Establishing psychological wellbeing metrics for the built environment

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Establishing psychological wellbeing metrics for the built environment

KELLY J WATSON^{1 2}

¹Manchester Urban Institute, School of Environment, Education & Development, University of Manchester

Kelly.Watson@manchester.ac.uk

²Arup, Manchester, M1 3BN

Kelly.Watson@arup.com

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Abstract

The business case for wellbeing is now an influential agenda in the built environment. Increasing demand for user-centred environments means evidence-based design proven to deliver wellbeing outcomes for end users is essential. The challenge is to effectively capture and disseminate this evidence to a range of expert and non-expert audiences. Further, being able to make the link between increased wellbeing and an increase in the productivity, or performance, of building users requires new definitions and methods. An innovative wellbeing valuation approach is presented, consisting of a multi-item scale to measure and quantify the wellbeing outcomes experienced by building users, and impact reporting techniques using Social Return on Investment (SROI) to produce transferable, monetised evaluation metrics. This combination has the capability to communicate the value of design in a powerful and accessible manner. Wellbeing valuation metrics represent an opportunity to develop new user-driven knowledge and shape the built environment in positive ways.

Keywords Building users, Metrics, Post-occupancy, Psychological, Wellbeing, Valuation

Practical application

Wellbeing has become an influential agenda in the built environment in recent years, suggesting that user-centred priorities will become increasingly significant to the design and construction sector. The wellbeing valuation approach presented represents an innovative blend of a psychological wellbeing model, quantitative measurement and financial reporting to produce transferable metrics to communicate the value of design in a powerful and transformative manner. Wellbeing valuation is a nascent practice, but it provides the professions with opportunities to collaborate with end users and develop new knowledge about buildings, enhancing the ability of practitioners to shape the built environment in positive ways.

1.0 Introduction

Wellbeing has emerged as an influential agenda in the built environment in recent years¹, promoting the social and, significantly, the economic aspects of triple bottom line sustainability. It embodies an accessible and affirmative goal for occupants and practitioners alike, compared to the technical discourse of restraint that surrounds energy efficiency. Its growing prominence is reflected in the emergence of new valuation practices in the built environment, particularly around the “business case” for wellbeing and a range of associated metrics and frameworks for this end^{2 3 4}. Interestingly, increased wellbeing is often associated with anticipated improvements in occupant performance, particularly productivity², yet the existing frameworks for evaluation do not explicitly prove this relationship, nor generate learning about how it can be achieved in practice. As the property market increasingly demands user-centred environments, evidence-based design proven to deliver wellbeing outcomes for end users is essential. The challenge of capturing and disseminating this evidence to a range of expert and non-expert audiences is therefore a topical professional concern, and requires an evaluative shift away from measuring building performance towards measuring the outcomes experienced by people⁵.

2.0 Wellbeing in the built environment

The term “wellbeing” is increasingly used across a wide set of academic, commercial and public sector built environment arenas. The academic literature that investigates wellbeing in the built environment can be distinguished between studies at an urban planning scale, i.e. cities and local neighbourhoods, and studies at a post-occupancy building scale, i.e. individual buildings across a variety of typologies. The post-occupancy literature that addresses wellbeing (in a broad sense) within individual buildings is substantial, addressing a variety of typologies including housing, commercial offices, industrial workplaces, healthcare, care homes and elderly housing, schools, universities, academic workplaces, retail and service sector, and energy efficient and low carbon buildings.

Whilst widely used, the term “wellbeing” is without clear definition. Typically, wellbeing is considered synonymous with health, usually mental health^{6 7 8 9} and more rarely with physical health^{10 11}. It is also often used pragmatically, relating to comfort and indoor environmental quality in the built environment. However, this generally denotes a lack of negative problems being caused by the indoor environment rather than it promoting an improved state of comfort. Many studies define wellbeing as a combination of health and comfort^{12 13}, or health, comfort and happiness¹⁴. The inclusion of happiness suggests that wellbeing refers to something broader than a combination of health-related and pragmatic needs being fulfilled. In relation, quality of life is a much used concept in studies of wellbeing and the built environment, typically at a scale beyond individual buildings, but remains linked either to health¹⁵ or the indoor environment¹⁶.

However, a great deal of academic work exists in the social sciences which seeks to define wellbeing from a broader perspective, particularly in the disciplines of economics, psychology and sociology. Two key definitions can be identified in the existing research: *hedonic* wellbeing and *eudaimonic* wellbeing^{17 18 19 20}. Hedonic wellbeing relates to happiness and perceived quality of life, whereas eudaimonic wellbeing relates to a fuller psychological concept of one’s life having purpose and an individual having the capabilities to function effectively to this end. This is known as self-determination²¹, or flourishing²².

Hedonic, also often referred to as subjective, wellbeing has received considerable scholarly attention and is defined as a combination of life satisfaction, the presence of positive affects (emotions) and lack of negative feelings²³. The life satisfaction component represents a cognitive evaluation of various life domains (health, finances, job, leisure, relationships, etc) across a relatively long time period, i.e. something that is evaluated via a thought process. The other two components are usually interpreted as affective emotions within a shorter time period. More recently, there has been a growing interest in the spatial differences of subjective wellbeing, from urban, regional to national scales, and understanding the context of place in wellbeing outcomes²³. There has been a similar level of interest from the public sector, particularly the potential of subjective wellbeing as an alternative measure of development²⁴ and in public policy evaluation²⁵.

Taking the notion of hedonic wellbeing into consideration suggests that a wider definition of wellbeing outcomes in the built environment is required that goes beyond health, comfort and happiness. There is existing research into the impact of energy management systems on the wellbeing of occupants which takes a hedonic view of wellbeing in buildings, identifying the established subjective measures of Satisfaction and Affect as most relevant²⁶. However, eudaimonic wellbeing, the psychological needs required for effective functioning, is not taken into account in this model and remains undefined in relation to the built environment.

Employing concepts of self-determination²⁷, wellbeing is understood to consist of a combination of thinking, feeling and functioning. It can be defined as *cognitive* satisfaction (achieved through goal accomplishment), the presence of positive *affect* (and lack of negative feelings), in combination with the *psychological* needs of competence (personal ability), relatedness (social ties) and autonomy (personal control and resilience). This can be represented by measures of Satisfaction, Affect, Competence, Relatedness and Autonomy. The synthesis of cognition and emotion with effective function, equating to the concept of flourishing²², is of particular importance in the context of growing demands to make the case for increased wellbeing outcomes leading to increases in occupant performance. Health and comfort are excluded from this conceptualisation of wellbeing in the built environment as they are separate concepts and represent other, discrete outcomes produced by buildings. There is a lack of systematic, academically-informed design guidelines to promote the development of buildings which generate wellbeing outcomes in the end users. A range of academic research exists which offers guidelines for various design features, including studies of a specific element of indoor environmental quality, a particular building typology, the impact of colour, and a small number relating to the management of buildings to promote occupant wellbeing. Further, a variety of industry publications represent sources of advice on wellbeing in the built environment, including the wealth of building certification schemes globally offering a range of frameworks and checklists for the design of green buildings (BREEAM, LEED, Green Star), and more recently, for healthy buildings (WELL). However, they rarely offer guidelines beyond health and comfort-related elements and do not consider a fuller, psychological conceptualisation of wellbeing.

In relation, only a small number of approaches and even fewer tools exist for the measurement of wellbeing outcomes in the built environment. Several frameworks and toolkits have been published in recent industry reports^{23 4} to capture the impact of the built environment on wellbeing and other outcomes such as health, satisfaction, and performance. However, there is no direct measure of wellbeing that currently exists beyond self-report questions. Academic work on measuring wellbeing tends to be split between the cognitive (measuring long term satisfaction) and the affective (measuring short term emotions). Research typically focuses on preventing health or comfort-related problems due to building design, rather than considering the potential psychological benefits of positive stimuli in the environment. As a result, there is a lack of evidence-based research that investigates the ways that the built environment can influence wellbeing outcomes, and particularly when defined in terms of individual flourishing.

As a result there are plentiful opportunities for both research and practice to drive learning about wellbeing outcomes in buildings. Considerable further investigation is required to understand the complex interrelations between wellbeing outcomes, physical building design, organisational culture, and individual practices. Therefore, there is a need to promote a wider, psychologically-informed definition of wellbeing in the built environment and to develop a related approach for its capture and measurement. There is currently a lack of robust wellbeing measures that can be applied in post-occupancy evaluations of buildings, and overcoming this gap is critical for the effective transfer of new knowledge into replicable, evidence-based design for the advancement of wellbeing in future development.

3.0 Wellbeing valuation in practice

This section introduces a novel wellbeing valuation approach consisting of a multi-item scale to measure and quantify the wellbeing outcomes of building users in an objective and cost effective manner, followed by the monetisation of the results using techniques from Social Return on Investment (SROI), a social impact methodology, to produce transferable reporting metrics. The approach represents the first output in the development of a toolkit that can evidence the commercial case for people-centred design.

3.1 The Building Wellbeing scale

The first part of the wellbeing valuation approach is a multi-item scale. Its development was based on the fuller, psychologically-informed definition of wellbeing as flourishing. As outlined above it is made up of five components: Satisfaction, Affect, Competence, Relatedness and Autonomy, termed the SACRA model. It was developed in reference to two existing, academically developed and validated, multi-item scales for measuring wellbeing in individuals or populations, i.e. not in relation to the built environment. The first scale is the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS)²⁸ and the second is the Questionnaire for Eudaimonic Wellbeing (QEWB)²⁹. Both scales are made up of a set of Likert style items, where respondents rate their agreement on a five point scale. The WEMWBS is made up of 14 positively worded items, and whereas the QEWB is made up of 21 items with a mixture of positive and negative wording. The items of the WEMWBS and QEWB were categorised according to the SACRA components of Satisfaction, Affect, Competence, Relatedness and Autonomy, as shown in Figure 1 and Figure 2.

Please tick (✓) the box that best describes your experience of each over the **last 2 weeks**

STATEMENTS	None of the time	Rarely	Some of the time	Often	All of the time
I've been feeling optimistic about the future	1	2	3	4	5
I've been feeling useful	1	2	3	4	5
I've been feeling relaxed	1	2	3	4	5
I've been feeling interested in other people	1	2	3	4	5
I've had energy to spare	1	2	3	4	5
I've been dealing with problems well	1	2	3	4	5
I've been thinking clearly	1	2	3	4	5
I've been feeling good about myself	1	2	3	4	5
I've been feeling close to other people	1	2	3	4	5
I've been feeling confident	1	2	3	4	5
I've been able to make up my own mind about things	1	2	3	4	5
I've been feeling loved	1	2	3	4	5
I've been interested in new things	1	2	3	4	5
I've been feeling cheerful	1	2	3	4	5

Satisfaction
 Affect
 Competence
 Relatedness
 Autonomy

Figure 1: The Warwick-Edinburgh Mental Wellbeing Scale

Figure 2: The Questionnaire for Eudaimonic Wellbeing (QEWB)

Based on the length of the existing WEMWBS and QEWB scales, it was decided that three items would be used for each component of wellbeing to produce a 15 item scale. A combination of items were taken from the WEMWBS (10 items) and the QEWB (five items) and the wording modified for their use with building users. The reworded items are shown in Figure 3 according to the five components of wellbeing.

Satisfaction	
I feel useful when I'm in this building	WEMWBS
I have purpose when I'm in this building	QEWB
I feel fulfilled when I'm in this building	QEWB
Affect	
I feel optimistic when I'm in this building	WEMWBS
I feel at ease when I'm in this building	WEMWBS
I feel energised when I'm in this building	WEMWBS
Competence	
I deal with problems well when I'm in this building	WEMWBS
I think clearly when I'm in this building	WEMWBS
I can apply myself to what I'm doing when I'm in this building	QEWB
Relatedness	
I feel interested in other people when I'm in this building	WEMWBS
I feel close to other people when I'm in this building	WEMWBS
I feel valued when I'm in this building	WEMWBS
Autonomy	
I can make up my own mind about things when I'm in this building	WEMWBS
I can be myself when I'm in this building	QEWB
I trust my own decisions when I'm in this building	QEWB

Figure 3: Selected items for the Building Wellbeing scale

The items were rearranged into a random order and assigned a five point Likert scale, as seen in both the WEMWBS and QEWB, using the labels "Strongly disagree" to "Strongly agree". This is because time-related labels like "None of the time" to "All of the time" are considered to have lower face validity (i.e. more likely to be misconstrued) in the built environment context, as people are being asked to answer based on being in the building under question, regardless of long they spend there. The first version of the Building Wellbeing scale is shown in Figure 4.

When distributed to the end users of a building, the data produced is analysed using basic descriptive statistics, accessible to a wide range of practitioners and audiences. The responses to each item are simply added up and turned into a percentage to produce a wellbeing score per individual, and by taking a mean average across all participants an overall wellbeing score is produced for the building. Finally, a mean wellbeing score for each measure of the SACRA model can also be produced.

Figure 4: The Building Wellbeing scale, version 1

The scale has been piloted in a series of case building typologies, including commercial offices, non-clinical healthcare centres, university libraries and student residential halls during 2016 and 2017, with more than 2,000 responses collected overall. This data has been used to validate the scale in an iterative manner using the Rasch model, a psychometric approach for analysing and validating categorical data, specifically multi-item scales, as a function of the trade-off between respondent traits and the item difficulty. The WEMWBS was also validated using this method. The iterative approach meant that small changes could be made to the scale items as required before the next pilot. Analysis has shown a good fit to model expectations, as would be expected from a scale that is based on two pre-existing and academically validated scales. There were some observable ceiling effects where fit was skewed towards items with a higher difficulty. In practice, this meant that high numbers of building users were able to select “Strongly agree” and achieve maximum scores of five on

the majority of the items. Therefore, additional items with increased difficulty were added to the scale in order to provide a more accurate measure of high levels of wellbeing. For example, items such as “I feel joyful when I’m in this building” are less likely to elicit top scores than “I feel at ease when I’m in this building”.

In addition, the 5 point Likert scale was changed from 1, 2, 3, 4, 5 to -2, -1, 0, +1, +2. This was a decision to make it more intuitive to understand whether a score is signifying a positive or negative finding for wellbeing. On version 1 of the scale, a score of less than 50% suggests that wellbeing is low, whereas it actually means that wellbeing is negatively impacted by the building, i.e. the building is actively reducing user wellbeing. Updated versions of the scale make this clearer, as a score of less than 0% represents negative wellbeing and score above 0% represents positive wellbeing.

The final set of pilot studies have been carried out and the associated validation is in the process of being carried out. Redundant items and items that show misfit to the model, for example due to gender bias, will be removed from the scale to produce a final, validated version. The most up-to-date version of the scale is presented in Figure 5.

The Building Wellbeing scale represents a simple, accessible and cost effective method to quantify the wellbeing outcomes experienced by the end users of a built environment. It produces a range of wellbeing data and metrics, including wellbeing scores for each individual user, an overall wellbeing score for the building, and a score for each measure of wellbeing across the SACRA model. It can be distributed as part of a survey (i.e. during post-occupancy evaluation activities), which could also include questions to collect some basic demographic information, the average time spent in the building, and other data of interest.

The Building Wellbeing Scale					
Please answer based on your experience of spending time in this building					
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I feel optimistic when I'm in this building	-2	-1	0	+1	+2
I have purpose when I'm in this building	-2	-1	0	+1	+2
I feel rewarded when I'm in this building	-2	-1	0	+1	+2
I feel at ease when I'm in this building	-2	-1	0	+1	+2
I feel interested in other people when I'm in this building	-2	-1	0	+1	+2
I can be myself when I'm in this building	-2	-1	0	+1	+2
I feel worthwhile when I'm in this building	-2	-1	0	+1	+2
I deal with problems well when I'm in this building	-2	-1	0	+1	+2
I feel empowered when I'm in this building	-2	-1	0	+1	+2
I think clearly when I'm in this building	-2	-1	0	+1	+2
I feel inspired when I'm in this building	-2	-1	0	+1	+2
I feel useful when I'm in this building	-2	-1	0	+1	+2
I feel close to other people when I'm in this building	-2	-1	0	+1	+2
I feel successful when I'm in this building	-2	-1	0	+1	+2
I feel fulfilled when I'm in this building	-2	-1	0	+1	+2
I can make up my own mind about things when I'm in this building	-2	-1	0	+1	+2
I feel valued when I'm in this building	-2	-1	0	+1	+2
I can apply myself to what I'm doing when I'm in this building	-2	-1	0	+1	+2
I feel joyful when I'm in this building	-2	-1	0	+1	+2
I feel in control of my own decisions when I'm in this building	-2	-1	0	+1	+2
I feel energised when I'm in this building	-2	-1	0	+1	+2
I feel at my best when I'm in this building	-2	-1	0	+1	+2
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Figure 5: The Building Wellbeing scale, current version

3.2 Valuation using SROI

The second aspect of the wellbeing valuation approach is the monetisation of the quantitative wellbeing scores produced by the Building Wellbeing scale, using impact reporting techniques from Social Return on Investment (SROI). Assigning a monetary value to wellbeing outcomes is anticipated to enhance transferability compared to typical post-

occupancy evaluation summaries, facilitating the dissemination and implementation of findings within the design and construction industry³⁰.

SROI is a methodology designed for the social enterprise sector to measure and account for a wider concept of value for the attainment of multi-bottom lines. It was originally developed in the US by the Roberts Enterprise Development Fund (REDF) in the mid-1990s. It has been further developed by the New Economics Foundation (nef) in the UK since the late 1990s with a widely applicable stakeholder emphasis and a replicable, standardised methodology. It is based on traditional cost-benefit analysis and assigns a monetary value to social returns using financial proxies, which are compared against the level of investment to produce an SROI ratio of costs to social outcomes. An SROI analysis can be retrospective or prospective, encompass the value generated by an entire organisation or focus on specific programmes or projects. It is one of the most developed social impact methodologies, being designed to measure the outcomes of an intervention, rather than solely tracking outputs³⁰. Its monetisation technique facilitates the comparison of otherwise incommensurable benefits across different activities. Based on real data, the results are disseminated using 'return on investment' language that is familiar with investors and commissioners. It is widely used in the UK social enterprise sector to evidence organisational impact and is endorsed by the Cabinet Office. SROI has achieved a significant deal of traction within the social enterprise sector³¹ and, increasingly, public policy^{32 33} and commercial industry³⁴.

The SROI methodology has six stages as set out in The Guide to Social Return on Investment³⁵:

1. Establishing scope and identifying key stakeholders
2. Mapping outcomes
3. Evidencing outcomes and giving them a value
4. Establishing impact
5. Calculating the SROI
6. Reporting, using and embedding

Watson and Whitley³⁶ provide a detailed account of applying SROI to the built environment, which is not an established practice. The third stage of the SROI methodology is applied to the wellbeing data collected using the Building Wellbeing scale in order to place a value on the quantitative wellbeing scores. The SROI methodology uses financial proxies to assign a value to the outcomes under study, an alternative to traditional cost-benefit analysis methods such as preference-based valuation³⁷. A suitable financial proxy has been identified in HACT's Guide to Using the Wellbeing Valuation Approach³⁸, which values wellbeing at £36,776 per individual per year. This figure can be adjusted to make it applicable to the time spent in the building under study, for example, a daily or weekly value would be better suited to employees in an office, whereas an hourly value would be better suited to visitors of a healthcare centre. The value of wellbeing to an individual is therefore £100.78 per day, or £4.20 an hour. The adjusted value is multiplied by the average time spent in the building per end user per year, and by the total number of end users, to produce the total value generated by that building in wellbeing outcomes over a one year period. The inherent subjectivity of the valuation process requires that it is made fully transparent, a core principle of the SROI methodology³⁵.

The total wellbeing value is then multiplied by the quantitative wellbeing score collected during the user survey, which is inputted as a percentage to remove deadweight from the total. It is also possible to consider attribution at this point, that is, the proportion of wellbeing that can be attributed to the building as opposed to other factors like Facilities Management, organisational culture, or human factors. This information can be gathered during the user survey by asking end users to report how much of their wellbeing they believe is due to the building design. An average is calculated and removed from the total, producing a final impact-adjusted valuation for wellbeing.

An SROI ratio can be calculated by dividing the wellbeing figure by the building costs, i.e. the design fees, contract sum and the furniture, fittings and equipment (FF&E) cost. The SROI ratio represents the return generated by the building for the building users in a year, per every £1 spent. Further ratios can be projected at useful time points to inform maintenance and re-fit decisions, such as after 10 years at which point a re-fit is typically required, and after 60 years, the typical life time of building design. Whilst discounting is not prescribed by SROI, it is usually considered appropriate in the design and construction industry and HM Green Book discounting rates can be applied to the valuations. The resulting ratios represent the return generated by the building for the building users over a specified period, per every £1 spent.

The wellbeing valuation approach presented, whilst still under development, is a simple, accessible and cost effective activity that can be carried out by design professionals but also by developers, clients and occupying organisations, as technical expertise about building performance or complicated statistical analysis is not required. The resulting metrics will inform interested parties about the impact of a building, or different spaces within a building, on end user wellbeing in a more objective manner than relying on anecdotal evidence. Furthermore, its basis in a psychological definition of wellbeing using the SACRA model, means that a link can be more firmly drawn between wellbeing and performance, enhancing the business case for user-centred environments. It also has considerable potential as part of a wider research program to begin to unpick what aspects of buildings are most influential when it comes to the wellbeing experienced by the people using them, including physical design features, environmental conditions, factors of organisational culture, social norms and individual practices. This paper is an early step towards building a new knowledge base about people and buildings.

4.0 Conclusions

The rapid rise of the wellbeing agenda in the built environment suggests that user-centred priorities are gaining ground alongside traditional economic and environmental imperatives in the design and construction industry. The significance of wellbeing to the commercial property sector is set to intensify as organisations and end users alike demand people-friendly spaces that help them think, feel and function at their best. The need to make the case between increased wellbeing and improved performance requires a more considered approach to defining and measuring wellbeing. The importance of thorough and robust learning loops in the design process will become evident and the need for user-centred evaluation unavoidable. This represents a timely and exciting opportunity for the diffusion of novel methodologies and metrics that can capture, measure and disseminate the impact of the built environment to inform commissioning, tendering, high level design and briefing

processes, and post-occupancy assessment at a range of scales across a variety of contexts.

The wellbeing valuation approach presented in this paper is still under development, yet represents an innovative blend of the psychological SACRA model, quantitative measurement and financial reporting to produce transferable metrics with the capability to communicate the value of design in a powerful and transformative manner. A key part of the appeal is its calculative nature which offers something new when looking at user experience and, crucially, can tap into the monetised language around the “business case for wellbeing”. That financial valuation will come to play a defining role in the emerging wellbeing sector in commercial property is a likely prospect. Wellbeing valuation is a nascent practice, but it provides the professions with opportunities to collaborate with end users and develop new knowledge about building performance and experience, enhancing the ability of practitioners to shape the built environment in positive ways.

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Establishing psychological wellbeing metrics for the built environment

Abstract

The business case for wellbeing is now an influential agenda in the built environment. Increasing demand for user-centred environments means evidence-based design proven to deliver wellbeing outcomes for end users is essential. The challenge is to effectively capture and disseminate this evidence to a range of expert and non-expert audiences. Further, being able to make the link between increased wellbeing and an increase in the productivity, or performance, of building users requires new definitions and methods. An innovative wellbeing valuation approach is presented, consisting of a ~~validated~~-multi-item scale to measure and quantify the wellbeing outcomes experienced by building users, and impact reporting techniques using Social Return on Investment (SROI) to produce transferable, monetised evaluation metrics. This combination has the capability to communicate the value of design in a powerful and accessible manner. Wellbeing valuation metrics represent an opportunity to develop new user-driven knowledge and shape the built environment in positive ways.

Keywords Building users, Metrics, Post-occupancy, Psychological, Wellbeing, Valuation

Practical application

Wellbeing has become an influential agenda in the built environment in recent years, suggesting that user-centred priorities will become increasingly significant to the design and construction sector. The wellbeing valuation approach presented represents an innovative blend of a psychological wellbeing model, quantitative measurement and financial reporting to produce transferable metrics to communicate the value of design in a powerful and transformative manner. Wellbeing valuation is a nascent practice, but it provides the professions with opportunities to collaborate with end users and develop new knowledge about buildings, enhancing the ability of practitioners to shape the built environment in positive ways.

1.0 Introduction

Wellbeing has emerged as an influential agenda in the built environment in recent years¹, promoting the social and, significantly, the economic aspects of triple bottom line sustainability. It embodies an accessible and affirmative goal for occupants and practitioners alike, compared to the technical discourse of restraint that surrounds energy efficiency. Its growing prominence is reflected in the emergence of new valuation practices in the built environment, particularly around the “business case” for wellbeing and a range of associated metrics and frameworks for this end^{2 3 4}. Interestingly, increased wellbeing is often associated with anticipated improvements in occupant performance, particularly productivity², yet the existing frameworks for evaluation do not explicitly prove this relationship, nor generate learning about how it can be achieved in practice. As the property market increasingly demands user-centred environments, evidence-based design proven to deliver wellbeing outcomes for end users is essential. The challenge of capturing and disseminating this evidence to a range of expert and non-expert audiences is therefore a topical professional concern, and requires an evaluative shift away from measuring building performance towards measuring the outcomes experienced by people⁵.

2.0 Wellbeing in the built environment

The term “wellbeing” is increasingly used across a wide set of academic, commercial and public sector built environment arenas. The academic literature that investigates wellbeing in the built environment can be distinguished between studies at an urban planning scale, i.e. cities and local neighbourhoods, and studies at a post-occupancy building scale, i.e. individual buildings across a variety of typologies. The post-occupancy literature that addresses wellbeing (in a broad sense) within individual buildings is substantial, addressing a variety of typologies including housing, commercial offices, industrial workplaces, healthcare, care homes and elderly housing, schools, universities, academic workplaces, retail and service sector, and energy efficient and low carbon buildings.

Whilst widely used, the term “wellbeing” is without clear definition. Typically, wellbeing is considered synonymous with health, usually mental health^{6 7 8 9} and more rarely with physical health^{10 11}. It is also often used pragmatically, relating to comfort and indoor environmental quality in the built environment. However, this generally denotes a lack of negative problems being caused by the indoor environment rather than it promoting an improved state of comfort. Many studies define wellbeing as a combination of health and comfort^{12 13}, or health, comfort and happiness¹⁴. The inclusion of happiness suggests that wellbeing refers to something broader than a combination of health-related and pragmatic needs being fulfilled. In relation, quality of life is a much used concept in studies of wellbeing and the built environment, typically at a scale beyond individual buildings, but remains linked either to health¹⁵ or the indoor environment¹⁶.

However, a great deal of academic work exists in the social sciences which seeks to define wellbeing from a broader perspective, particularly in the disciplines of economics, psychology and sociology. Two key definitions can be identified in the existing research: *hedonic* wellbeing and *eudaimonic* wellbeing^{17 18 19 20}. Hedonic wellbeing relates to happiness and perceived quality of life, whereas eudaimonic wellbeing relates to a fuller psychological concept of one’s life having purpose and an individual having the capabilities to function effectively to this end. This is known as self-determination²¹, or flourishing²².

Hedonic, also often referred to as subjective, wellbeing has received considerable scholarly attention and is defined as a combination of life satisfaction, the presence of positive affects (emotions) and lack of negative feelings²³. The life satisfaction component represents a cognitive evaluation of various life domains (health, finances, job, leisure, relationships, etc) across a relatively long time period, i.e. something that is evaluated via a thought process. The other two components are usually interpreted as affective emotions within a shorter time period. More recently, there has been a growing interest in the spatial differences of subjective wellbeing, from urban, regional to national scales, and understanding the context of place in wellbeing outcomes²³. There has been a similar level of interest from the public sector, particularly the potential of subjective wellbeing as an alternative measure of development²⁴ and in public policy evaluation²⁵.

Taking the notion of hedonic wellbeing into consideration suggests that a wider definition of wellbeing outcomes in the built environment is required that goes beyond health, comfort and happiness. There is existing research into the impact of energy management systems on the wellbeing of occupants which takes a hedonic view of wellbeing in buildings, identifying the established subjective measures of Satisfaction and Affect as most relevant²⁶. However,

eudaimonic wellbeing, the psychological needs required for effective functioning, is not taken into account in this model and remains undefined in relation to the built environment. Employing concepts of self-determination²⁷, wellbeing is understood to consist of a combination of thinking, feeling and functioning. It can be defined as *cognitive* satisfaction (achieved through goal accomplishment), the presence of positive *affect* (and lack of negative feelings), in combination with the *psychological* needs of competence (personal ability), relatedness (social ties) and autonomy (personal control and resilience). This can be represented by measures of Satisfaction, Affect, Competence, Relatedness and Autonomy. The synthesis of cognition and emotion with effective function, equating to the concept of flourishing²², is of particular importance in the context of growing demands to make the case for increased wellbeing outcomes leading to increases in occupant performance. Health and comfort are excluded from this conceptualisation of wellbeing in the built environment as they are separate concepts and represent other, discrete outcomes produced by buildings. There is a lack of systematic, academically-informed design guidelines to promote the development of buildings which generate wellbeing outcomes in the end users. A range of academic research exists which offers guidelines for various design features, including studies of a specific element of indoor environmental quality, a particular building typology, the impact of colour, and a small number relating to the management of buildings to promote occupant wellbeing. Further, a variety of industry publications represent sources of advice on wellbeing in the built environment, including the wealth of building certification schemes globally offering a range of frameworks and checklists for the design of green buildings (BREEAM, LEED, Green Star), and more recently, for healthy buildings (WELL). However, they rarely offer guidelines beyond health and comfort-related elements and do not consider a fuller, psychological conceptualisation of wellbeing.

In relation, only a small number of approaches and even fewer tools exist for the measurement of wellbeing outcomes in the built environment. Several frameworks and toolkits have been published in recent industry reports^{2 3 4} to capture the impact of the built environment on wellbeing and other outcomes such as health, satisfaction, and performance. However, there is no direct measure of wellbeing that currently exists beyond self-report questions. Academic work on measuring wellbeing tends to be split between the cognitive (measuring long term satisfaction) and the affective (measuring short term emotions). Research typically focuses on preventing health or comfort-related problems due to building design, rather than considering the potential psychological benefits of positive stimuli in the environment. As a result, there is a lack of evidence-based research that investigates the ways that the built environment can influence wellbeing outcomes, and particularly when defined in terms of individual flourishing.

As a result there are plentiful opportunities for both research and practice to drive learning about wellbeing outcomes in buildings. Considerable further investigation is required to understand the complex interrelations between wellbeing outcomes, physical building design, organisational culture, and individual practices. Therefore, there is a need to promote a wider, psychologically-informed definition of wellbeing in the built environment and to develop a related approach for its capture and measurement. There is currently a lack of robust wellbeing measures that can be applied in post-occupancy evaluations of buildings, and overcoming this gap is critical for the effective transfer of new knowledge into replicable, evidence-based design for the advancement of wellbeing in future development.

3.0 Wellbeing valuation in practice

This section introduces a novel wellbeing valuation approach consisting of a validated-multi-item scale to measure and quantify the wellbeing outcomes of building users in an objective and cost effective manner, followed by the monetisation of the results using techniques from Social Return on Investment (SROI), a social impact methodology, to produce transferable reporting metrics. The approach represents the first output in the development of a toolkit that can evidence the commercial case for people-centred design.

3.1 The Building Wellbeing scale

The first part of the wellbeing valuation approach is a multi-item scale. Its development was based on the fuller, psychologically-informed definition of wellbeing as flourishing. As outlined above it is made up of five components: Satisfaction, Affect, Competence, Relatedness and Autonomy, termed the SACRA model. It was developed in reference to two existing, academically developed and validated, multi-item scales for measuring wellbeing in individuals or populations, i.e. not in relation to the built environment. The first scale is the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS)²⁸ and the second is the Questionnaire for Eudaimonic Wellbeing (QEWB)²⁹. Both scales are made up of a set of Likert style items, where respondents rate their agreement on a five point scale. The WEMWBS is made up of 14 positively worded items, and whereas the QEWB is made up of 21 items with a mixture of positive and negative wording. The items of the WEMWBS and QEWB were categorised according to the SACRA components of Satisfaction, Affect, Competence, Relatedness and Autonomy, as shown in [Figure 1](#) and [Figure 2](#).

Please tick (✓) the box that best describes your experience of each over the **last 2 weeks**

STATEMENTS	None of the time	Rarely	Some of the time	Often	All of the time
I've been feeling optimistic about the future	1	2	3	4	5
I've been feeling useful	1	2	3	4	5
I've been feeling relaxed	1	2	3	4	5
I've been feeling interested in other people	1	2	3	4	5
I've had energy to spare	1	2	3	4	5
I've been dealing with problems well	1	2	3	4	5
I've been thinking clearly	1	2	3	4	5
I've been feeling good about myself	1	2	3	4	5
I've been feeling close to other people	1	2	3	4	5
I've been feeling confident	1	2	3	4	5
I've been able to make up my own mind about things	1	2	3	4	5
I've been feeling loved	1	2	3	4	5
I've been interested in new things	1	2	3	4	5
I've been feeling cheerful	1	2	3	4	5

■ Satisfaction
■ Affect
■ Competence
■ Relatedness
■ Autonomy

Figure 1: The Warwick-Edinburgh Mental Wellbeing Scale

Figure 2: The Questionnaire for Eudaimonic Wellbeing (QEWB)

Based on the length of the existing WEMWBS and QEWB scales, it was decided that three items would be used for each component of wellbeing to produce a 15 item scale. A combination of items were taken from the WEMWBS (10 items) and the QEWB (five items) and the wording modified for their use with building users. The reworded items are shown in [Figure 3](#) according to the five components of wellbeing.

Satisfaction	
I feel useful when I'm in this building	WEMWBS
I have purpose when I'm in this building	QEWB
I feel fulfilled when I'm in this building	QEWB
Affect	
I feel optimistic when I'm in this building	WEMWBS
I feel at ease when I'm in this building	WEMWBS
I feel energised when I'm in this building	WEMWBS
Competence	
I deal with problems well when I'm in this building	WEMWBS
I think clearly when I'm in this building	WEMWBS
I can apply myself to what I'm doing when I'm in this building	QEWB
Relatedness	
I feel interested in other people when I'm in this building	WEMWBS
I feel close to other people when I'm in this building	WEMWBS
I feel valued when I'm in this building	WEMWBS
Autonomy	
I can make up my own mind about things when I'm in this building	WEMWBS
I can be myself when I'm in this building	QEWB
I trust my own decisions when I'm in this building	QEWB

Figure 3: Selected items for the Building Wellbeing scale

The items were rearranged into a random order and assigned a five point Likert scale, as seen in both the WEMWBS and QEWB, using the labels "Strongly disagree" to "Strongly agree". This is because time-related labels like "None of the time" to "All of the time" are considered to have lower face validity (i.e. more likely to be misconstrued) in the built environment context, as people are being asked to answer based on being in the building under question, regardless of long they spend there. The first version of the Building Wellbeing scale is shown in [Figure 4](#).

When distributed to the end users of a building, the data produced is analysed using basic descriptive statistics, accessible to a wide range of practitioners and audiences. The responses to each item are simply added up and turned into a percentage to produce a wellbeing score per individual, and by taking a mean average across all participants an overall wellbeing score is produced for the building. Finally, a mean wellbeing score for each measure of the SACRA model can also be produced.

Figure 4: The Building Wellbeing scale, version 1

The scale has been piloted in a series of case building typologies, including commercial offices, non-clinical healthcare centres, university libraries and student residential halls during 2016 and 2017, with more than 2,000 responses collected overall. This data has been used to validate the scale in an iterative manner using the Rasch model, a psychometric approach for analysing and validating categorical data, specifically multi-item scales, as a function of the trade-off between respondent traits and the item difficulty. The WEMWBS was also validated using this method. The iterative approach meant that small changes could be made to the scale items as required before the next pilot. Analysis has shown a good fit to model expectations, as would be expected from a scale that is based on two pre-existing and academically validated scales. There were some observable ceiling effects where fit was skewed towards items with a higher difficulty. In practice, this meant that high numbers of building users were able to select “Strongly agree” and achieve maximum scores of five on

the majority of the items. Therefore, additional items with increased difficulty were added to the scale in order to provide a more accurate measure of high levels of wellbeing. For example, items such as “I feel joyful when I’m in this building” are less likely to elicit top scores than “I feel at ease when I’m in this building”.

In addition, the 5 point Likert scale was changed from 1, 2, 3, 4, 5 to -2, -1, 0, +1, +2. This was a decision to make it more intuitive to understand whether a score is signifying a positive or negative finding for wellbeing. On version 1 of the scale, a score of less than 50% suggests that wellbeing is low, whereas it actually means that wellbeing is negatively impacted by the building, i.e. the building is actively reducing user wellbeing. Updated versions of the scale make this clearer, as a score of less than 0% represents negative wellbeing and score above 0% represents positive wellbeing.

The final set of pilot studies have been carried out and the associated validation is in the process of being carried out. Redundant items and items that show misfit to the model, for example due to gender bias, will be removed from the scale to produce a final, validated version. The most ~~recently validated~~up-to-date version of the scale is presented in [Figure 5](#).

The Building Wellbeing scale represents a simple, accessible and cost effective method to quantify the wellbeing outcomes experienced by the end users of a built environment. It produces a range of wellbeing data and metrics, including wellbeing scores for each individual user, an overall wellbeing score for the building, and a score for each measure of wellbeing across the SACRA model. It can be distributed as part of a survey (i.e. during post-occupancy evaluation activities), which could also include questions to collect some basic demographic information, the average time spent in the building, and other data of interest.

The Building Wellbeing Scale					
Please answer based on your experience of spending time in this building					
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I feel optimistic when I'm in this building	-2	-1	0	+1	+2
I have purpose when I'm in this building	-2	-1	0	+1	+2
I feel rewarded when I'm in this building	-2	-1	0	+1	+2
I feel at ease when I'm in this building	-2	-1	0	+1	+2
I feel interested in other people when I'm in this building	-2	-1	0	+1	+2
I can be myself when I'm in this building	-2	-1	0	+1	+2
I feel worthwhile when I'm in this building	-2	-1	0	+1	+2
I deal with problems well when I'm in this building	-2	-1	0	+1	+2
I feel empowered when I'm in this building	-2	-1	0	+1	+2
I think clearly when I'm in this building	-2	-1	0	+1	+2
I feel inspired when I'm in this building	-2	-1	0	+1	+2
I feel useful when I'm in this building	-2	-1	0	+1	+2
I feel close to other people when I'm in this building	-2	-1	0	+1	+2
I feel successful when I'm in this building	-2	-1	0	+1	+2
I feel fulfilled when I'm in this building	-2	-1	0	+1	+2
I can make up my own mind about things when I'm in this building	-2	-1	0	+1	+2
I feel valued when I'm in this building	-2	-1	0	+1	+2
I can apply myself to what I'm doing when I'm in this building	-2	-1	0	+1	+2
I feel joyful when I'm in this building	-2	-1	0	+1	+2
I feel in control of my own decisions when I'm in this building	-2	-1	0	+1	+2
I feel energised when I'm in this building	-2	-1	0	+1	+2
I feel at my best when I'm in this building	-2	-1	0	+1	+2
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Figure 5: The Building Wellbeing scale, current version

3.2 Valuation using SROI

The second aspect of the wellbeing valuation approach is the monetisation of the quantitative wellbeing scores produced by the Building Wellbeing scale, using impact reporting techniques from Social Return on Investment (SROI). Assigning a monetary value to wellbeing outcomes is anticipated to enhance transferability compared to typical post-

occupancy evaluation summaries, facilitating the dissemination and implementation of findings within the design and construction industry³⁰.

SROI is a methodology designed for the social enterprise sector to measure and account for a wider concept of value for the attainment of multi-bottom lines. It was originally developed in the US by the Roberts Enterprise Development Fund (REDF) in the mid-1990s. It has been further developed by the New Economics Foundation (nef) in the UK since the late 1990s with a widely applicable stakeholder emphasis and a replicable, standardised methodology. It is based on traditional cost-benefit analysis and assigns a monetary value to social returns using financial proxies, which are compared against the level of investment to produce an SROI ratio of costs to social outcomes. An SROI analysis can be retrospective or prospective, encompass the value generated by an entire organisation or focus on specific programmes or projects. It is one of the most developed social impact methodologies, being designed to measure the outcomes of an intervention, rather than solely tracking outputs³⁰. Its monetisation technique facilitates the comparison of otherwise incommensurable benefits across different activities. Based on real data, the results are disseminated using 'return on investment' language that is familiar with investors and commissioners. It is widely used in the UK social enterprise sector to evidence organisational impact and is endorsed by the Cabinet Office. SROI has achieved a significant deal of traction within the social enterprise sector³¹ and, increasingly, public policy^{32 33} and commercial industry³⁴.

The SROI methodology has six stages as set out in The Guide to Social Return on Investment³⁵:

1. Establishing scope and identifying key stakeholders
2. Mapping outcomes
3. Evidencing outcomes and giving them a value
4. Establishing impact
5. Calculating the SROI
6. Reporting, using and embedding

Watson and Whitley³⁶ provide a detailed account of applying SROI to the built environment, which is not an established practice. The third stage of the SROI methodology is applied to the wellbeing data collected using the Building Wellbeing scale in order to place a value on the quantitative wellbeing scores. The SROI methodology uses financial proxies to assign a value to the outcomes under study, an alternative to traditional cost-benefit analysis methods such as preference-based valuation³⁷. A suitable financial proxy has been identified in HACT's Guide to Using the Wellbeing Valuation Approach³⁸, which values wellbeing at £36,776 per individual per year. This figure can be adjusted to make it applicable to the time spent in the building under study, for example, a daily or weekly value would be better suited to employees in an office, whereas an hourly value would be better suited to visitors of a healthcare centre. The value of wellbeing to an individual is therefore £100.78 per day, or £4.20 an hour. The adjusted value is multiplied by the average time spent in the building per end user per year, and by the total number of end users, to produce the total value generated by that building in wellbeing outcomes over a one year period. The inherent subjectivity of the valuation process requires that it is made fully transparent, a core principle of the SROI methodology³⁵.

The total wellbeing value is then multiplied by the quantitative wellbeing score collected during the user survey, which is inputted as a percentage to remove deadweight from the total. It is also possible to consider attribution at this point, that is, the proportion of wellbeing that can be attributed to the building as opposed to other factors like Facilities Management, organisational culture, or human factors. This information can be gathered during the user survey by asking end users to report how much of their wellbeing they believe is due to the building design. An average is calculated and removed from the total, producing a final impact-adjusted valuation for wellbeing.

An SROI ratio can be calculated by dividing the wellbeing figure by the building costs, i.e. the design fees, contract sum and the furniture, fittings and equipment (FF&E) cost. The SROI ratio represents the return generated by the building for the building users in a year, per every £1 spent. Further ratios can be projected at useful time points to inform maintenance and re-fit decisions, such as after 10 years at which point a re-fit is typically required, and after 60 years, the typical life time of building design. Whilst discounting is not prescribed by SROI, it is usually considered appropriate in the design and construction industry and HM Green Book discounting rates can be applied to the valuations. The resulting ratios represent the return generated by the building for the building users over a specified period, per every £1 spent.

The wellbeing valuation approach presented, whilst still under development, is a simple, accessible and cost effective activity that can be carried out by design professionals but also by developers, clients and occupying organisations, as technical expertise about building performance or complicated statistical analysis is not required. The resulting metrics will inform interested parties about the impact of a building, or different spaces within a building, on end user wellbeing in a more objective manner than relying on anecdotal evidence. Furthermore, its basis in a psychological definition of wellbeing using the SACRA model, means that a link can be more firmly drawn between wellbeing and performance, enhancing the business case for user-centred environments. It also has considerable potential as part of a wider research program to begin to unpick what aspects of buildings are most influential when it comes to the wellbeing experienced by the people using them, including physical design features, environmental conditions, factors of organisational culture, social norms and individual practices. This paper is an early step towards building a new knowledge base about people and buildings.

4.0 Conclusions

The rapid rise of the wellbeing agenda in the built environment suggests that user-centred priorities are gaining ground alongside traditional economic and environmental imperatives in the design and construction industry. The significance of wellbeing to the commercial property sector is set to intensify as organisations and end users alike demand people-friendly spaces that help them think, feel and function at their best. The need to make the case between increased wellbeing and improved performance requires a more considered approach to defining and measuring wellbeing. The importance of thorough and robust learning loops in the design process will become evident and the need for user-centred evaluation unavoidable. This represents a timely and exciting opportunity for the diffusion of novel methodologies and metrics that can capture, measure and disseminate the impact of the built environment to inform commissioning, tendering, high level design and briefing

processes, and post-occupancy assessment at a range of scales across a variety of contexts.

The wellbeing valuation approach presented in this paper is still under development, yet represents an innovative blend of the psychological SACRA model, quantitative measurement and financial reporting to produce transferable metrics with the capability to communicate the value of design in a powerful and transformative manner. A key part of the appeal is its calculative nature which offers something new when looking at user experience and, crucially, can tap into the monetised language around the “business case for wellbeing”. That financial valuation will come to play a defining role in the emerging wellbeing sector in commercial property is a likely prospect. Wellbeing valuation is a nascent practice, but it provides the professions with opportunities to collaborate with end users and develop new knowledge about building performance and experience, enhancing the ability of practitioners to shape the built environment in positive ways.

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Figures

- Figure 1: The Warwick-Edinburgh Mental Wellbeing Scale
- Figure 2: The Questionnaire for Eudaimonic Wellbeing (QEWB)
- Figure 3: Selected items for the Building Wellbeing scale
- Figure 4: The Building Wellbeing scale, version 1
- Figure 5: The Building Wellbeing scale, current version