EXPLORING THE BUSINESS CASE FOR MORE ADAPTABLE BUILDINGS: LESSONS FROM CASE STUDIES

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Abstract
This paper explores the business case for designing more adaptable buildings, an issue that has, for the most part, been overlooked in the literature. It reviews some of the existing literature on adaptability and discusses the drivers for and barriers to designing buildings that are more adaptable. In doing so, it draws upon lessons from the developing market for 'greener' or more sustainable buildings. The costs and benefits of designing more adaptable buildings are explored through a workshop with industry stakeholders and illustrated with evidence from case studies. The findings of this research highlight the circumstances that would need to change, in terms of industry mindsets and market conditions, in order for adaptable buildings to become more widespread.

Keywords: Adaptability; cost-benefit; obsolescence; risk; sustainability.

INTRODUCTION

In recent years there has been growing interest in the issue of adaptability in the built environment. This interest has been stimulated by a number of factors, including increasing rates of technological change and a desire to make the built environment more sustainable by extending the life of our existing building stock. However, most of the academic literature on the subject has tended to focus on *how* to design buildings to be more adaptable, rather than trying to understand the reasons *why* some buildings are designed to accommodate change, while others are not. This paper therefore explores the business case for designing and constructing more adaptable buildings. In doing so, it examines the potential costs, benefits and risks of designing adaptability into buildings and the social, economic, political, legal and commercial conditions under which greater adaptability would either be a more desirable or less desirable design objective.

This paper begins by discussing what is meant by adaptability in the context of the built environment and by exploring the economic and environmental drivers for more adaptable buildings in the United Kingdom (UK). In doing so, it looks at the reasons why designing buildings for adaptability is not part of mainstream property development and draws parallels with the emerging market for 'greener' or more 'sustainable' buildings. A range of different adaptable design strategies are then introduced, each relating to a particular type of change in the built environment, and the costs and benefits of each strategy are explored through a workshop with industry stakeholders. Case studies are then used to unpack the reasoning behind particular adaptable design solutions and illustrate their implementation. This paper concludes by looking at what would need to change, in terms of current market conditions and industry mindsets, to create a greater demand for adaptable building design solutions.

BACKGROUND

> *"Almost no buildings adapt well. They're designed not to adapt; also budgeted and financed not to, constructed not to, administrated not to, maintained not to, regulated and taxed not to, even remodelled not to..." (Brand, 1994)*

Definitions of what constitutes 'adaptability' in buildings vary widely in the literature, but most tend to imply a capacity to accommodate change (Schmidt III *et al*, 2010). The idea of designing buildings that can accommodate change is by no means new: in the 1960s Weeks (1963 and 1965) talked about 'indeterminate architecture' and in the 1970s Alex Gordon, the then President of the Royal Institute of British Architects, put forward the principle of 'long life, loose fit and low energy' buildings (Anon, 1972; p26). In the last two decades, the terms 'flexible' (e.g. Gann and Barlow, 1996; Slaughter, 2001; Gibson, 2003; Steiner, 2006; Finch, 2009) and 'agile' (e.g. Joroff *et al*, 2003) have become increasingly common in the literature on buildings, perhaps reflecting developments in other business and management disciplines, such as manufacturing, where the capacity to embrace and manage change has become seen as critical strategy for surviving in an increasingly dynamic business environment.

The argument in favour of designing more adaptable buildings has a number of strands. One is that by designing buildings to be more adaptable, designers can help to reduce the whole life costs of owning and using buildings by making them easier to change post-construction (Slaughter, 2001; Arge, 2005). This is particularly important in sectors where occupier needs change frequently and where maladaptive buildings can impose costs on occupiers by constraining their activities (Iselin and Lemer, 1993). More recently, the case for adaptability has been underpinned by concerns about the environmental impact of the built environment, the notion being that buildings that are more adaptable are more sustainable (Kendall, 1999; Graham, 2006). Designing buildings that can be changed with minimal disruption to their existing fabric (Engel and Browing, 2008) could help to mitigate the risk of obsolescence and retain the energy, natural resources and carbon dioxide emissions that were embodied in their structure and fabric during construction.

Nevertheless, despite these compelling arguments, designing buildings for adaptability is still not common practice in the UK and elsewhere. Parallels can be drawn with the slow adoption of 'green' or 'sustainable' building techniques in the UK. As is the case with adaptability, many of the technical solutions to designing more sustainable buildings have been around for years but it is only recently that these solutions have begun to be adopted by the property development industry. Some authors have attributed this slow up-take to a 'circle of blame' (Figure 2), whereby constructors do not produce 'greener' buildings because they claim that developers do not want them, who in turn claim that investors will not fund them because there is no demand from occupiers (Keeping, 2000). For years, the lack of a clear business case for more sustainable buildings meant that the property development industry was unable to break out of this circle of blame, a situation that has only recently started to change, for reasons discussed below. However, as yet no comparable business case has been articulated for designing more adaptable buildings.

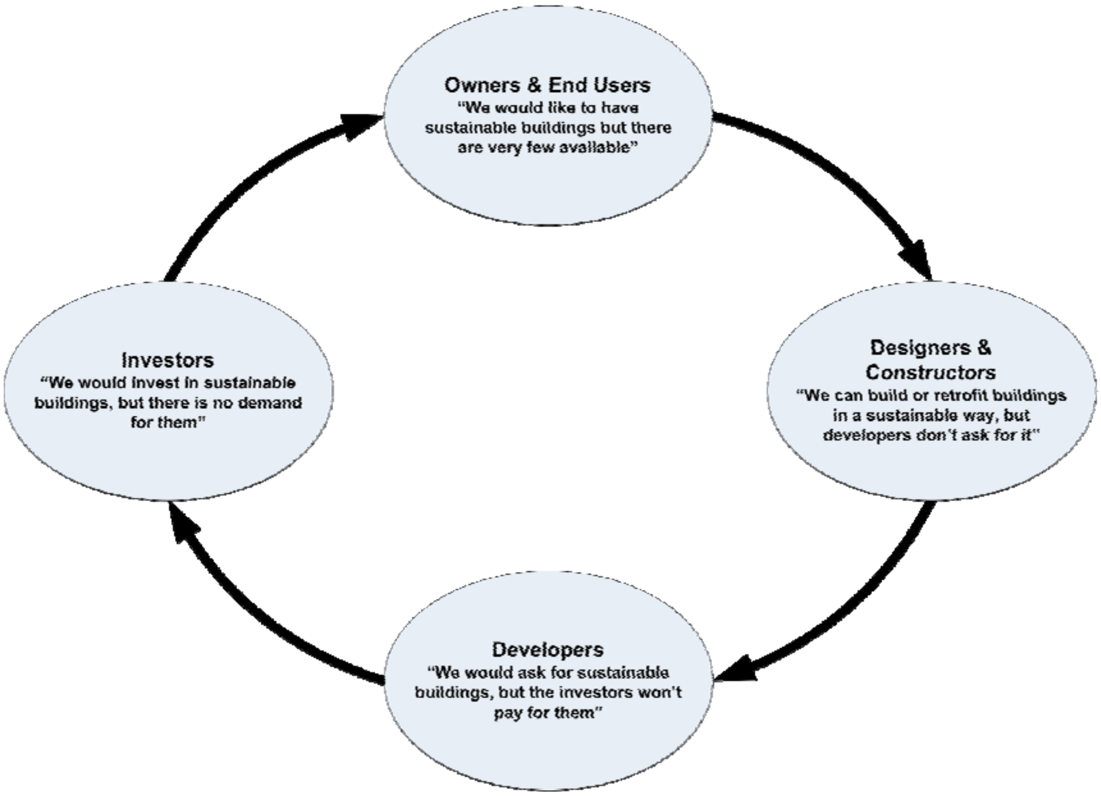

Figure 1: *The circle of blame (from Hartenberger, 2008; p.3)*

As with any other business decision, articulating the case for designing more adaptable buildings requires an analysis of the costs, benefits and risks involved (Gambles, 2009). It is often assumed that adaptability gives rise to higher initial construction costs, an assumption that has been fuelled by previous attempts at 'future-proofing' buildings. For instance, in the UK in the 1980s and 1990s it was common for developers to over-specify the mechanical and electrical services and floor loadings in their office buildings in order to cater for possible future changes in occupier requirements, even though such levels of redundancy were rarely utilised. The costs of such over-specification were ultimately passed on to occupiers through higher rents and service charges (Guy, 1998). In the United States (US), Slaughter (2001) examined the costs of implementing adaptable design strategies in 48 construction projects and found that there was a median increase of one percent in initial construction costs. However, the median cost savings at the first refurbishment cycle were estimated to be two percent of initial construction costs, although it is not clear whether these costs and savings were discounted and, if so, at what rate.

Some of the potential benefits of designing more adaptable buildings were alluded to earlier in this paper, however understanding who receives the benefits is a key part of developing the business case for adaptability. For owner-occupiers, institutional investors or developers with a long-term interest in buildings, investing in adaptable design strategies can be justified, even if this involves a marginal increase in initial construction costs, because they may recoup the benefits in the future, in the form of lower adaptation costs. However, for developers that construct buildings for sale, the incentives to design for adaptability are less clear, because the cost of changing the building in the future will fall on another party. This thinking was borne out in research undertaken in Norway by Arge (2005), who found that office buildings developed by owner-occupiers incorporated more adaptable design features than those that were developed to let and manage; the office buildings that incorporated the least number of adaptable design features were those that had been developed for sale.

For developers that are procuring buildings to sell, more adaptable buildings will only be worth investing in if they are easier to sell and/or command a premium over less adaptable buildings, which in turn will be dependent on them being more attractive to investors and/or occupiers. Moreover, the attractiveness of adaptability to occupiers and investors would need to be reflected in the calculations of worth used by valuation professionals. Research by Ellison and Sayce (2007) suggested that only a very limited interpretation of adaptability, relating primarily to the flexibility of internal spaces, was currently factored into commercial property valuations. Consequently, valuations fail to reflect other forms of adaptability, such as the ability to accommodate changes of use. Ellison and Sayce (2007, p.298) concluded that:

> *"An appraisal that fails to reflect a property's potential to adapt is likely to be proved erroneous over time by not accurately reflecting the extent to which one property may represent a higher risk in terms of depreciation than another. This is of growing importance to investors as lease lengths shorten, making re-lettability a more critical issue, and as discount rates fall, increasing the significance of cash flow over the lifetime of the asset."*

Again, comparisons can be made with the developing market for more sustainable buildings, where a frequently asked question has been: do more sustainable buildings command a price and rental premium over less sustainable buildings? The ability to answer this question has been facilitated by the development of voluntary 'green' building certification schemes, such as the BRE Environmental Assessment Method (BREEAM), Leadership in Energy and Environmental Design (LEED) and Energy Star, which provide a proxy measure of 'sustainability' in buildings. A recent study by Fuerst and McAllister (2010) examined the sale price and rental differential between buildings in the US that were certified through LEED or Energy Star and buildings that were not. They found that LEED certification resulted in a 5% rental premium and a 25% sale price premium, with Energy Star certified buildings commanding a 4% rental premium and 26% sale price premium. Such premiums will send price signals to funders and developers that it is worth investing in more sustainable buildings.

When considering the costs, benefits and risks of designing more adaptable buildings it is useful to distinguish between the different types of change that occur in the built environment. Schmidt III *et al* (2010) identified six different types of change, each of which they associate with a particular type of adaptability (Table 1). For instance, the 'stuff' inside a building, such as furniture, fixtures and equipment may be designed to be adjustable in order to facilitate changes in the tasks of users, something that may occur relatively frequently. In contrast, a building may change in size very infrequently; nevertheless the building's space, services, skin and structure may still be designed to be scalable. In some cases, one particular type of adaptability may affect another. For example, many contemporary 'open-plan' offices are designed to be versatile, but the ability to change their spatial layout is often constrained by the inability for users to easily adjust the location and configuration of the furniture and equipment within the space.

Table 1: *Adaptable building design strategies (adapted from Schmidt III et al., 2010; p.7)*

Type of adaptability	**Type of change**	**Building layer(s) affected**	**Frequency of change**
Adjustable	Change of task	Stuff	High
Versatile	Change of space	Stuff, space	High
Refittable	Change of performance	Services, skin	Moderate
Convertible	Change of function	Space, services, skin	Moderate
Scalable	Change of size	Space, services, skin, structure	Moderate/low
Moveable	Change of location	Structure, site	Low

WORKSHOP

In order to explore in more detail the costs and benefits of designing more adaptable buildings, the authors undertook a workshop with a range of stakeholders from the construction and property development industry. Further details about the workshop and the outcomes arising from it are described below.

Approach

The workshop participants were divided into two groups, each consisting of an industry representative from the seven stakeholder categories in Table 2 (e.g. funder, owner, designer etc.), and were presented with a project scenario (Scenario A: private office building; Scenario B: public building) in which to contextualise their ideas. The scenario data included local and national context, briefing notes, procurement information, details of the built solution, highlighting the different systems and components used, and an insight into how the users had appropriated the building over time. Each group was then asked to work through a stakeholder specific sheet of costs and benefits for each of the six types of adaptability, and indicate whether the costs and benefits were relevant to them in their particular scenario.

They were then asked to work through the sheet a second time and rate the significance (high, medium or low) of each cost and benefit, after which the high responses were marked on a large matrix for all stakeholders to see and discuss the advantages and disadvantages of the six design strategies and the potential alliances and conflicts between stakeholders. Table 2 provides a condensed version of the sheets illustrating the costs and benefits for each stakeholder (in parenthesis, with the costs marked in red) related to higher-level costs and benefits that cut across stakeholders and adaptability types. For example, designing buildings to be scalable has the high-level benefit of extending their life spans, which may ultimately bring future costs for constructors, in the form of less construction work. However, such buildings are likely to be easier and cheaper to adapt, thereby giving rise to benefits for constructors, in the form of more adaptive re-use work and lower levels of risk during such projects.

Outcomes

The workshop exercise served to highlight the motivating factors behind different stakeholders when it comes to the development of new buildings. Funders conveyed a desire for simplicity and the use of traditional construction methods to reduce risk, costs and tenant churn. Owners were driven by a desire to minimise risk and initial capital expenditure, while being able to sell or lease the building was a key motivator for applying any type of adaptability. As shown in Arge's (2005) research, there was also a clear distinction in the motivations between the different development models (develop to sell, manage or occupy), with owner-occupancy driving a greater interest in adaptability. This was complimented by end-user preferences for a versatile and refittable building that provides fewer disruptions, improved service and better quality of space.

From the supply side, designers saw the adaptable design strategies as a means of improving their reputation and as a basis for generating future work opportunities. They were positive about an increased shift away from new build work and viewed scalable buildings as the most likely source of future work opportunities. Contractors saw themselves not as initiators of adaptability, but as a service, only focused on the speed and cost of initial construction. While they did see potential to improve quality and competitiveness in response to client demands it was not a huge motivator in changing practices. Manufacturers felt more removed from the decision-making process, but were interested in balancing the tension between reducing costs and extending component lifecycles. Overall, society was seen to be one of the main beneficiaries of designing buildings that are more adaptable; keeping buildings occupied and reducing waste, resource use and disruption to the community were all seen as positive benefits for society. However, there was a realisation that these benefits would be dependent on strong local activism and/or government regulation.

One of the major outcomes of the workshop was the greater sense of clarity amongst stakeholders, due to an improved understanding of the full spectrum of stakeholder motivations. This helped the dialogue to avoid 'muddy waters' by enabling stakeholders to clarify their own position, even to the extent that it allowed them to be more selfish or focused. In addition, it was agreed that designing for alternative uses should not compromise the initial use: future benefits cannot be applied if it is at the cost of a sub-optimal first use. However, there was also an agreement that many of the costs and benefits are context specific and need to be evaluated on a project-by-project basis. The mapping exercise would therefore be a useful tool for a client when trying to determine the extent to which a building should be designed to be adaptable.

Table 2: *Summary of the costs and benefits of different adaptable building design strategies, by stakeholder group*

Stakeholders	**Costs/benefits**	**Adaptable design strategies**					
		Adjustable	**Versatile**	**Refittable**	**Convertible**	**Scalable**	**Moveable**
Constructors	Overdesign buildings for initial use (increase construction costs/revenues)		x	x	x	x	x
	Easier to construct buildings (quicker construction/lower construction risk)			x		x	x
	Easier/cheaper to adapt buildings (more adaptation work/lower project risk)		x	x	x	x	x
	Extend the life of buildings (less new build work)		x	x	x	x	x
Designers	Easier to lease/sell buildings (develop good reputation/generate more business)		x	x	x	x	x
	Overdesign buildings for initial use (develop bad reputation/lose business)				x	x	x
	Easier/cheaper to adapt buildings (more adaptation work/lower fees)		x	x	x	x	x
	Extend the life of buildings (less new build work)		x		x	x	x
	Increased user control over buildings (loss of design control)	x					
Funders	Overdesign buildings for initial use (increase construction costs/capital required)		x	x	x	x	x
	Easier to construct buildings (quicker construction/lower construction risk)			x			x
	Easier/cheaper to adapt buildings for initial use (reduced demand risk)		x	x	x	x	x
	Easier to sell buildings (quicker exit from projects/lower financing costs)		x	x	x	x	x
	Higher sale prices for buildings (increase return on investment)		x	x	x	x	
Manufacturers	Easier to construct buildings (develop good reputation/demand for products)	x		x		x	x
	Easier/cheaper to adapt buildings (more adaptation work/demand for products)	x	x	x	x	x	x
	Extend the life of buildings (less new build work/reduced demand for products)	x	x	x	x	x	x

Stakeholders	Costs/benefits	Adaptable design strategies					
		Adjustable	**Versatile**	**Refittable**	**Convertible**	**Scalable**	**Moveable**
Owners	Increased building values (more capital/larger mortgage loan required)		x	x	x	x	x
	Easier/cheaper to adapt buildings to new demands (less demand risk/voids/cost)	x	x	x	x	x	x
	Easier to lease buildings (higher occupancy rates/fewer voids/greater cashflow)		x	x	x	x	x
	Easier to sell buildings (quicker to sell/reinvest capital)		x	x	x	x	
	Higher rents/sales prices for buildings (increased return on investment)		x	x	x	x	
Society	Overdesign buildings for initial use (increase resource use/embodied energy)		x		x	x	x
	Easier to adapt buildings (reduction in resource use/waste/environmental impact)		x	x	x	x	x
	Extend the life of buildings (less demolition waste/maintain embodied energy)		x	x	x	x	x
	Less demand for new buildings (reduction in resource use/environmental impact)		x	x	x	x	x
	Easier to sell/lease buildings (fewer vacancies/less urban decay/more taxes)		x		x	x	x
Users	Overdesign for initial use (higher rental costs/service charges)	x	x	x	x	x	x
	Easier to adapt buildings (buildings stay fit for purpose/less downtime)	x	x	x		x	x
	Cheaper to adapt buildings (lower service charges/churn costs)	x	x	x		x	
	Increased user control over buildings (lower churn costs/better productivity)	x	x				

CASE STUDIES

The issues arising from the workshop have been investigated in further detail through case studies of existing buildings in a range of sectors, including offices, schools and retail. The case studies have involved interviews with developers, designers, owners and other project stakeholders in order to unpack the reasoning behind the use of particular adaptable design strategies. Two such case studies are presented below.

Case study 1

The first case study building is located in the Brianza region of northern Italy. Completed in 2009, the building was designed to be convertible, in that it can be fitted-out for use as an office, warehouse, laboratory or storage space. The three-storey building (Figure 2) has two adjacent wings that are connected by two separate lobby areas, to enable the building to be sub-let more easily. Sub-letting of the building is also facilitated by the fact that the building has four separate service cores, two in each wing of the building. The building's external cladding was designed to be more easily refittable, for example to enable warehouse doors to be retrofitted, and floor loadings are sufficient to accommodate light-industrial activities. However, the desire for a convertible building has involved some compromises. For instance, the building is fitted with a building management system, the performance of which can be affected when occupants open windows, a feature that had to be included because, according to the architect, local planning regulations dictate that buildings used for industrial purposes must have operable windows.

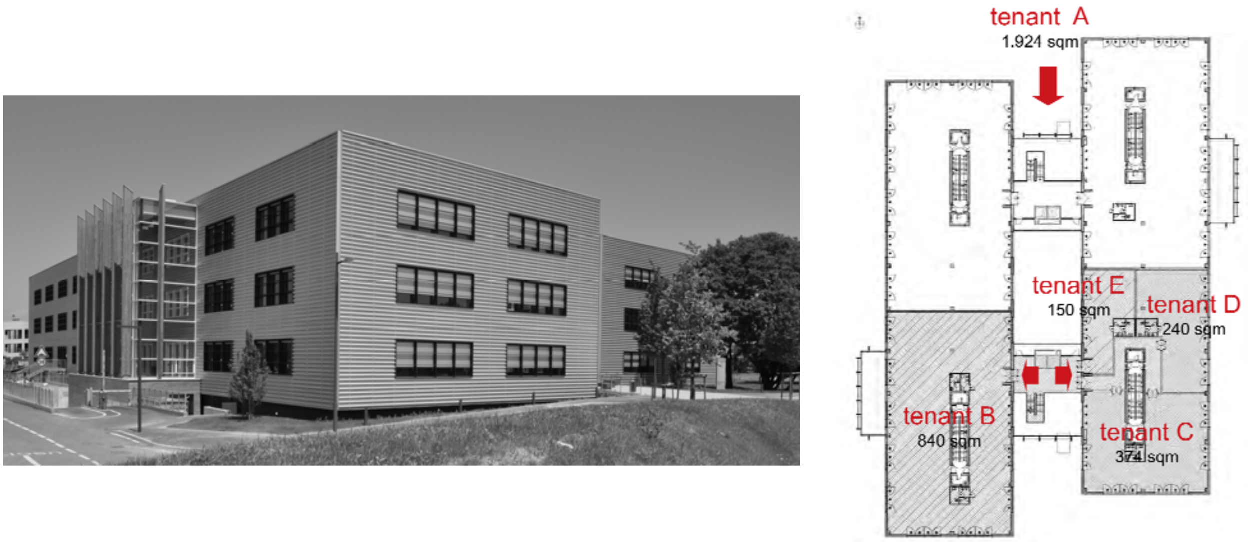

Figure 2: *An external view and floor plan of case study 1*

The construction costs for the building were higher than those for comparable Grade A office buildings that the developer had constructed elsewhere, although some of these costs can be attributed to the fact that the building was designed to achieve LEED certification. However, as an investor-developer with a long-term interest in the buildings that it constructs, the developer views adaptable design as an intrinsic part of its business strategy in response to changing occupier demands and achieving higher levels of sustainability. By procuring a building that can be converted to different uses more easily, the developer is attempting to mitigate demand risk and reduce its exposure to future adaptation costs. The design of the building also raises a number of interesting questions, not least about whether the building could, in practice, accommodate mixed-uses. For instance, would a corporate office tenant be content to see adjacent spaces being used for light-industrial purposes or would their lease preclude such an arrangement? The interplay between such non-physical factors could therefore potentially limit the adaptability of the building (even though it is technically feasible).

Case study 2

The second case study is a speculatively developed science park building that was constructed on a brownfield site in the East Midlands region of the UK. The building (Figure 3) was completed in 2008 and comprises approximately 3,000 m^2 of floorspace that can be used to accommodate a mix of offices and laboratories. Serviced workspaces range from 90 m^2 to 1,800 m^2 and can be occupied on flexible lease terms by organisations involved in research and development, science and technology industries. The rationale behind the development was to provide ‘grow-on’ space for such companies. Adaptability was designed into the building through the provision of a central hub, with pods feeding from it, enabling the floorspace to be divided up to meet the needs of different occupiers. Other adaptable design features included raised access flooring, refittable external wall cladding and services that can be adjusted to meet different space layouts. Such design features are common in speculative office developments in the UK.

Figure 3: *An external view of case study 2*

The developer behind the science park building is half owned by the UK government and half by an investment fund that was specifically set up to be a catalyst for regeneration and sustainability. This enabled the developer to take risks that other private developers would not normally be willing or able to take. Whereas the funding structures of most commercial developers are normally based around short-term returns, the developer of this building had a longer-term outlook (based on a 5-6 year business plan). As the developer confessed, conventional property development models are not good for encouraging innovation and adaptability, as they are all about finding a formula and replicating it as much as possible, in order to mitigate risk. Nevertheless, despite its longer-term business model, it was not the developer's intention to retain ownership of the development and the scheme will eventually be sold to a property investor. Ultimately then, the design of the building needed to conform to the expectations of the mainstream property market, something that might have precluded the use of more innovative adaptable design strategies.

CONCLUDING REMARKS

Despite the fact that adaptability in buildings is considered to be a desirable design characteristic by many in the construction and property industry, it is still not common practice for buildings in the UK to be designed with adaptability in mind. So what would need to change in the industry for adaptability in buildings to become more commonplace? Figure 4 presents an archetypal view of a property and construction industry in which adaptability in buildings is the norm due to an alignment in the interests of different stakeholder groups: developers procure buildings that are more adaptable because they attract higher prices from investors, who in turn find that they are more attractive to occupiers and end-users because they are easier to change. This 'virtuous circle' is reinforced by a series of other influences: valuers factor the benefits of adaptability into their appraisals and industry bodies encourage their members to think about adaptability when procuring, designing or constructing buildings; similarly planners encourage developers to develop more adaptable buildings and banks lend to investors and occupiers at more favourable rates because more adaptable buildings are seen as less risky.

A number of factors could help to bring about such a change in industry mindsets. One would be to develop a better understanding of the costs, benefits and risks of adopting different adaptable design strategies. In the construction and property industry, existing attitudes towards adaptability are, to some extent, epitomised by a comment from the architect of one of the two case study schemes, who suggested that:

> *"I completely concur and I like buildings to last 500 years. I'd like them to change uses ten times. I'd like to be able to dismantle an office façade and put another kind of façade and respond to the climate and all of that. I guess the problem is that the more flexibility you create… the more cost there is"*

Providing more robust evidence as to the real costs and benefits of adaptability and the way in which these play out in practice could enable clients and their advisors to make more informed decisions about which, if any, design strategies to deploy in their buildings. Learning from examples of existing buildings can be a useful way of understanding the costs and benefits of adaptability and the authors of this paper are therefore engaged in ongoing case study research in this area.

There is also a need for a clearer articulation of what constitutes adaptability in buildings, so as to overcome some of the misconceptions that surround the issue. Evidence from the related field of 'sustainable' buildings suggests that being able to certify or label a building as ‘green’ can help to improve transparency in the property market and help occupiers to make more informed decisions about which buildings to purchase or lease. Moreover, such certification schemes can help valuers and investors to factor the benefits of sustainable design features into their appraisals of worth and send positive price signals to developers. A useful goal for researchers and industry bodies might therefore be to develop a similar scheme for the adaptability potential of buildings or to see how adaptability potential can be factored into existing ‘green’ building certification schemes, such as BREEAM and LEED. Indeed, there have already been moves in this direction. For instance in the UK, the *Lifetime Homes* standard – a set of design criteria for ensuring that new homes are adaptable for lifetime use – has been incorporated into the *Code for Sustainable Homes* (DCLG, 2006). In the US, the American Institute of Architects has adopted the “long life, loose fit” principle as one of its ten measures of sustainable design in its annual top ten green projects competition, in which entrants are asked to describe, amongst other things, the adaptive re-use potential of their buildings (AIA, 2004).

Government regulation may also play a role in changing industry mindsets towards adaptability in the built environment. One of the key principles of sustainability is that development today should not compromise the ability of future generations to meet their own needs (WCED, 1987). However, buildings that are difficult to adapt pose a problem for future generations, because the buildings either need to be demolished, undergo costly and potential environmentally damaging refurbishment or remain vacant, which itself can have indirect negative social and economic consequences. Rising land fill taxes in the UK and other countries mean that waste from building demolition and refurbishment will be increasingly costly to dispose of in coming years and although the principle of extended producer responsibility is unlikely to be applied to whole buildings, it could potentially be applied to particular building elements and components (Guggemos and Horvath, 2003). Such changes could give rise to greater demand for buildings that are more adaptable, particularly in terms of the ease with which they can be retrofitted, scaled up or down in size, or converted to a new use.

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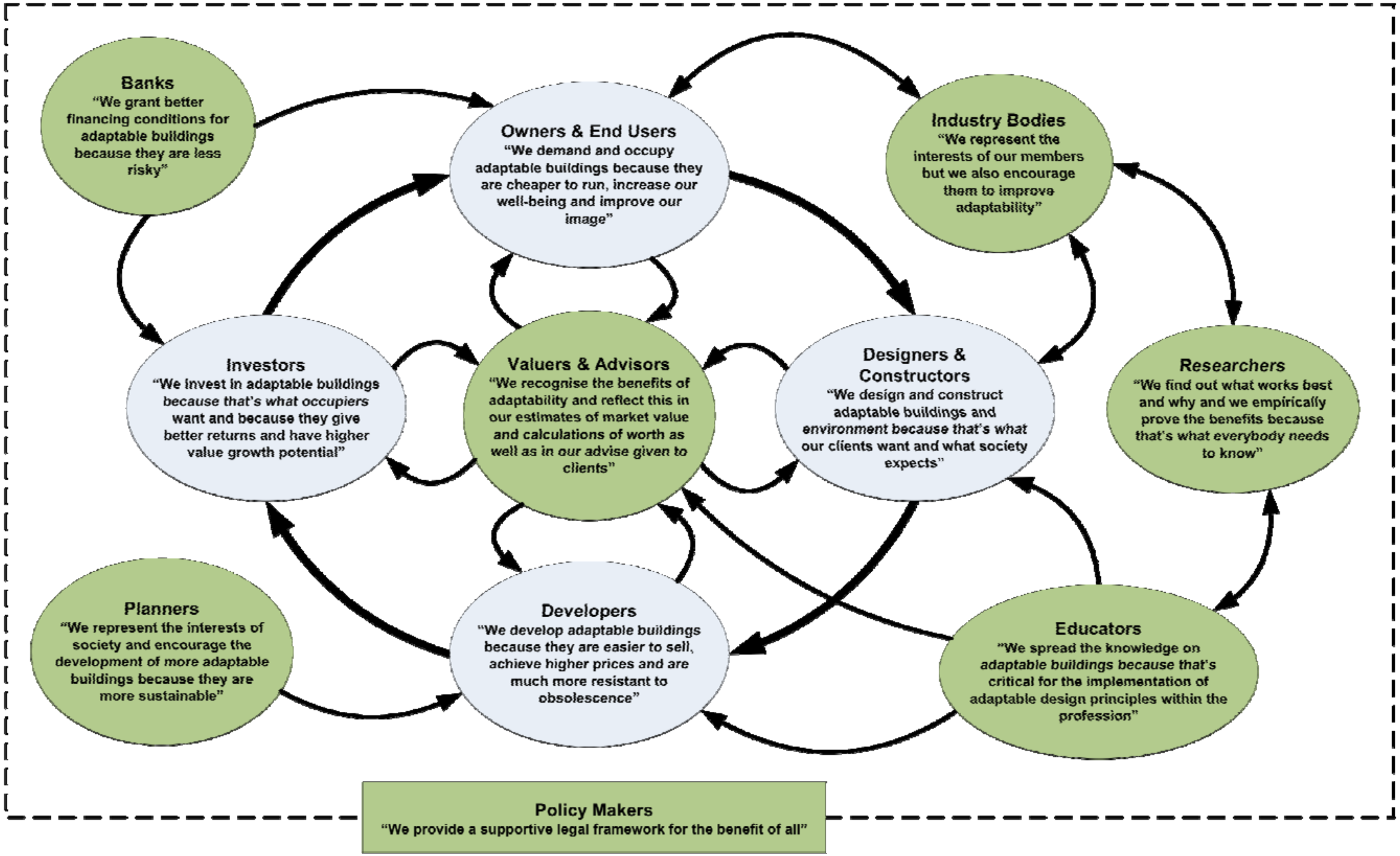

Figure 4: *Creating a virtuous circle for more adaptable buildings (adapted from Hartenberger, 2008; p.6)*

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