view that our task can be a lot easier if we can move away from the expanding oppression of the motor car, the dominant oil and power interests, and the creation of unnecessary consumer markets. All these make environmental collapse more imminent, but I must reach and then confine my task to making some assessment of our research and development needs over the next 18 years. From the early references I have made, it will be understood how hazardous any forecast must be. On the one hand, we have the heavy hand of the historic traditions of the industry with little to encourage innovation: on the other the enormous forces of change, many of which can be detrimental to life-giving environment. Building as an activity provides a substantial component to that environment for better or worse.

Before all else in these circumstances, there comes the need to educate and train many more research workers to operate within the problems of the industry, while standing a little apart

from it. They will need to be immune to the general research pessimism of the industry, and their motivation must be towards an understanding of socio-technological change. It follows that our future research programmes should not, and cannot be so dominated by increased productivity and quantitative objectives. A prime task is therefore to investigate new education methods for training a new kind of research worker, retaining most of the analytical skills of his predecessors, yet able to forecast with more accuracy the social and environmental results of innovation. Obviously we cannot wait until we can assemble a number of such new scientists ready made, but both the strategy for future research might be planned, and the industrial climate for development participation improved. I am in danger of resorting to jargon and generalities which I would like to avoid, and for this reason now wish to subdivide, albeit inaccurately, my forecasts under three headings. I readily concede that others, perhaps more satisfactory, could be used, but I do not regard the 'shopping list' I catalogue as being as important as setting up the stall and the salesmen. If my salesmen, then, are the new research workers, the stall required is to work for the widespread recognition of a building project system, in the precedent of systems engineering, so that research and development can become an essential part of the greater system. By these means we can find an intrinsic niche for research development as part of the general process, within the industry, of the construction of advanced building projects. This could be very different from the setting up of specialized contracts which has tended to be the lot of some of the B.R.S. most commendable efforts. The research effort concerned with acceptable (and beneficial) industrial participation must of course be continued and developed.

With these two major needs stated, anticipations about research programmes can be put into categories of progression of (a) scientific and technical improvement – which might lead to (b) innovation – which might lead into the developing socio-technological concepts of (c) environmental strategy. Of course many tasks would stay easily within the stated categories, but some characteristics of innovatory research and nearly all within 'environment' must be related to conditions of change in which the research remains on-going and some of the argued findings become obsolete as time goes on. It is this aspect that makes Industrial participation so vital.

(a) *Scientific and technological improvement*

Within this general heading must feature much of the work on which research stations and universities are presently involved. Among the projects can be found valuable work on sealants

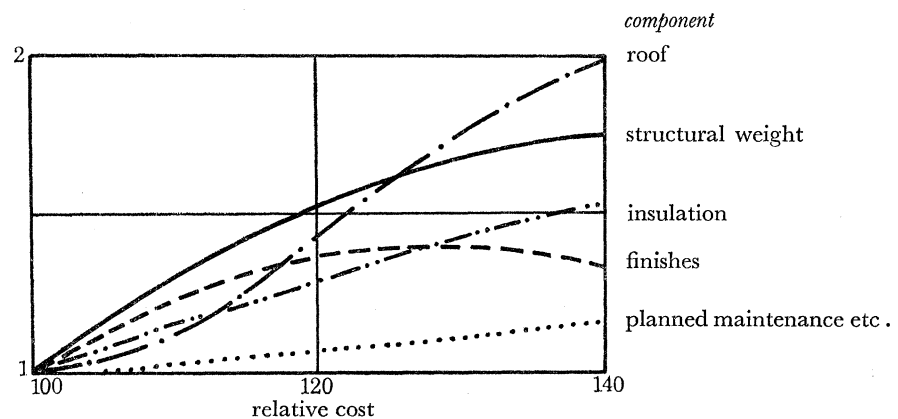


FIGURE 1. Performance values.

and joining systems, accuracy and tolerances, and on the improved insulation of materials. It can be expected that many of these programmes in so far as they have stated and limited objectives will have been resolved before the 1980s.

Within at least five areas however, work could proceed well into the next decade. These would be studies of erection and assembly techniques directly related to ergonomic standards of control, handling and performance. This work will require much more advanced techniques of the performance measurement of components. I believe that we will turn our attention to the development of a much more universal kit of building parts applicable to a wide variety of building projects. They may well be timber based duly guaranteed against ready combustion. Finally in this category, much more work must be undertaken on building safety – particularly during erection, though also during occupation. A concomitant of this work must include some real study of the developing techniques of the demolition of high and big span concrete buildings.

(b) *Innovation*

The first moves here must be from product to process. Because I believe industry in general through its traditional management framework, resists change in its organizational structure, there must be a prolonged and even unpopular effort to examine and re-assess the roles necessary within a new organization structure for buildings. This is not so much because of the fairly

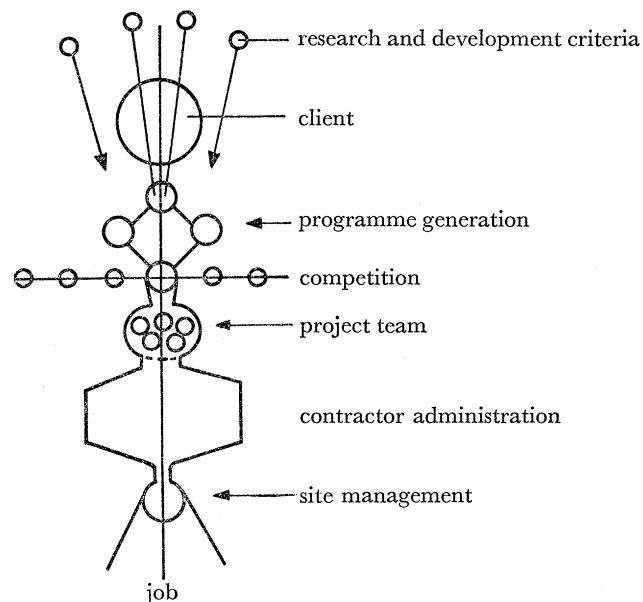


FIGURE 2. Organization and control

normal resistance to changing technologies, but because of the development of new demand – political and cultural – will require new skills, and the attainment of new values on the scene of operations. It has become a cliché to refer to the separate functions of design and production in building, without much happening to close this gap. Again, demand and problems associated with performance of completed buildings will force changes of building method upon the industry.

Three research programmes, in some measure already being developed in Manchester, must be pursued with the support of industry. They are interlinked and include a dissection of the actual operation of the conditions of contract as determinates of satisfaction for all parties: the

improvement of the standards of site management by better and more sustained education and training and by the provision of sensible resources commensurate with the complexity of the project: and the design of the tools and the development of a system of communications which really informs all concerned and receives return messages back to headquarters.

These research projects will first develop as simulation studies, and then on to model projects, at which point they will require appreciable support from specimen clients and from government. They stand as prerequisites of a real improvement in performance both for the site, and for the completed building. They need, however, to be accompanied by much further work on design methods so that, in support of the genesis of a project, real programmes in line with future requirements can be prepared and satisfactory performance specifications can be developed. These must not evade the cost level at which the project is aimed, and some attempt at the interrelationships between performance and values must be made so that agreed standards of materials and workmanship can be anticipated.

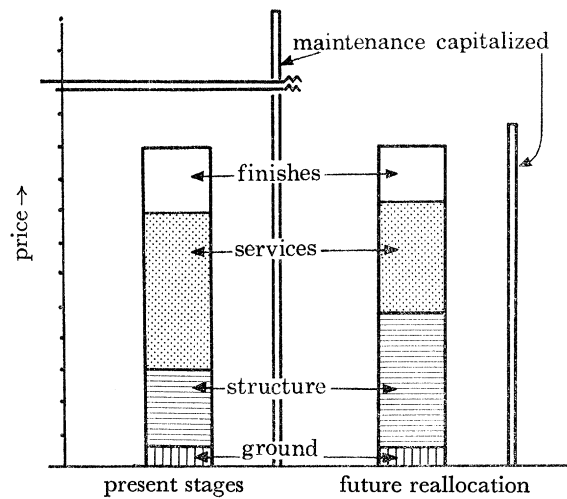


FIGURE 3. Relative stage prices.

These investigations which can of course be developed from many case studies, must be accompanied by the development of more satisfactory techniques of usage analysis. The analysis of user reactions and requirements has so far been disappointing largely because so many disparate emotions cloud the answers to questionnaires, to the point where they must be regarded as too unreliable for our purpose. Thus new techniques must be devised and tried, particularly in the light of more user participation at various decision levels.

(c) *Environmental strategy*

In the development of many urban and planning studies of the 1950s we had some reason to be pleased with our performance in new towns and some of the more elegant extensions to some of the old ones. Increasing costs were capable of control, and it seemed that the expected environmental needs would be adequately met by density and land use standards. Little concern was shown for the impact of new considerable urban building upon the original environment and landscape, nor was much anxiety expressed concerning the influence of the motor car and door to door transport. Now we know much more about the impact of new population on the urban fence, on the countryside and farming, about the widespread run off from paved areas, and about the problems of sewage waste, refuse and discarded apparatus.

All these problems have increased by the recent concentrations which are found in our rising densities, the greater floor space indices and the way even the more expensive houses are being crowded together on minute plots of land. We have to accept humbly that though buildings can improve the environment, within the context of these necessary densities, they rarely do and we must (reluctantly) consider the building as a waste receptacle and a waste and pollution maker.

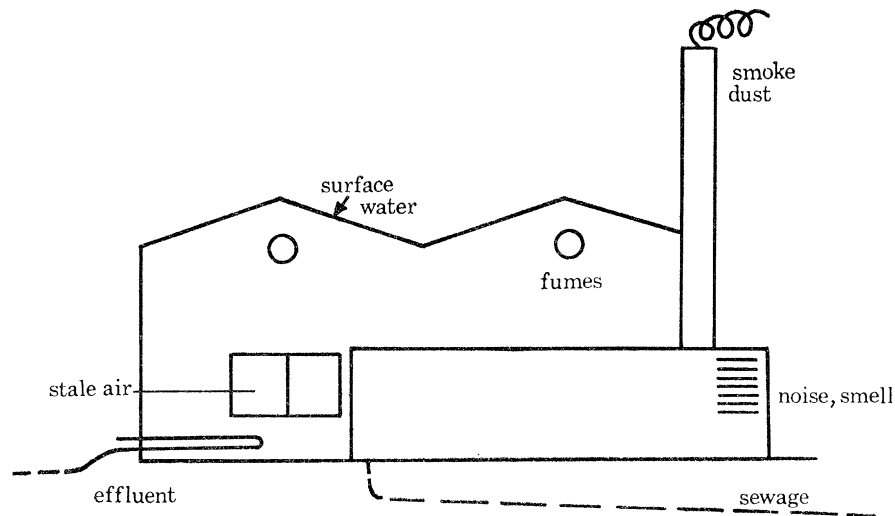


FIGURE 4. Building exhausts.

This suggests that our future research must broadly look at the services and servicing of buildings afresh by studying the anatomy of relationships between the external fabric and the totality of services just necessary to provide adequate comfort standards. This work must include reducing to a minimum all waste products – sewage, fuel smoke and fumes and that vast amount of wrappings and waste paper that is trundled out in bins. We must devise means by which all this waste is first reduced and the rest dealt as a responsibility of ownership – on the spot. Such new research projects could far transcend work we have so far done on building environment, but nevertheless research and development work must continue for some time on wind effects on and around buildings. More real analytical work needs also to be done on both internal and external lighting, for standards in many areas have exploded unnecessarily and uneconomically. We commonly witness total artificial lighting on very bright days in nearly totally glass-fronted buildings.

Much reference is made by research workers and others to flexibility to allow for the increasing changes expected in building needs and requirements. This tends to mean capacity to alter and adapt sometime after completion, but I think it can be better served by considering specialist stage building in which we think of ground works, superstructure, services and furnishings as having separate identities with opportunity for specialist design and erection teams – the work would proceed continuously, but the team would change. There is a serious and difficult research task here to reassess standards of performance in such a form that the spatial and material standards of such a building for its latter stages of services and finishes could remain flexible for some time after actual construction had started. Obviously such a system would require quite new design attitudes but successful solutions would give a better basis for change later. The building built tailor-made for a special purpose quickly decays when that purpose declines.

This brings me to a final research subject of urban decay and the need for stepping up new work only recently started on this subject. We know that there are great problems of urban values and a great need to control these in our usual urban areas of mixed development, age and use, which we now know will always be with us. We have come to believe, after some sombre experiences of wholesale central redevelopment, that we must in fact recognize and cherish the very humanity of mixed development. This means that we should develop early warning systems within the boundaries of small environmental areas, which permit us to halt decay and set in process renewal techniques, which so far we have only witnessed the very sought-after old dwellings of Chelsea and other inner London suburbs.

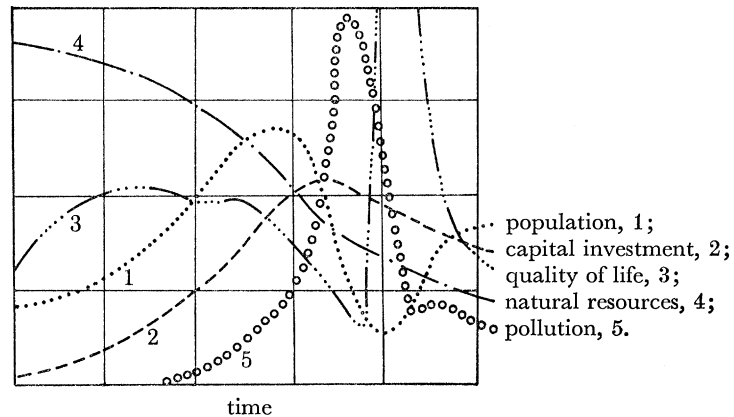


FIGURE 5. The predicament of mankind: sample prediction of M.I.T. from *World Dynamics* by J. W. Forrester (*Guardian* 20 October 1971).

I have catalogued enough to show some kind of possible programme for the 1980s. There will be many who will disagree. In the circumstances of the 1930s and even the 1950s, it might have seemed an exciting and confident prospect. In the light of the M.I.T.'s chart of 'the predicament of mankind' I cannot see it that way. I do believe we must, through research and development in which much more of our industry must participate, add our small contribution to the safeguarding of our environment.