

ECONOMIC QUALITY DESIGN

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Key decisions in the development of a project affecting cost and quality need to be taken in the very early stages of the design process to achieve the best value. It is therefore important to make the correct strategic decisions in the early stages, as it becomes increasingly expensive and unrealistic to make changes as design proceeds.

The aim of this research is to produce a reliable strategy, for use at an early stage of the design process, which enables the evaluation of a proper balance between cost and quality, in order to achieve best value.

The definition of quality is complex. Quality in building design will embrace all the aspects by which a building is judged, all the meanings and associations attached by people to places, the aesthetic qualities assigned by people to their surroundings.

Hampshire County Council Primary Schools are used as an example for data collection and analysis. These schools were selected as the County's policy is the achievement of a positive balance between quality and cost. The schools are regarded as excellent, in a quality scale of poor to excellent, by users, the public and construction professionals alike. The study enabled us to identify design quality patterns and to get a better understanding of how qualitative and quantitative criteria relate and the extent to which quality and cost are related to each other.

Keywords: best value, building design, cost, quality design, quality patterns.

INTRODUCTION

There is no clear consensus of what constitutes quality. Powell (1987) claimed that the term quality might be loosely used in association with words and concepts as varied as appearance, fitness, merit, reliability, utility and value. According to Cornick (1991) the problem with the word quality is related to its different meanings for different people, in particular situations. There are intrinsic difficulties in defining quality, as there can be no absolute definition of quality that will always satisfy the myriad circumstances in which the quality issue has to be dealt with (Seymour and Low 1990). The definition of quality is indeed a very difficult and subjective one. Atkin and Potheary (1994) argue that quality can be differentiated from other parameters by the elusiveness of its definition and the difficulty in establishing measures of performance. Even excellence in technical performance can be subjective, as individual people react differently, both emotionally and physically, to the same environment (Cornick 1991).

Pursuit of quality is a widespread implicit aim in building design activity (Powell 1987). In considering how to assess quality in design, many possible judging criteria are available. While some try to appraise quality objectively through performance standards and measurable attributes (Harrison and Keeble 1983), others prefer to do it subjectively (Holgate 1982). Aesthetic quality is something that is highly subjective and is prone to change from time to time, as does any activity concerned with visual

appearance (Cornick 1991). Quality in building design will embrace all the aspects by which a building is judged, all the meanings and associations attached by people to places, the aesthetic qualities assigned by people to their surroundings.

Quality in design of buildings clearly bears some relation to, but is not entirely governed by, cost (Spedding 1984). Inevitably all design decisions have cost implications: the shape of an intended building, the materials and the method chosen for its construction, and its expected cost will determine if it will be built or not. Moreover, when completed and in use, its design will have significant effect on maintenance costs. In effect, quality buildings should have lower running costs, besides being relatively free of major maintenance costs (Ferry 1984).

The primary purpose of this study is to investigate whether there is a relationship between building cost and the quality of design. Hampshire County Council Primary Schools are used as an example for data collection and analysis. These schools were selected as the County's policy is the achievement of a positive balance between quality and cost. Users, the public and construction professionals regard the schools as excellent, in a quality scale of poor to excellent. Further, the cost of school buildings has traditionally been fairly rigidly controlled by the Department of Education and Science (Hawkes 1981), although the abolition of cost limits for school building has allowed individual authorities a greater degree of freedom in deciding how to allocate their budgets (Barbrook 1988).

BACKGROUND TO SCHOOL BUILDING DESIGN

Schools have developed and grown into a significant national resource since the original Victorian commitment to state education (Seaborne and Lowe 1977). After the Second World War, and in response to the unprecedented demand for new schools to cope with the post-war baby boom, there was a commitment to replace what was then considered outmoded Edwardian and Victorian buildings (Hannay 1987a). The Butler's Education Act of 1944 proclaimed an extensive change in the objectives of education with new education methods and functions demanding both new buildings and new architectural forms (Ringshall *et al.* 1983). Further, the new school buildings conveyed the message that progressive, liberal education had arrived, opening the way to a massive school building programme (Jordan 1956). It was between 1948 and 1956 that the main lines of school building policy for the post-war period were effectively established. (Maclure 1984).

Cost control of school buildings was also introduced by the Ministry of Education in 1949, establishing limits of capital expenditure upon each project, together with the publication of statutory regulations for minimum sites, teaching areas, lavatory accommodation, etc (Seaborne and Lowe 1977). In 1965, the Ministry of Education changed its name to Department of Education and Science (DES). The 'new' DES administration tightened cost limits on new school buildings, these were made through the use of system building (Ringshall *et al.* 1983). Restrictions on public spending have coincided with an aging stock, and new responsibilities for schools to manage varying percentages of their building maintenance (Seaborne and Lowe 1977).

Further, environmental concerns and their implications for school designs were more and more a priority issue. Ringshall *et al.* (1983) argue that, ever since the Education Act of 1870, the nature of the physical environment has been one of the major themes in school building. In the post-war years, and stimulated by the Butler's Education Act of 1944, minimum daylight standards for teaching rooms were introduced (Hawkes

1981). In 1969, a House of Commons debate resulted in the creation of 'Environmental Guidelines for schools buildings', which eventually became DES Design Note 17 (Poole 1988), whose guidelines search for a balance of environmental factors, setting parameters for comfort, good day-lighting, acoustics and heating.

HAMPSHIRE PRIMARY SCHOOLS

SCOLA Schools

During the 1950s and 1960s, the commitment to a new kind of architecture was paralleled by the movement towards child-centred education, and open-plan buildings were used (Cooper 1981). The school building consortia ranged in concept from attempts to introduce as much prefabrication as possible, to rationalized traditional buildings albeit usually relying upon a steel frame (Spedding 1984). School building was dominated by systems such as Clasp, Mace and, in Hampshire, SCOLA. By the 1970s, the flat-roofed, ample sunlight and open-air system-built school, based on Gropius's concept of pre-fabrication by components rather than units of structure, was firmly identified with all that was best in progressive teaching methods. Education was perceived as inseparable from environment (Saint 1987). It was then thought that good architecture was embodied by those system building schools (Hellman 1985), though they invariably give little comfort to the users or aesthetic pleasure to anyone who observed them (Farrell 1985: 7).

Today, all the problems associated with those schools with their flat roofs, thin construction, arbitrary use of glass and false economies have altered this judgement (Weston 1991). For instance, the structures chosen for these buildings were initially designed for economy in structural and production terms, and did not necessarily achieve a good fit with the spaces to be provided (Spedding 1984).

In 1974, like other County Councils, Hampshire County Council was facing with ever-growing maintenance problems from SCOLA buildings (Farrelly 1988). The need for change was urged by the global oil crisis focusing attention on energy consumption, the deep recession of building industry and the falling birth rate. This meant a radical reduction in the building programme, enabling the emphasis to shift from quantity to quality (Weston 1991). The real change started in the early 70s with the reintroduction of brickwork and pitched roofs (Hellman 1985).

The Hampshire success

In Hampshire, the 70s coincided with the re-organization of local government and the arrival of a new county architect, Colin Stansfield Smith, whose aim was to turn his design office into a design centre, where all the architects worked on the drawing-board, and all professions contributed creatively to the building design (Weston 1991). The Hampshire standard brief of the 1970s stressed the qualitative aspects of the educational environment, in particular, the significance of scale and variety and the design aimed to provide a range of different educational environments (Eaton 1989). Hampshire's briefing notes to architects call for a school building in scale with children, which promotes feelings of warmth and intimacy which provide for different kinds of activities to be going on the same time (Hellman 1985). The briefing goes on to call for a series of spaces of varying character, with home bases having access to shared facilities such as library/ resource area, hall and music/drama room and where pairs of classes are associated to facilitate team teaching.

The environment is controlled by orientation of classrooms and the use of natural light and ventilation, a more appropriate technology following the energy crisis of the early 70s (Eaton 1989). In Hampshire Primary Schools the design team aim was to produce a low energy building, but not at the expense of higher capital cost (Barbrook 1988). Indeed, with respect to energy management by design, Hampshire schools have always been well within the target set by DES Design Note 17, with several awards in this respect (Nelson 1987).

By the mid-1980s Hampshire's achievements were attracting wider interest (Powell 1998) and the patent success of new school building in Hampshire was essentially due to Hampshire's approach to energy consumption and conservation and to the Architects Department's intention to promote architectural quality. Further, Farrell (1985) argues that the success of Hampshire Architect's Department is due not only to changed architectural attitudes and philosophies, but also to mastering new teamwork skills. MacCormac (1991) also argues that underlying the Hampshire achievement is a professional attitude to the conduct of architectural practice, a commitment that puts the product and the client before process.

USER INPUT TO DESIGN

The relationship between buildings and users has become a central theme of design discourse as designers must know for whom they design and why (Margolin 1997). A new approach and attitude is discernable, not only to architecture, but to group working and leadership, towards simpler buildings where the quality of human life must be closely related to the quality of the environment that society creates for itself (Farrell 1985).

Kernohan *et al.* (1992) argue that it seems more sensible for designers and managers to become involved in a process of negotiation with clients and users to develop building solutions acceptable to all. Indeed, the idea of user involvement suggests a desirable co-operation between client/user and designer. Yet we must anticipate that this will not often be the case as designers may not have access to users. In effect, designers must please their clients who are often not the end users. They face a tough task as they answer to their clients, and it may be hard to find out who the actual users are (Norman 1998), consequently what their needs and expectations are. It is difficult to plan for the needs of user clients who are neither well known nor readily available to plan with (Zeisel 1984).

On the other hand, as the scale, complexity, and number of people affected by design increases, it becomes even more difficult to realize effective user involvement in the design process (Mitchell 1993). Lewin (1946) argues that, to be effective, people involved in social change must also be involved in the process of generating knowledge about that change, in posing issues to be researched, in implementation, and in evaluation. Furthermore, it is difficult to make three-dimensional design comprehensible.

Kernohan *et al.* (1992) believe that one means for bringing users and providers together is to develop processes that enable users, designers and managers to benefit from the social negotiation of building quality. Punter (1994) also points out that there is a need for innovative approaches to handling the development process, finding the right design solutions through the constant collaboration of developers, architects, planners and the local community. Furthermore, Goodacre *et al.* (1982) argue that, to

Table 1: Significant school costs

	Yateley	Netley Abbey	Tadley	Woodlea
Year	1980	1983	1985	1990
Total costs/m ²	£257.16	£363.66	£415.62	£668.14
Average national costs/m ²	£230.00	£300.00	£300.00	£550.00
Floor area (m ²)	1040	992	1029	1157
Roof area (m ²)	1162	1021	1290	1344
Costs of roof (%)	16.31	20.22	17.35	18.58

Table 2: Spatial arrangement

Yateley Newlands	Netley Abbey	Tadley	Woodlea
Two rectangular blocks either side of a glazed conservatory, which reduces internal circulation, allows extra teaching facility and allows landscape to be brought into the heart of the building	Classrooms organized along south-east facing conservatory, which acts as the principal circulation route. Indeed, the organizational, social and environmental focus of the design is the conservatory.	All the shared and circulation areas are gathered together into a central common space, off which the classrooms opened, though not every front to the classrooms is open to the shared area	School positioned around a natural bowl with three different levels within the building. All classrooms have glazed clerestory windows facing south (into the bowl)

articulate building users needs and demands for quality buildings, the most commonly used method is to hold a series of meetings with the representatives of the client body.

RESEARCH METHOD

An extensive literature search was conducted on Hampshire County Council primary school buildings and it was decided to focus this study on four primary schools built between 1980 and 1990, namely Yateley Newlands, Netley Abbey, Tadley and Woodlea. Those schools are all well documented on building studies and reviews, besides being regarded by users and designers as quality buildings.

According to the Hampshire standard brief, each school design must evolve, preserve and enhance existing site features, in order to achieve a harmonic integration with their surroundings. Moreover, the design aims to provide a range of different educational environments.

Some of the similar characteristics of the four primary schools selected are displayed in Table 1 and Table 2.

From table 1, we can see that total costs/m² are above the average national costs/m² as a whole, though all four actually present a considerable saving in running and maintenance costs when compared with the norm. Indeed, each school design presents a selective approach to environmental control, in order to make maximum use of daylight, natural ventilation and solar gains, besides enabling users to control and select environmental conditions.

Further, we can also notice that roof costs represent an expressive percentage of total school costs. A similarity is the extraordinary preoccupation with roofs. These

colourful high pitched roofs are not just required to shelter and enclose, but are used to outline and unify the variety of volumes they enclose, besides providing a proper identity to the school building. The wide roof overhangs are a common attribute aim to provide protection from summer overheating and adverse weather conditions.

A brief summary of the school's spatial arrangements is presented on table 2. This table outlines a common feature in all four schools, a central conservatory or bowl which acts as the principal circulation route, besides serving as a useful additional resource area and allowing landscape to be brought into the heart of the building. All classrooms present glazed windows facing south.

DATA ANALYSIS

In order to search for quality patterns, some common characteristics of the four school buildings have been compared and an exploratory quality criteria has been delineated, focusing on five main issues:

- *users' view*: an investigation on how users perceive and experience their school buildings, on how users' goals and aspirations are achieved.
- *design team and client interaction*
- *spatial organization*: plan forms, circulation systems, flexibility, etc.
- *spatial variety*: differing scales and shapes, variety of materials, colours and details, aesthetics, etc.
- *technical specification*: traditional or modern building, functionality, efficiency, etc

Users' view

Hampshire County Council intends their buildings to be a reflection of a new attitude of participation, which encourages in the community a sense of pride in its involvement and shared ownership (Hampshire 1985). However, designers of public primary schools have to deal at an increasingly complex interface with their public, as they have to satisfy the needs of building users (most of the times, they can only ask the collaboration of head teachers) as well as administrative and adviser clients.

A designer usual procedure in Hampshire new schools is to visit many schools, to listen to the users on these visits, to collaborate with the appointed head teachers, to listen to the advice from the Educational Department's building division and to use their previous experience. School reviews on user's views, made after school occupation, support designers' choices, as users are usually delighted with their schools.

Design team and client interaction

Cornick (1991) argues that quality in the finished building design can only be achieved if all the requirements in every phase are clearly defined and communicated and have agreed acceptance criteria between the participants. Farrell (1985) argues that the success of Hampshire Architect's Department is due not only to changed architectural attitudes and philosophies, but also to mastering new teamwork skills. Indeed, a successful design process is generally thought of as a team effort where there is a continuous interaction until the end of the process. In Hampshire primary schools, there is usually a good team interaction during the design and construction

phases. A very successful co-operation was that of Woodlea school, where builders' and designers' accounts describe the construction period as exciting and enjoyable co-operative work at its best.

Spatial organization

The building forms have evolved partly as a result of tackling the energy problems, and partly through monitoring the advantages of traditional school buildings. The new schools feature relatively high internal spaces with roof glazing and associated glazed conservatories. Besides, they are flexible buildings as Hellman (1985) points out, when he claims that Hampshire architecture is conceived as an adaptable and 'loose fit' shell that can be somewhat disengaged from the immediate and specific constraints of the brief, and perhaps be adaptable to future change.

Spatial variety

The peculiarities of the buildings are expressed internally more in form than materials, such as the irregular shape of the assembly hall in Woodlea school for acoustic reasons. In Tadley school, the natural and artificial lighting blend effectively in the deep plan spaces, being particularly pleasing underneath the shared area (Hannay 1987b). Further, the roofs, as stressed above, present a variety of structures, materials, forms and colours to emphasize volumes that provide a sense of identity to each school. The materials, their assembly, juxtaposition and finishing are all rather friendly.

Technical specification

The use of resources, particularly designing for low energy consumption, has been optimized through experience, in the Hampshire school building. Hampshire's policy involves a sensible and pragmatic approach to energy use and conservation without recourse to complex technology. Comfortable environments are maintained using simple and comprehensible services systems with low technology and low maintenance.

With high rooms a cushion of air at the upper levels maintains heat and the larger volume reduces the need for ventilation, while maintaining an even temperature at working level. The high-pitched roof section typical of Hampshire schools is designed to operate on this principle in winter. Further, the conservatory stores heat that can be recycled through a simple convector system. In summer, by using easy open high-level glazing, a chimney effect is created cooling the buildings air change rates equivalent of those of a more sophisticated mechanical system are achieved. Moreover, opaque elements of the structure have high standards of insulation such as the roof, opaque walling (insulated cladding panels and cavity brickwork that act as diaphragm walls) and floor finishes (usually carpets).

CONCLUSIONS

Hampshire County Council's primary commitment is to quality with architectural form, environmental control, and educational content subtly integrated and interrelated. Further, there is an attitude of participation, which encourages in the community a sense of pride in its involvement and shared ownership (Hannay 1987b). An architecture that is genuinely public must be accessible, physically and psychologically, to everyone, and be made with people (Weston 1991). In order to search for quality patterns, some commonly characteristics of four Hampshire primary school buildings have been compared and exploratory quality criteria have been

delineated based on five issues: user's views, design team and client interaction, spatial organization, spatial variety and technical specification.

On the other hand, the estimation of quality in relation to cost necessarily involves subjective judgement (Spedding 1984). According to Burt (1978) the best value for money in a project is achieved when quality is maximized for a given cost, cost minimized for a given quality or some optimal compromise between those two. Then, maximum value will mean high quality in relation to the cost to ensure that level of quality. In Hampshire County Council schools, as in other County Councils, the quality concern must be achieved with the control of costs, as there are restrictions in public expenditure.

In the four primary schools studied, there was not a direct link between quality and costs as, in spite of cost restrictions, Hampshire County Council has effectively succeeded to create quality school places responsive to context, to changing social needs and to a concern for environmental and energy conservation. However, further research must be done with a more representative sample in order to reach more definite conclusions.

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