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Adaptive reuse and sustainability of commercial buildings

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Abstract

Purpose – To investigate the viability of adaptive reuse of commercial buildings and the impact it has on the sustainability of existing built environment in Western Australia.

Design/methodology/approach – A survey of building owners in Western Australia and a review of literature concerning adaptive reuse of commercial buildings.

Findings – The concept of adaptation is supported by building owners and there is a strong intuition/perception that adaptive reuse serves the key concepts of sustainability. Building owners are considering adaptive reuse as a viable option to demolition and redevelopment of existing facilities.

Research limitations/implications – The use of a structured questionnaire limits the depth of responses in the study. A follow up study using interviews would allow further because it does not allow probing, prompting and clarification of the issues addressed.

Practical implications – Results from this research has implications for building owners and managers as it will eventually provide a theoretical framework that can be incorporated in the decision-making process for adaptive reuse projects.

Originality/value – The contribution of existing buildings to the three tenets of sustainability has not been explored comprehensively in Western Australia.

Keywords Sustainable design, Buildings, Industrial property, Australia

Paper type Research paper

Introduction

The change to reuse and adaptation of buildings is a trend that has been clearly charted by Gallant and Blickle (2005), Kohler and Hassler (2002), Ball (2002, 1999) and Bon and Hutchinson (2000). In countries such as Australia there is a significant switch from new buildings to adaptation and rehabilitation of existing structures (De Valence, 2004). The importance of this trend is that extending the useful life of existing buildings supports the key concepts of sustainability by lowering material, transport and energy consumption and pollution (Gregory, 2004; Douglas, 2002).

Adaptation is gaining recognition as an effective strategy to improve the sustainability of existing buildings (Ball, 1999; Brand, 1994; Pickard, 1996; Kohler, 1999; Latham, 2000; Cooper, 2001; Kohler and Hassler, 2002; Douglas, 2002; Gregory, 2004). There is nothing new in adapting buildings for different uses (Brand, 1994; Ball, 1999; Douglas, 2002). One reason for the interest in adaptation is the growing perception that old buildings are often cheaper to convert to new uses than to demolish and rebuild (Gregory, 2004; Department of Environment and Heritage, 2004; Pearce, 2004; Douglas, 2002; Ball, 2002; Vanegas *et al.*, 1995). Reusing the existing building stock, particularly as a result of performance upgrading, has been identified as having an important impact on sustainability of the built environment (Bromley *et al.*, 2005, Sustainable Construction Task Group, 2004; Rohracher, 2001; Kohler, 1999; Kendall, 1999). Although socio-economic growth generates a constant demand for



new buildings, the number of buildings constructed annually in developed countries only corresponds to 1.5-2 per cent of the existing building stock. At that rate of construction output, it would take anything from 50 to 100 years to replace the current stock of existing buildings. Therefore, the majority of them will remain with us for decades (Sustainable Construction Task Group, 2004; Kohler and Hassler, 2002; Curwell and Cooper, 1998). Myers and Wyatt (2004) maintain that debates concerning sustainable development raise the importance of the building stock as economic, social and cultural capital that should not be wasted. However, Holyoake and Watt (2002) argue it is often expensive and sometimes (Ball, 2002) requires substantial and costly refurbishment. O'Donnell (2004) maintains it is difficult to make them meet current sustainability standards which appears to support the perception that old, inefficient and out of fashion buildings need replacing with new buildings regardless of condition or life expectancy. There are growing calls to limit new construction in favour of improving the existing stock (Graham, 2003) and even to completely stop constructing any additional new buildings in industrial countries (Kohler, 1999).

Despite the increasing justification for reuse, the most likely situation for the short term is continued production of new single-use buildings designed for short life cycles, rather than adaptation as recommended by Storey and Baird (2001). In fact the biggest impediment to reuse strategies are the buildings, particularly ordinary office buildings (Kendall, 1999), many of which were designed for obsolescence, with short life cycles. A second impediment is created where economic constraints force sub quality construction or manufacturing to take place (Vanegas *et al.*, 1995). Continual improvement is one aim of sustainability. Not surprisingly, improving old buildings by adaptation is considered an effective strategy for sustainability. Bromley *et al.* (2005), Rovers (2004) and Balaras *et al.* (2004) add that the existing building stock has the greatest potential to lower the environmental load of the built environment significantly within the next 20 or 30 years.

The role of adaptive reuse in sustainability

According to English Heritage (2000) the whole notion of what constitutes reuse and the importance attached to our built heritage appears to be more definitive than ever. Reuse can mean something special, unique, and often expensive (Holyoake and Watt, 2002) and adaptation describes rehabilitation, renovation or restoration works that do not necessarily involve changes of use. Rehabilitation is the recycling of buildings involving restoration and new construction (Gregory, 2004; Douglas, 2002). The difference is that restoration returns a building to the condition it was when originally constructed, whereas renovation modifies a building so that it meets current standards and codes. Although it extends the useful life of a building, renovation does not involve a change in use (Douglas, 2002). It can therefore be reasonably argued that adaptation is a method of extending the useful life of buildings and hence their sustainability by a combination of improvement and conversion (Lowe, 2004; Kohler and Hassler, 2002; Douglas, 2002; Cooper, 2001).

The following definitions of adaptive reuse have been adopted throughout this paper:

- A process that retains as much as possible of the original building while upgrading the performance to suit modern standards and changing user requirements (Latham, 2000).

- Conversion of a building to undertake a modified change of use required by new or existing owners (Douglas, 2002).
- Rehabilitation or renovation of existing buildings or structures for any uses other than the present uses (Dolnick and Davidson, 1999).
- A process that changes a disused or ineffective item into a new item that can be used for a different purpose (DEH, 2004).

If one of the aims of sustainability is continual improvement, improvement and reuse of old buildings is one of the means to achieve this. Adaptive reuse of buildings has a major role to play in the sustainable development of communities, circumventing the wasteful processes of demolition and reconstruction. This alone sells the benefits of adaptive reuse (Department of Environment and Heritage, 2004). Reuse can create valuable community resources from unproductive property, substantially reduce land acquisition and construction costs, revitalize existing neighbourhoods, and help control sprawl. Also, it is not difficult to see conservation as being consistent with the concerns of sustainable development. English Heritage, for example, sees its record of work in Conservation Area Partnerships as an investment in sustainability (English Heritage, 1999).

Tentative steps towards a more sustainable built environment are evident by the gradual recognition of the value of disused buildings by the private sector (Lutzendorf and Lorenz, 2005; Myers and Wyatt, 2004; Walljes and Ball, 1997; Coupland, 1997). That is partly connected to costs, but also partly linked to the heritage-based movement towards reuse. The quest for sustainability of the built environment has been prompted by the need for a reduction of natural resource consumption, energy use and emissions. Together with the impact on buildings from climate change, these factors are driving the need for buildings to be more adaptable to change. This drive has also resulted in a shift in investment patterns that was first noted in the 1980s (Kendall, 1999). In many ways, reuse is a superior alternative to new construction in terms of sustainability (Pearce, 2004), a view supported by (Latham, 2000; Cooper, 2001; Kohler and Hassler, 2002; Douglas, 2002).

Western Australia

Despite raising many questions for the construction industry, the Government of Western Australia is convinced that sustainability is the only way forward. The State Sustainability Strategy will show the way for other states, if not countries, towards new approaches to sustainable building (Gallop, 2004; Davidson, 2004). In terms of sustainability policy, the Western Australia Government has stolen the march, a view supported by the World Business Council for Sustainable Development (Stigson, 2004). Perth in Western Australia is experiencing increased residential construction activity as a consequence of continual urban growth. Coupled to the decline of average Australian household size (2.6 persons in 1996 compared with 3.3 persons in 1976) and the increase in average floor space (3 per cent per annum over the last 7 years) pressures on the environment are growing (APCC, 2002).

There has also been an increase in the amount of vacant commercial buildings in the Perth Central Business District (CBD). Current vacancy rates for office building are 12.2 per cent which is the highest since 1999 (Property Council of Australia, 2004). As this trend appears to show little sign of changing it may force commercial building owners to contemplate adaptation of their vacant buildings for alternative uses.

For this reason and due to the diverse style, age and construction of the existing building stock, Perth was considered to be a valuable source of feedback from building owners about the implications of adaptation as a sustainability strategy. There are examples of adaptive reuse of old commercial buildings in Perth but most office building assets are not new. Also, few would ever match sustainability standards which means buildings owners see no economic benefit in updating buildings to green standards (O'Donnell, 2004). Gulliver (2004) adopts the reverse view that failing to upgrade the sustainability standards of existing buildings could result in a diminished potential market. Historically, the industry is great at replacing buildings with new ones whereas real sustainability is achieved by optimizing the use of the existing stock (Salmon, 2004). Industry appears to be changing, however, because more is now being spent on changing buildings than on constructing new ones (Latham, 2000; Douglas, 2002; Property Council, 2004). This change may be driven by the need for commercial buildings to adapt in response to intense competitive pressure to perform. Certainly, buildings that allow multiple uses will meet that demand and tend to survive longer (Hassler *et al.*, 2000). Despite this, adaptation remains an anathema to architects and most of the building professions (Brand, 1994; Gregory, 2004).

Generally an adapted building will not completely match a new building in terms of performance, although the shortfall should be balanced against gains in social value. Life expectancy of an existing building may also be less than a new alternative despite any improvements that adaptation may inject. Certainly the life cycle expectancy of the existing materials may well fall short of new ones. This will directly affect the ongoing maintenance costs of the adapted building which may well be higher than those for a new building. In terms of environmental performance, old buildings even after adaptation may not reach the desired standards of new buildings. According to O'Donnell (2004) this applies to office building assets in Western Australia.

Research method

The purpose of the research was partly explorative, as the literature showed few examples that describe how adaptive reuse of existing buildings makes them more sustainable. The research was also correlational and sought to provide insights into how adaptive buildings might accommodate sustainability while staying within the parameters of acceptable performance and standards. The aim of the research was to carry out a preliminary investigation of building owners' views about adaptive reuse and strategies for improving the sustainability of existing buildings in Western Australia. The significance is that examining how existing buildings have adapted to change may identify the key factors needed to develop adaptable and sustainable new buildings. Analysis of these factors will identify the features that will increase the likelihood of a building being adapted and consequently becoming more sustainable.

The majority of research into assessing the adaptability of buildings has focused on new or proposed development projects and tended to concentrate on environmental criteria of sustainability. There has been little work to investigate new comprehensive strategies based upon better knowledge of the existing building stocks, a need identified by Hassler *et al.* (2000). The issues of adaptability and sustainability are discussed primarily in the context of buildings in Western Australia but also extend to publications and opinions expressed in the USA and UK, which show similarities in the development of buildings with some regional variations.

The first stage of the research investigates building owners/occupiers instead of the more traditional area of design, as the drive for sustainable buildings will come from the former. Wall (2004) supports this because there is a genuine intent by Australian building owners to embrace sustainability. Kohler and Hassler (2002) also justify this approach with the argument that the building stock plays a minor role in the conscience of the architectural profession. A questionnaire was developed to gather data relating to the five research questions. The questionnaire included open and scaled questions as this was felt to be the most appropriate for the sample. It allowed a full range of movement from general to specific comment and back again to maintain the interest of the respondents.

The population for the survey was all 30 members of a multi-stakeholder group of business, public sector and education professionals from the Western Australian Sustainable Industry Group (WASIG). The small size of the sample could be considered to reduce the global significance of the responses received. However, this should be balanced against the value of obtaining opinions from a group of professionals with specialised and specific knowledge of sustainability principles. The group is the only organisation in Western Australia comprising business professionals that specifically promote consideration and implementation of best practice in sustainable development. WASIG is also a member of the Regional Network of the World Business Council for Sustainable Development. The survey adopted a questionnaire distributed by e-mail, as it was the quickest and easiest way of obtaining results from the geographically diverse population. It stimulated considered and objective views from respondents because it allowed writing as opposed to talking about the issues. Questionnaire survey forms were sent to all 30 representatives of the companies making up WASIG and 14 responded to the survey, thus achieving a response rate of about 49 per cent. Although this approach is limited because it does not allow probing, prompting and clarification of questions, overall it was felt that the advantages of the questionnaire approach would outweigh its weaknesses. The questionnaire is a preliminary stage of a progressive program to research the effectiveness of adaptive reuse as a sustainability strategy for existing buildings.

Research questions for questionnaire

The aim of the questionnaire was to obtain views from building owners and managers about the key issues surrounding adaptive reuse of existing commercial buildings in Western Australia. In support of this aim the objectives of the survey were to investigate whether adaptation of existing commercial buildings is more likely to satisfy the environmental, social, economic and institutional tenets of sustainable development than demolition and redevelopment. To pursue these objectives it was decided to ask respondents the following questions:

- Is it economically more viable to extend the life of existing buildings through adaptation or demolish and rebuild?
- What issues should be included in the decision process used to assess the suitability of a building for adaptation?
- To what extent are heritage buildings in Western Australia exemplars of the economic, environmental and social principles of sustainable development?

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- What examples of buildings in Western Australia illustrate the opportunities/barriers of adaptive reuse?
 - Should there be an assessment process in place in Western Australia that considers sustainable and reusable building construction and management methods?

Main findings of survey

Question 1. Is it economically more viable to extend the life of existing buildings through adaptation or demolish and rebuild?

Philosophically 83 per cent of respondents felt it was preferable to adapt rather than demolish but 77 per cent felt it would only be viable where the costs and benefits are factored in over the life of the building. Generally adaptation is a more sustainable option but it is case sensitive. According to 41 per cent of respondents it is critical that decisions should be based on finding the option that leads to the most effective use of land such as increased density. Adaptive reuse was seen to be effective because 75 per cent of the respondents that referred to economic viability, felt the costs to demolish outweighed the costs to improve the building.

Provided the structure of existing buildings is invariably still functional, 53 per cent of respondents felt that adaptation should be the prime consideration by designers. It must be assessed on a case by case basis but with an innovative approach the longer term sustainability of a building is enhanced by adaptation. It would appear from the respondents generally that adaptive reuse of existing buildings provides the opportunity to make them more aesthetically pleasing and productive.

Question 2. What issues should be included in the decision process used to assess the suitability of a building for adaptation?

Respondents identified various factors that should be considered during the feasibility stage of the decision process. It was felt by respondents that cultural significance (68 per cent) and heritage significance (83 per cent) should be assessed collaboratively with stakeholders and the practical aspects of various use options should be fully explored while keeping community values and heritage values uppermost in their mind. Feasibility studies should determine whether projected outcomes would meet sustainability benchmarks and whether demolition and subsequent rebuilding would increase density and plot ratio. It was regarded important by 74 per cent of respondents to establish how technically and economically challenging the adaptation would be, for example, how easy it would be to match existing components and how the intended construction methods would maintain the structural integrity of the building. In conjunction, a cost benefit analysis extending to triple bottom line objectives should be carried out. This should consider economic sustainability (70 per cent of respondents), environmental sustainability (87 per cent of respondents) and social sustainability (51 per cent of respondents) and other questions should include whether the adaptation would be innovative.

Respondents also provided general comment on the overarching concept of adopting adaptive reuse as a sustainability strategy for the built environment. It was felt where policy decisions are being formulated consideration should be given to the extent to which adaptive reuse of buildings will raise public awareness of sustainability. Also the extent to which adaptation processes will contribute to development of sustainable building technologies should be assessed and the influence this may have on the economics and institutional dynamics of the local building industry (Table I).

Table I.
Factors that should be considered during the adaptive reuse decision process

Factors that should be considered during the decision process	Percentages of respondents who identified factor
Cultural significance	68
Life cycle assessment	32
Heritage significance	83
Effectiveness in meeting sustainability benchmarks	79
Economic sustainability	70
Environmental sustainability	87
Social sustainability	51
Value to local community	47
Orientation of building	28
Influence on local economy	32
Technical ability of building to adapt	74
Stakeholder views	33

Question 3. To what extent are heritage buildings in Western Australia exemplars of the economic, environmental and social principles of sustainable development?

In terms of buildings that provide exemplars of sustainable development 82 per cent of the respondents felt there were similar quantities of good and bad examples. Heritage buildings were seen by 63 per cent of respondents to represent the states history and therefore where possible should be preserved. In the case of more well known buildings such as the Perth Treasury Building and the Swan Brewery Site 41 per cent felt they should be preserved for their sense of place regardless of their sustainability. Examples nominated by respondents where adaptation was not really successful included the Old Perth Boys School in West Perth and the “E” Shed Markets at Victoria Quay in Fremantle. Two respondents stated that although the school is important architecturally and historically it is totally unsuitable for its new use ironically as a heritage centre. “E” shed market was adapted from warehouses and relocated from its original site. Three respondents felt that it is a good example of successful adaptive reuse but moving the building has in effect robbed it of much of its historical significance.

Four of the respondents felt that because heritage buildings become cultural icons their preservation impacts on community well-being, sense of place and therefore social sustainability. Owing to the importance of these factors they felt it was preferable to retrofit heritage buildings rather than replacing them regardless of bad plot ratios and lack of efficiency. Heritage invests local communities with a powerful reason to look after their local environment and lead more sustainable lifestyles. The majority of respondents (76 per cent) were certain that adapted heritage buildings could be exemplars of sustainable development, provided they retained the dignity and character of the original building while at the same time providing modern facilities and ambience.

Question 4. What examples of buildings in Western Australia illustrate the opportunities or barriers of adaptive reuse?

Respondents identified a wide range of barriers and opportunities to adaptive reuse. Although economics was a common thread running through their opinions, there was evidence of a shift, albeit a subtle one, towards the other tenets of sustainability. It was generally considered more difficult to estimate the costs of adapting a building than constructing a new one. But it was even more difficult to provide a value of the social

and environmental factors of sustainability. Generally respondents identified a need for education to illustrate and raise the awareness of the possibilities that adaptive reuse presents.

There were other barriers to adaptive reuse that invariably concern cost but this was seen as a smoke screen obscuring the real reason that it is easier for everyone in the development process to produce a new building. Also a new building is considered a creation whereas adaptation of existing building is less creative and attracts less kudos. Respondents felt that many buildings would be suitable for some form of adaptation as the key issue is ongoing environmental impact of buildings in use. This could be improved by efficiencies incorporated during adaptation. Opportunities would stem from maximising the proven benefits of a building while at the same time addressing any shortcomings, almost like having the benefit of a test drive. However, there are other benefits in the form of visual amenity and cultural heritage values which are powerful drivers of sustainability (Table II).

Adaptation would be cost effective in most cases but the availability and price of materials to match existing may be a problem with 47 per cent of the respondents identifying it as a barrier. Out of the 58 per cent that responded 82 per cent felt that retaining older buildings rather than building more new ones would create more interesting community environments. However, 65 per cent of the 19 per cent that responded felt adaptive reuse may also obstruct the opportunity to increase urban density using a demolition and rebuild approach. Would the aesthetics of the building fit with surrounding streetscape after adaptation? It was felt that many buildings particularly those constructed during the 1950s and 1960s were easy to adapt but the finished article would still be ugly. Location of old buildings are on sites that are very desirable and while this makes them ideal for adaptation there could be problems with orientation, sightlines, bulk and scale. Older commercial buildings often do not support passive techniques, however, 89 per cent out of the 65 per cent that responded felt the varying architecture and construction of existing buildings provides opportunity to

Opportunities and barriers identified by respondents	Percentages of identifying opportunity or barrier	Percentages of feeling it could be a barrier	Percentages of feeling it could be an opportunity
Location of building in terms of market opportunity	61	54	46
Estimate economic viability compared to redevelopment	84	53	47
Estimate environmental viability compared to redevelopment	87	61	39
Estimate social viability compared to redevelopment	77	84	16
Availability of materials to match existing	41	47	53
Increasing urban density	19	65	35
Expected benefits of reusing rather than redeveloping	68	17	83
Impact on visual amenity and cultural heritage	37	19	81
Demand for building after adaptation	73	31	69
Community value of existing buildings	58	18	82
Opportunity for technical innovation	65	11	89
Planning approval process	76	59	41
Compliance with building codes	71	67	33
Creative value compared to redevelopment	27	85	15

Table II. Potential opportunities and barriers to carrying out adaptive reuse of existing buildings

test many new technologies and develop diverse solutions to sustainability issues. The location of existing buildings was seen to be a critical component of market opportunity, but opinion was fairly evenly divided with 54 per cent seeing it as a barrier and 46 per cent seeing it as an opportunity for adaptive reuse. Overall, 69 per cent of the 73 per cent that responded felt that adaptive reuse would present an opportunity in terms of enhancing the demand for retaining existing buildings.

Question 5. Should there be an assessment process in place in Western Australia that considers sustainability methods when reusing buildings?

There should definitely be an assessment process in Western Australia that considers sustainably reusing buildings according to 68 per cent of the respondents. Three respondents felt that a concept plan and assessment should be produced for every building under consideration. It should be prepared by an architect and based on a brief prepared in conjunction with the potential user. The assessment should also incorporate social, environmental and economic impacts of the adaptation. Of the respondents, 57 per cent felt that rating proposed adaptation schemes would not only guide developers as to how well their plans are performing but also give regulatory bodies a basis to judge planning applications. One of the respondents revealed that in Fremantle, building owners were awarded a bonus for retaining old buildings but although effective, they were granted *ad hoc*. By awarding adaptive reuse projects a sustainability rating 74 per cent of the respondents were confident that the assessment process would be more effective.

According to 61 per cent of respondents, all existing buildings should have an environmental management audit which perhaps could be incorporated within current schemes such as the Greensmart assessment system. Additionally, prior to any demolition, 73 per cent of respondents agreed that all existing buildings should be assessed for their suitability to undergo adaptation as part of a sustainable reuse feasibility study. Out of this group of respondents 62 per cent also agreed that any assessment that considers the adaptability of existing buildings should also incorporate criteria that ensure the adaptation will not affect heritage.

Conclusions

Although there are many qualifying factors, the concept of adaptive reuse has significant support as a positive strategy to make the built environment more sustainable. Adaptive reuse enhances the longer-term usefulness of a building and is therefore a more sustainable option than demolition and rebuilding. The positive benefits for adaptive reuse identified during the research also support the tenets of sustainability and include:

- reducing resource consumption, energy use and emissions;
- extending the useful life of buildings;
- being more cost effective than demolition and rebuilding;
- reclaiming embodied energy over a greater time frame;
- creating valuable community resources from unproductive property;
- revitalizing existing neighbourhoods;
- reducing land consumption and urban sprawl;
- enhancing the aesthetic appeal of the built environment;
- increasing the demand for retained existing buildings;

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- retaining streetscapes that maintain sense of place; and
 - retaining visual amenity and cultural heritage.

There are also barriers to adaptive reuse, which invariably concern cost. However, this is often a smoke screen obscuring the real reason that it is easier under current development processes to produce a new building. Adaptation of existing buildings is frequently considered to be less creative than producing a new building and therefore attracts less kudos. The range of barriers to adopting adaptive reuse for an existing building identified during the research include:

- only being viable where the costs and benefits are factored in over the life of the building;
- building owners see no economic benefit in reuse;
- older buildings may require extensive and costly refurbishment;
- inability to match the performance of a new building;
- ongoing maintenance costs may be higher than a new building;
- older buildings may be unable to meet current sustainability standards;
- availability and price of matching existing materials may create problems; and
- maintaining the structural integrity of older buildings may be difficult.

The research has revealed divided opinion concerning the extent of the benefits and barriers to carrying out adaptive reuse. Despite this, it receives substantial support as a process that has potential to satisfy the tenets of sustainability. However, any consideration of adaptive reuse should certainly incorporate an assessment of the merits of reusing a building on an individual basis. The projected outcomes of the projects should be matched to sustainability benchmarks as part of a feasibility study. This should also assess whether increased density and plot ratios from demolition and rebuilding may in fact be more beneficial in terms of sustainability outcomes.

Doubts remain about the viability of adaptive reuse, which invariably focus on economic criteria to the exclusion of social and environmental issues. This underlines the general need for education to illustrate and raise the awareness of the possibilities that adaptive reuse presents. It also indicates a need to investigate the extent to which the feasibility of adaptive reuse is influenced by social and environmental issues. The research has highlighted several broad questions concerning assessment methods, user needs and the decision process for adaptive reuse. These will be investigated in future phases of research to answer the over-arching question of where adaptive reuse fits within development of a more sustainable built environment.

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