REACHING THE PERFORMANCE "SWEET SPOT" WITH CERTAINTY

ABSTRACT

The search for the so-called "*performance sweet spot*" (1) within buildings has tended to concentrate on the investigation of narrow technical issues, usually citing poor design, construction detailing or even controls complexity as the primary causes.

New research (2) suggests the reasons for errant building performance is significantly more complex than designers understanding, involving metaphysical, sociological, even psychological and cultural factors which lie largely ignored. In addition, resistant and highly conservative protocols within the construction industry conspire to create added misalignment (3), further compromising building user's expectations for a successful building product outcome.

The quest for better appreciation by designers and constructors of these complex issues is an urgent one if the industry is to meet the needs of its customers for ever more demanding, healthy and sustainable buildings. This paper examines the divergent issues for designers and users, and how using more customer-focused approaches, design and engagement processes might be better initiated and informed. All with a view to improved user aspirations for buildings which provide a home for better user outcomes, higher quality and lower costs. One where building users and designer's efforts are truly aligned to hit the "performance sweet spot" with repeatable certainty.

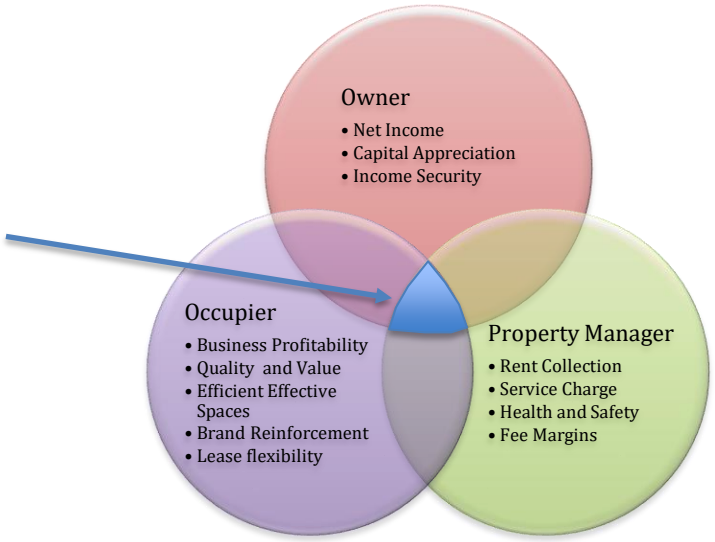
KEYWORDS

building, performance, design, quality, agile, scrum, management, POE

INTRODUCTION

A recent report (1) by the British Council for Offices (BCO), following a survey of over 2,000 of property industry clients concluded: "*the property industry is lagging well behind other industries in the customer service revolution*". The report went on to say*, "occupiers would like … a far more sophisticated approach…to see attention switch from a one-dimensional focus on [contractual] capital value and/or income appreciation to finding the 'performance sweet spot' – the point at which the owner, manager and occupier are aligned ...and where potentially greater value can be released*".

Owners/Managers/Occupiers would like to see the property industry provide buildings which hit the sweet spot with more certainty:



Courtesy of British Council for Offices

Figure 1. The "performance sweet spot" between Owner, Occupier and Property Manager Interests

The search for *"the performance sweet spot"* amongst design and construction professionals, has until now tended to involve the post-occupancy investigation of narrower, more technical issues, usually concentrating on poor construction information or design and controls complexity as the root causes, none of which are likely to accentuate the interest of owners or users.

Similarly, recent research into the methods used by post occupancy researchers has tended to overlook the fact that users require a different value proposition (2) from that on offer within the industry's studies. It is apparent that at the interfaces between buildings and users, there are sociological, even psychological and cultural, as well as technical issues at play, none of which are being addressed in the feedback to the industry. In addition, hardwired procedural protocols within building design teams conspire to create even further misalignment with user's expectations (3), all of which compromises the design team's ability to achieve a wholly successful outcome.

The search for a deeper understanding to these complicated issues has led the author to undertake an investigation into why the property industry has fallen short in overlooking the real needs of its customers. This paper explores how other industries have successfully addressed similar problems in living up to the expectations of users, and how by using similar design management techniques to them, the property industry might replicate this success in meeting users' needs to hit the defined "performance sweet spot" with certainty.

CONTEXT

In 2011 Monfared (4) study of the perception of users of a modern award-winning BREEAM Excellent building provided disturbing evidence that users have entirely different expectations to those of designers. Following a carefully constructed and monitored the 3-

year longitudinal investigation of building occupant's perceptions, the study concluded, the "satisfaction of occupants with a building" is most closely derived from three distinctly social elements: -

- Increased productivity
- Feelings of improved health and wellbeing (in comparison to other buildings)
- Feelings of contentment with features and facilities.

Monfared went on to cite Newsham (2009) (5) who suggested that the two most common features studied and measured by researchers in forming conclusions on the measurement of "satisfaction of occupants with a building" where technical:-

- Perception of environmental comfort
- Control over environmental conditions

In the search for why buildings are failing occupants, it seems it is the norm for designers and architects to devise post-occupancy evaluation (POE) studies which measure success from their own technically familiar perspective, rather than from that of the users whose view of their building is established using very different criteria.

Deuble et al. (2014) (2) evaluated the responses of occupants to a POE across two similar office buildings on the same university campus. The study established that occupant complaints of discomfort within one of the two buildings could not be explained by actual measured comfort data in the spaces. There was a reason to believe that occupants of the "defective" office had a unique perspective which was informed by business needs, organisational culture and general job satisfaction, thus motivating the negative returns made on the POE questionnaires. The study concluded that where POE's concentrate on technical issues alone, they cannot adequately evaluate the overall performance of a building, nor the extent to which the project meets the needs of its end users (Vischer (2009) (6)). A more holistic and robust performance evaluation is required if researchers are to understand how occupants view their building. One that incorporates an assessment of physical environmental data collection in parallel with occupant subjective metaphysical occupant responses, as suggested by (Ventre (1988) (7) Preiser (2001) (8); Vischer (2001) (6); Loftness et al.(2009 ((9)).

It seems that looking at issues from a building users perspective, is not something that should just be confined to the POE process. Moezzi (2009) (10) concludes: the "*fascination [by designers] with* the *performance of engineering systems and the quality of their installation and control*" has tended to introduce high expectations of them [the building's systems]. Hopes that they can seldom live up to.

Heerwagen et al. (2005) (11) reinforces this point following review of a number of green buildings to advocate;

- Buildings are relevant to business [users] interests across the full spectrum of concerns, from portfolio issues (e.g., the resale value of the property) to enhanced quality of individual workspaces (through improved ambient conditions).

- Because the potential influence of [green] buildings is broad, research on green buildings should address a range of outcomes rather than focusing narrowly on just a few. Issues of interest to organisations include workforce attraction and retention, quality of work life, work output, and customer relationships.

- Buildings can provide both cost reduction benefits and value-added benefits. The emphasis to date, however, has been on costs, rather than on benefits. The need for more data on value-added benefits underscores the importance of studies that focus on these human and organisational factors.

All of which leads to the question, can buildings be systematically designed in ways which can illicit with more certainty, by incorporating user's agency and sense of belonging to it, i.e. "the sweet spot *where potentially greater value can be released"?*

User Centric Design: Origins

In consideration of this, investigations to source a more flexible set of user-centric design management tools commenced with a review of project management methodologies deployed in other user-centric, customer orientated sectors of the global economy.

The study found that the hospitality, technology media and telecommunications (TMT), aeronautics, and automotive industries each invest large sums annually in researching customer experience. Within the TMT industry, a specialist sub-sector "UX" an acronym for user experience matured, which formed around what are known as Agile Project Management (APM) techniques, and which have come to dominate the project management disiplines of modern day software and application development. So much so, APM has overtaken PRojects IN Controlled Environments (PRINCE2) as the preferred design tool methodology in these sectors over the last three decades.

APM grew out of the post-war United States, European and Japanese war rebuilding programmes where automation and efficiency were needed to offset the loss of working-age labour. Over the next fifty years, Agile Methods (unfortunate naming terminology sometimes confused with Lean and Kanban or agile office design, which are somewhat different) was recognised as the solution to solve the inherent inadequacies of conventional Taylorism PRINCE2 software design management approaches.

Continuing the development of APM into the 1970's Winston Royston (1971) (12) coined the term "waterfall", as an almost derogatory descriptor for Taylorism in project management, i.e. following a linear process and falling over weirs or milestones to the next stage. Inferring that once the process flow had commenced, it became difficult to halt the momentum

generated, and the project went with the flow to completion, as is the case in construction today.

Royston contended that with waterfall, the certainty of satisfaction with the outcome is not determined until the process is complete. Cost and time estimation is an estimation and is invariably wrong.

Reis (13). is more scathing of Taylorism's waterfall process noting several defects;

- **Scope Bloat**. - Cram in as much as the budget can afford. Aspirations usually exceed budget eventually leading to cost overrun and "de-value engineering".
- **Blind Investment** – cost risk remains and is only mitigated on completion.
- **Architectural Risk** - Design risks come to surface too late
- **Functional Risk** – Users don't get to know if it works until the end.
- **Change Risk** – Cost risk supersedes change risk, meaning it is never adequately addressed.
- **Uncertain Cost and Duration** – Large numbers of change requests are commonplace.
- **Resource levelling/availability** –Windows of availability never align. Availability of the right people input at the right time is difficult to align, which reduces quality.
- **Team motivatio**n – When projects go wrong commercially, interest wains, quality declines further, user outcomes drop to the bottom of the priority list.

All the above being factors that affect the production of buildings, and which ultimately lead to uncertainty and user dissatisfaction with the outturn product.

Expanding the work of Royston, Deming (14) with the experience of several years troubleshooting projects in post second world war Japan, proposed his 14 principles for project or process management success.

From his experiences, Deming observed that the failure of a project was usually the product of a management process failure, rather than a failure of execution or the competence of the operatives implementing it. He noted that managers of the failed projects also tended to diagnose the causes of their inability by incorrectly attributing the reasons for project failures on technical non-compliance or operative incompetence. In most cases, Deming observed, the failure had its origins in the generation, management and care taken over the quality of information arriving or leaving the design table, and usually had little to do with the execution of the planned procedure at site level.

Deming proposed that projects should have the core purpose of increasing quality for the customer from the outset. Where quality becomes the focus, the project team would find better ways to reduce time and cost by default.

The 14 principles led Deming to the corollary;

a) When people and organisations focus primarily on quality (of information), defined

by the following ratio,

$$\text{Quality} = \frac{\text{Results of work efforts}}{\text{Total costs}}$$

quality (of the product) tends to increase, and costs fall over time.

(b) However, when people and organisations focus primarily on *costs*, costs tend to rise and quality declines over time.

This movement towards improving quality and a focus on how information flows within the design process became Deming's theory for advocating a separate design management process, splitting and separating the management of the design from the management of the construction process.

Swayed by the need to improve the quality of information on the design table, at IBM Weinberg (1971) (15), Jacobson et al.(1991) (16), and Kilb (1998) (17) brought forward thinking on "adaptive" software development, following on in the 1990s, to eventually be called *lightweight* software development methods. Lightweight development includes Agile Methods, all evolving in reaction to the perceived inadequacies of heavyweight Taylorism methods.

The common thread for the all Agile Methods (including Scrum which became the predominant of all of the above Agile methodologies) is in integrating feedback from users at the very earliest stages in the design process. This is achieved by incorporation of rapid prototyping, testing and even trial and error early in the design process, as a means of eradicating the risk of failure associated with rejection of the product by users post launch to the market. Due to their deeper involvement, users become the custodians of product quality while also sustaining customer change requirements and innovation feedback loops for a de-risked product outcome.

Through the mid-1990's, IBM with other large software and manufacturing corporates continued to improve in-house lightweight Agile Methods to produce Dynamic Systems Development Method (DSDM), Scrum, Crystal Clear, and Extreme Programming (XP). All these lightweight methods became variant subsets of the Agile Project Management philosophy. In parallel, research into lightweight APM techniques (or more commonly referred to as Agile Methods) continued in the automotive, manufacturing (1991) (22) and aerospace sectors.

Proliferation of Agile Methodologies in Industry (mainly TMT)

In 2001, seventeen software developers all prominent proponents of lightweight project development, met in Utah to discuss how they might promote the apparent benefits of lightweight methods to a broader audience. To this point, the take-up of the methodologies

was mainly confined to the major corporates. In response, Fowler and Highsmith published The Agile Manifesto (2001) (18).

At the heart the manifesto are 12 principles (recommended to be read in full) which distil into four key themes as follows;

- **Individuals and Interactions over processes and tools** - Prioritising the quality of people and face to face collaboration above siloed activity with a prescribed project managed process
- ***Working product over comprehensive documentation. -*** Concentrate on how the product should work, and back cast this to the design process, over (not instead of) concentrating on producing a competent set of design specifications on time and on programme.
- ***Customer Collaboration*** *over contract negotiation – Manage the quality rather than the cost.*
- ***Responding to Change*** *over following a plan – Invite change to improve quality, the product is more important than the plan.*

The group went on to form the Agile Alliance, to further the development of Agile Methods across TMT and to promote adoption and training in its implementation.

In 2011 the Agile Alliance created the Guide to Agile Practices (renamed the Agile Glossary in (2016), an evolving open-source compendium of the working definitions of agile practices, terms, and elements, along with interpretations and experience guidelines from the now global community of agile practitioners.

Agile Use in Construction.

In recognition of findings of building POE research above, and the absence of focus on customer outcomes it seemed valid to ask if Agile Methods with its clear focus on customer outcomes could be of benefit to the construction industry? If so, how should Agile be deployed? Are the synergies of the TMT industry with that of construction strong enough to effect a successful introduction of Agile Methods, and if so how might it be achieved?

To begin with, a search was conducted to find instances where Agile Methods were deployed within the construction sector. The search located a small number of academic research papers with case study projects in Europe and the United States.

Owen and Koskela [2006] (19) undertook an analysis of the applicability of Agile to construction. The study references the work of Stapleton (20) and the DSDM Consortium following an EC funded pan-European research to identify the benefits of the broader use of Agile Methods for process improvements. The study found that where projects had adopted DSDM, significant enhancements resulted, which included a 23% improvement in the number of survey respondents who agreed or strongly agreed that delivery and client satisfaction had improved as illustrated below;

Objective	Target Improvement	Actual Improvement
Improve on-time delivery and customer satisfaction	20%	23%
Increase process predictability, higher maturity level	10%	40%
Improve organisational skills of both management and development of personnel	20%	79%

Table 1 DSDM in Process Improvement (Source Stapleton and DSDM Consortium (2003) (21))

The Owen and Koskela paper highlights the Shine Industries (2003) (21) online survey of companies who had used agile methods in their projects. The clear majority of respondents reported high or significant improvements in productivity, quality, and business satisfaction (see table 2 below).

Did Agile process result in:	Yes	Neutral	No
Reduction or significant reduction in cost	49%	46%	5%
Better or significantly better productivity	93%	5%	2%
Better or significantly better quality	88%	16%	1%
Better or significantly better business (user) satisfaction	83%	16%	1%

Table 2 Agile survey results (source Shine (2003)

Everts et al. (2011) (22) study documents the use of Scrum on a private rented new build residential project in Switzerland. Concluding that while new construction assignments require new (lightweight) more “human centred” management paradigms, existing paradigms [Taylorism] are tenacious in their hold on existing industry project and design management thinking.

Streule et al. (2016) (23) recorded a case study in the use of Agile Methods on a private residential scheme designed and built in Switzerland by property developer Swiss Property A.G. Agile Methods were applied across the design phases leaving the site level construction phases to revert to traditional PRINCE2 methods.

The methodology was deemed by participants to work well, albeit with some acknowledged issues of inexperience in the deployment of the method. It appears existing familiarities with waterfall methods were slow to be relinquished. But the paper concludes that this should not impede wider implementation of Agile Methods across the industry, suggesting it should even be extended into the construction phases, particularly on complex rapidly changing projects.

In all cases cited above, it appears Agile was deployed to improve information quality within the project management process as a basis for developing efficiency and productivity of the project implementation phases. There is little evidence to suggest any specific intention to improve outcomes for users of the final built product, with no evidence of the involvement of future users of the developed product during the design processes.

However small in numbers, the cited studies established a precedent for successful deployment of the methodology and meaningful grounds for proposing new approaches that could lead to broader adoption across the construction industry.

Agile for Buildings – A new methodology

While it is apparent that Agile Methods or an adapted variant of Agile has merit in providing the necessary improved performance outcomes, the property and construction industry continues to be resistant to change (24), to the point where recent events have highlighted obvious market failures.

Given the low appetite of change, it is reasonable to expect the introduction of Agile as a new means to manage the design process (as with the chequered history of Lean and BIM) would need to address perceived difficulties of gaining traction in what is seen as a conservative construction industry. This suggests that the methodology would find a better reception if it could be seeded by the client as a mandatory process to be adopted from the point of decision to procure a new building.

With the recent introduction of the Royal Institute of British Architects (RIBA) Plan of Work 2013 (25) Stage 0: Strategic Definition there is already encouragement that more emphasis should be placed by clients on commencing the process towards achieving quality through deeper and more meaningful engagement with end users.

Also, early in the design process (RIBA Stages 0 to 2) is where the best opportunity for change with the lowest impact on cost and programme exists. And where most value can be extracted from the involvement of the client user teams; particularly when invited to work jointly with designers in co-authoring the new building's design.

The challenge for any new methodology therefore, is to prioritise user outcomes and from here, to work with them towards their version of "the operational sweet spot" with greater purpose and certainty of outcome. This has became the active heart of a proposed new Agile for Buildings (A4B) proposed by the author. A4B is an Agile methodology adapted for use the property and construction industry. A4B is closely based on the Scrum variant of APM adhering to its generic processes as shown in Fig 1 below. Chosen because of its success in other industries, and proven albeit limited track record in property and construction, the main difference between A4B and conventional Agile Methods Scrum is that it is constricted to apply Agile principles across RIBA Stages 0 to 2 only, where Scrum in TMT might run across the entire project.

The initial goal of the A4B methodology as with Scrum is to extract the knowledge base of all building user stakeholders. Inviting them to be involved as co-authors of the future design, in what becomes a compelling journey towards a new business integrated building and forming the new workplace with real purpose through three active elements. The components of the methodology are as follows;

1 - User Stories: invites users at all levels of the client business to input there own ideas for their new building, recording each idea on record cards or post-it notes. The cards document the issues the users feel should be prioritised within the new design if the building is to demonstrate success for them.

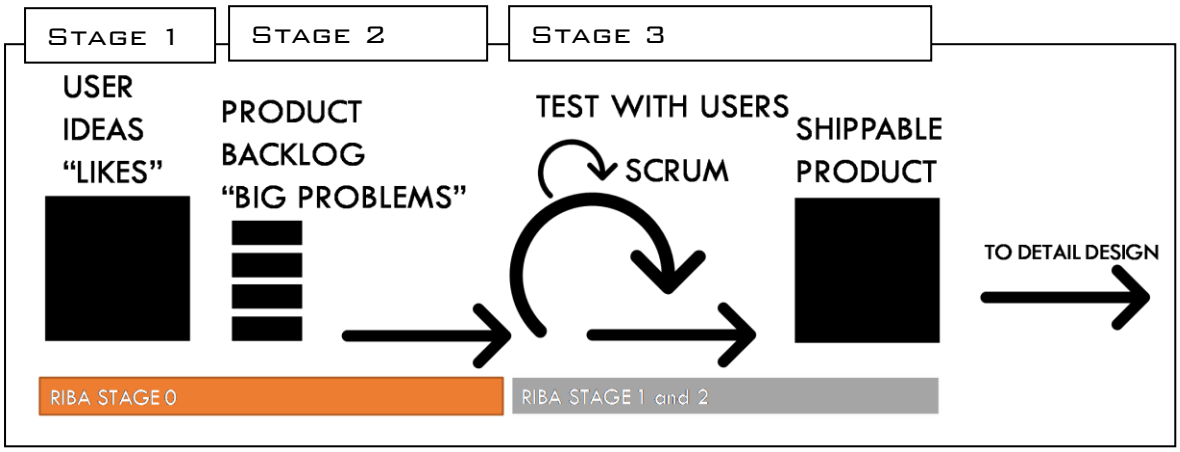


Figure 1. Diagrammatic of an Agile Scrum Process for use in the design of a building

2- Product or Problem Backlog: sifts what could be a multitude of Stage 1: User Story Record Cards from all users and stakeholders, placing them into thematic groupings or "bins" to arrive at a smaller number of larger consolidated thematic problems for resolution. This definitive list of thematic "big problem" categories is called a Product or Problem Backlog (PB). The constituent PB themes are prioritised in favour of highest value and lowest cost at the top, and lowest value and highest cost at the bottom.

3 - Scrum. The Scrum Teams comprising six people or less with up to three representatives of business users and three building design team members to work through each of the PB items. For each thematic PB item, scrum team members are tasked with the creation of a minimum viable prototype (MVP) to solve the aggregated PB problem. PB items will will be unique to the users and the business or organisation. The developed PB prototype solution must receive users agreement as a solution to the given Backlog Problem.

The MVP ask can take on any form. It can be "*a working prototype model of a new desk layout to promote great team cohesion*", or *a vitual reality model of a new teapoint to promote health and wellbeing*, even a short specification *to deliver the IT solution for a step change in seamless homeworking* . The only prerequisite for the PB and resultant MVP is that it should be capable of being meaningfully tested by

expected users before being incorporated as a final product or component of the whole building design.

As well as the designers and business representatives, orthodox Scrum Teams include two other influential individuals. First, the Problem Owner who represents the main body of business users, and says when the business is happy that the problem is solved. Next, the Scrum Master who guides the process, unblocking obstacles to success. When the Problem Owner in consultation with all business users is content with the solution; the working prototype is paired with a short specification description to be handed on to the design team in RIBA Stage 3: Developed Design. At this point the component is integrated into the formal design of the new building as a recognisable customer led feature.

The business Problem Owner will continue to be a guardian of the integration of the prototype solution through design and construction to delivery and final handover of the PB element. The Scrum team maintains responsibility for time and cost, and it is acceptable for the Problem Owner to say when enough time has been spent in search of a solution, even without having achieved success. This Scrum process is repeated for all items in the Product Backlog.

Within the methodology, users frame solutions, participate in their development, and gain the reward of seeing their solutions take shape. They also pick up knowledge through the process, become participants rather than observers, and eventually more informed critics of the construction process. The process will also have spin-offs in using the project to harmonise the user community around common goals, thus improving their engagement with the occupant business and leading to a building which informs a better company. Ultimately creating the conditions, where because they were involved as co-authors of the design, users have an agency with the design and construction process. The design is not done to users but with users. In this way, the necessary sociological aspects of design are addressed, and any subsequent POE is more likely to find improved understanding, greater forgiveness, and a broader sense of community. The defined “performance sweet spot” is achieved with measured certainty.

CONCLUSIONS AND RECOMMENDATIONS

Analysis of the work undertaken within other user-centric industries suggests there is much for the building design and procurement industries to learn.

Published POE studies and those from client bodies such as the British Council for Offices, confirm that there is an issue for the construction industry to address in closing the gap between what is expected by its customers and what is delivered. To add to this, the demands for ever more complex products in energy and the carbon-constrained world continues, in a situation where the industry is struggling to keep pace.

On top of this technological advances, coupled with a health and wellbeing agenda are placing even higher expectations on the performance of buildings by the people who inhabit them.

If the indications are that the construction industry is failing to meet current expectations now, the situation can only exacerbate with time. The industry must find ways to understand the needs of its end user customers and to integrate them more meaningfully into its design processes from the beginning.

The current fixation of the industry with commercial and technical outcomes as benchmarks of success, including its industry perspectives on POE feedback, only serves to compound these constraints, and is to the detriment of customer outcomes.

Lessons learned from other sectors such as TMT indicate that the construction's current pre-occupation with cost and contracts, over quality and effectiveness, is ultimately unsustainable, serving only to initiate a "*spiral to the bottom*" as argued by the industry's own seminal report "Modernise or Die". Despite this, the finish and quality of the built environment product is high, while users still find fault and complain. The industry is invariably building the wrong product by placing value in the wrong areas. Users feel the design is being done "to them" not "with them or for them" which is what ultimately lies at the heart of the "performance sweet spot" issue. It seems the logical solution to this situation is to involve users as customers and to do so in significantly more immersive ways.

The TMT industry has much in common with the construction industry where projects are complicated, subject to change and provided to an end-user for use. Agile Methodology which evolved in the TMT industry is proven to work in similar product development industries to that of construction. Successful case studies in construction environments suggest it could also be useful in improving the management of built environment design, by improvement of information from and feedback to users, all leading to improved operational outcomes and the achievement of the defined performance sweet spot.

With this as a new tenant of understanding, Agile for Buildings (A4B) methodology has been developed for use in a live project environment. The next immediate steps must be to fund a longitudinal study of A4B in a number of longitudinal case study projects with clients who are about to procure a new workplace building. There is room for optimism that where Agile Methods is introduced, design teams and clients will conspire from the outset to hit the performance sweet-spot with certainty.

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