Integrating Users Satisfaction to Support Decisions in Sustainable Developments

Dima AlKawadri, d.alkawadri@hw.ac.uk
Heriot-Watt University, Dubai, UAE

Yasemin Nielsen, yasemin.nielsen@hw.ac.uk
Heriot-Watt University, Dubai, UAE

Bilge Erdogan, b.erdogan@hw.ac.uk
Heriot-Watt University, Edinburgh, UK

Abstract

With the growing concerns on the environment and the rapid consumption of scarce re-sources, the green building movement and sustainability initiatives started to rapidly grow and stress the importance of sustainable developments and the related benefits under sustainability three dimensions (3D): social, economic, and environmental. Studies showed that current sustainability initiatives and rating systems could not successfully capture the claimed 3-dimensional benefits of sustainability. Most of the sustainability assessment systems and frameworks assign significant weight to environmental credits with an insufficient concentration on social and economic dimensions. Environmental consultants are inclined to follow the client aspirations without balancing user needs and satisfaction to achieve the highest 3D benefits. The study survey showed that lack of knowledge on the impact of green buildings solutions on business value and the lack of public awareness on sustainable developments are two main obstacles towards capturing 3D benefits in the UAE market. The aim of the study is to optimise the sustainability value by integrating the user preferences and levels of satisfaction as a leading role-player in balance with the extent of the scoring points. A survey was conducted to scale the users' satisfaction on several environmental, social and physical factors, wellbeing provisions selected from LEED and WELL building standards. LEED framework was chosen as a foundation of the study. Hence, the results were transformed to user preferences weight and associated with LEED credit options and UNSDG's to support practitioners in the UAE on accreditation decisions towards better sustainability benefits.

Keywords
Sustainability social pillar, UN Sustainable Development Goals (UNSDGs), Users satisfaction,.

1 Introduction

Sustainability assessment systems have vastly spread as they are considered user-friendly, easy to understand tools, and cover most of the substantial aspects of sustainable developments. These well-designed systems support construction practitioners in making sustainability decisions related to different solutions with the help of their precise structure design. Sustainability rating systems have claimed to contribute towards the three dimensions of sustainability through their structure and scoring system (Alyami et al., 2013) (Banani et al., 2016). However, many of the certified building performances were not always align with the desired sustainability targets. Research by Nyikos

(2012) and Hu et al. (2017) highlighted that some certified buildings received no credits for energy reduction or water reduction (Nyikos et al., 2012) (Hu et al., 2017). Various reasons are behind the unsuccessful achievement of the optimal sustainability benefits. The current trend follows the rating systems aimlessly based on the client aspiration as a target rather than developing a specific, project-based sustain-ability strategy causing inefficient use of these frameworks. The rating systems structure also participates hugely if the user does not have a precise sustainability strategy for a project. The rating systems scoring structure gives the more weight to environmental than the social and economic aspects. Following these systems blindly would lead to a level of certification but not the desired impact. The impact of the building on the users is significant, and integrating user comfort and satisfaction side to side with client aspiration drives to achieve further sustainability benefits. Improving the social aspects has proven to impact on and strengthen the business case of sustainable developments through increased productivity and reduced absenteeism (Furr, 2009) (IWBI, 2019). Strengthening the business case in return allows balancing the client aspiration with the desired impact of the sustainable developments. Each project is unique and each occupant or user has a different understanding of what the quality of life in a home or a workplace looks alike. The social satisfaction of the physical and environmental factors within the space like the site location, the design, the building materials, the colours, the thermal comfort, the natural elements within the space, the community, etc., also varies (Raof, 2004) This study aimed to emphasise the social implications and their effect in sustainable developments. For this purpose, this study utilises LEED framework, which is the most widely used green framework in the world and is aimed at creating an appropriate hierarchy of LEED credit options by looking at the corresponding average weights given by the users to aspects from LEED and WELL frameworks. The study then links these aspects back to LEED options and shows the contribution towards the UNSDG's as a guide towards a more holistic approach.

2 Obstacles of Capturing Sustainability 3D Benefits

Sustainability systems have claimed to capture benefits under sustainability three dimensions. However, studies showed that many obstacles preceded that, and the focus was on the accreditation level rather than the potential benefits, as discussed in subsections 2.1 and 2.2.

2.1 Current Studies and Practices in Sustainable Development

The client inspiration of silver, Gold, or Platinum target has always been a starting point for most projects. Environmental consultants are inclined to focus on these aspirations to achieve the certification. Many companies have created charts, listing credits of what are more effortless and costless credits to target. These charts eventually lead to a tick-box exercise without implementing a comprehensive and integrated approach to achieve the desired impact, which was also presented by Park et al. in (2017) (Park et al., 2017) The researchers created an optimisation algorithm to help practitioners obtain the minimum score for the desired certification level and building specifications at a minimum cost. The researchers constructed their algorithm on credits classified under costless-Easy, costless-Hard, cost-Easy, and cost-hard categories. Information on each credit cost was derived from the study of 3 certified projects in Korea. However, this algorithm has a fixed unit price which makes it challenging to adopt in different regions. Seeking to achieve the minimum credits score required for the desired level at the least cost does not always align with sustainability goals.

Many researchers have tried to build human knowledge and experience in different models using the cognitive approach. These models aimed to work as decision making support tools and to target the three-dimensional benefits. Researchers have acknowledged multi-criteria decision-making method (MCDM) as a suitable approach for sustainability. They have employed Analytical Hierarchy Process (AHP) as the most common and powerful MCDM method (Boggia and Cortina, 2010)

(Saaty, 2000). AHP is considered a decision making analysis tool in areas like social, economic, and management (Yu, 2002). In 2015, Nilashi et al. used the AHP to determine the experts' preference of different criteria and alternatives and build the fuzzy logic model (Nilashi et al., 2015). The model helps assess the existing building by implementing human knowledge and experience from a social, eco-nomic, and environmental perspective. Attallah (2014) utilised (MCDM) to reach a systematic pattern in the credits' selection process, and its relation to decisions on different sustainability-related solutions (Attallah, 2014). In 2017, Attallah et al. found that relying on intuition is the most effective method while using these rating systems (Attallah et al., 2017). Their study used (LEED and QSAS) as two sustainability rating systems at the pre-design stage of the project's lifecycle, showed the experts had used no systematic approach. At this phase of the project, there will be many variables and fewer measures to support the sustainability decisions and preferences. The researchers used Electre III to optimise experts' cognitive approach as a multi-criteria decision analysis method. Although researchers have looked into expert preferences, clients and end-users preferences, their specific hierarchy assigned minor importance to users satisfaction.

2.2 Sustainability Assessment Systems and Scoring Structure

The sustainability assessment systems and scoring structure is a cumbersome contributor to that argument. The rating systems contribution to sustainability three dimensions was analysed and studied by Awadh in 2017 (Awadh, 2017). BREEAM International 2016 and LEED V4 are widely proven and internationally used systems (BRE Global, 2016) (USGBC, 2019). Figure 1 and Figure 2 show how these sustainability systems assign most of their credits weight and scores towards the environmental pillar, fewer towards social and the least towards the economic pillar. The weight of LEED and BREEAM social-related credits is 12% and 16%, respectively (Awadh, 2017).

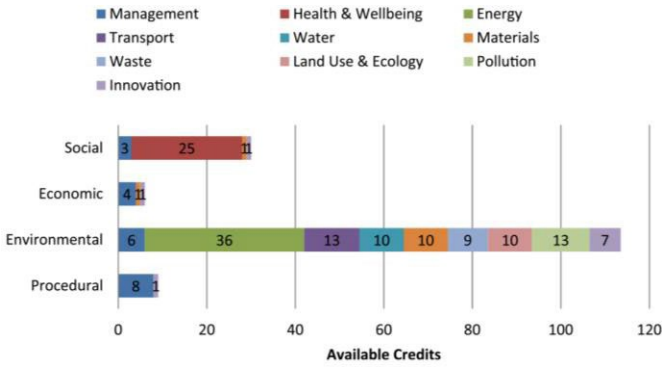

Figure 1. BREEAM International 2016 credits weighting of Environmental, Social and Economic Pillars, (Awadh, 2017)

The occupancy and operation profile variations are somehow neglected in LEED. Moreover, very few credits include the user survey and with little impact on the score. It is difficult to assess the building performance and the implications of the sustainability decisions made by the consultants without retrieving the information from the occupied project to look at the whole life cycle and reflect on the recent findings. Building occupants satisfaction and preference should not be abundant. They improve the building contribution towards more social and economic benefits.

Figure 2. LEED NC V4 credits weighting of
Environmental, Social and Economic Pillars, (Awadh, 2017)

3 Social Satisfaction and Perception of a Place

In the 20th century, the business cost was considered much higher than the energy cost and yet more urgent to improve productivity in the workplace. Today, both costs are close with higher energy consumption and the increased use of scarce natural resources (Raof, 2004). Sustainable development could achieve the balance between the two. However, up till 2019, the Green Building Council believed that there is still a lack of understanding about retaining employees and increasing productivity with healthy design practices in the physical environment. As each project is unique, the environmental consultant and client should set a sustainability plan or a sustainability strategy at the early phase of this particular project. At that stage, KPI's or indicators measure the achievement against that goal and monitor any change in a specific category over the project lifecycle. Indicators for energy usage and other criteria are more approachable, while occupant satisfaction indicators are complex to define and consider (Raof, 2004). Each building is different, and each occupant and building professional has a different opinion about the comfortable place, whether it is a workplace or a home. Roaf, S. et al, (2003) called it the perceived quality of life's factors (QOL) in building and named these indicators into building-level indicators, and personal indicators (Raof, 2004). Occupants conceive the quality of life through different environmental and social factors in space differently. Palich and Edmonds (2013) have also defined social sustainability as sustaining a healthy community and its diverse social relationships and supporting community and wellbeing through the physical, cultural, and social places, making the engagement with inhabitants of the place of a great value (Palich and Edmonds, 2013).

4 Social User Wellbeing and Satisfaction Implementation to Improve Business Case

Roaf et al. (2004) mentioned that linking health and sustainability to business has become increasingly important to people with the rising awareness about good indoor environmental quality and its relation to user satisfaction and productivity (Raof, 2004). UKGBC has connected users' comfort and happiness to a positive impact on clients business as a result of more productivity. "UKGBC the Wellbeing lab: Retails" was built in 2018 based on meeting the customers buying needs when visiting the physical shopping space as a must for any business to stand apart from other

competitors (UKGBC, 2018). The target was to tackle successful healthy design features towards happier employees yet happier customers. The framework of the study was designed under three categories; The environmental or physical characteristics that can be measured like lighting, thermal etc. The experience, which refers to employee and customers satisfaction and perceptions of the space. The economics, which refers to employee's turnover, absenteeism and value drivers such as sales and brand. Earlier in 2016, UKGBC built the" Offices Lab" based on the same belief (UKGBC, 2017). Organisations like M&S has also conducted semi-structured interviews and survey to identify employee preferences and outline key issues to implement in the current and future business. Moreover, with the rapid emergence of this concept, GRESB Real Estate has added Health and wellbeing Module in 2016 under the scheme of promoting employees' health and wellbeing and promoting health and wellbeing through products and services (GRESB, 2016). Having such a framework has allowed to include health and wellbeing in assessment and peer benchmarking similarly to the main Real Estate. The main concept behind the two areas is the impact of specific decisions and actions in relation to costs and performance when promoting the employees' health and wellbeing responsible for the entity through providing certain products and services. Prior to GRESB in 2014, a new official framework called Building WELL Standards (WELL V1) was launched by the International Well Building Institute (IWBI) to focus on the social pillar of sustainability and buildings direct impacts on the user's health and wellbeing (IWBI, 2019). WELL V2 pilot was released in 2018 as the second version of WELL Building Standards. The aim was to prioritise human wellbeing and positively impact people over the whole building life cycle by maintaining health, happiness, and wellbeing. WELL is the first rating system to quantify factors like nourishment and mind and get live feedback at the building's operational phase (IWBI, 2019).

5 Research Methodology

The selection of the methodology was due to different factors. The need to find controversial and diverse participants is one factor that is hard to achieve via other methods. In addition, the sampling is challenging. It is difficult to find information about anonymous people. Therefore, the survey was circulated on-line to involve employees and residents of the UAE using the Linkedin database via emails. The questions seek the user's perception of several environmental and physical factors, wellbeing initiatives and nourishments.

The first three survey results were used to test the survey design, the questions and the content, two were from the educational field and one from the construction industry. All amendments were implemented accordingly before circulating the survey. Sixty-five (65) participants attempted and completed the survey. The survey consisted of 5 sections, including the introduction and a total of eight (8) survey questions. A prescribed explanation was provided in the introduction section to give context to the participants and information about the survey time needed, confidentiality and security. Section 2 included questions about general information. Section 3, 4 and 5 included questions that required participants to scale their assessment to different environmental and wellbeing factors in buildings (5 is so important-1 is not important at all). Section 2 also asked to define the main obstacles towards capturing sustainability 3-dimensional benefits in the UAE market.

6 Findings and Discussion

The following two subsections 6.1 and 6.2 explained how the data was analysed, processed then implemented. As a result, the study linked the aspects and their average weights, the credit options and the UNSDG's in a qualitative method based on the understanding of each credit option and its intent. Having these data at the early phase of the project helps sustainability experts to look at what is more valuable to improve the social implication rather than reaching more scoring points.

6.1 Pre-possessing the Data

A weight was assigned to each credit option based on the end user preferences to different aspects from the survey questionnaire results. These aspects covered a breadth of social, environmental, and physical characteristics of the space inspired by LEED and WELL frameworks. The preferences given by the users were transferred to average user preferences weight in three steps of calculations to reach the final value. The value represents the average weight of an aspect given by users and reflects the users' perception of these credits-related aspects.

6.2 Linking the Average Weight to The Related Credit Option

The average weights given by the users were assigned to LEED credit options. Figures 03, 04, 05, 06, 07, 08, and 09 show the final average weight assigned to each credit option under the listed categories. The factors were linked to LEED credit options in a qualitative method based on understanding LEED and WELL credits requirements and intents. Each aspect or factor was given a code to simplify retrieving this information when needed and to be able to integrate it within the structure.

Figures 3 and 4 refer to the average user weight given to different aspects and their relation to LEED Indoor Environmental Quality credits. Although LEED assigned a low score to credits EQc7 and EQc8 (Daylight and Quality views) of 1 point to Quality views and 1-3 points to Daylights, the results show that credits EQc7 and EQc8 (Daylight and Quality views) were given the highest importance by users, which reflects the highest level of satisfaction and comfort with an average of 0.94. EQp1 (Min Indoor Air Quality Performance), EQc1 (Enhanced IQA Strategies option1 and option 2) during occupancy phase, EQc2 (option1 and option 2), EQc3 (related to during construction and pre-occupancy phase), and EQc4 (option1 and option 2), all came second with an average of 0.93. Reduced exposure to hazardous building material ingredients average weight was 0.91. Thermal comfort control in the UAE was given the importance of 0.90, while Acoustical comfort: sound barriers, absorption, masking and Lighting personal control, were assigned 0.85 and 0.84, respectively. Users gave 0.88 to a smoke-free environment, and it was linked to EQp2. Operable windows was similar to Lighting personal control with 0.84. Operable window was linked to EQc1 option 2 (additional enhanced IAQ Strategies). The results show the users' perception and satisfaction different to different credits as oppose to LEED credit weighting system. LEED awards more points to credits and strategies with more significant positive impact. However, under the Indoor Environmental Quality category, LEED has not differentiated between these credits and has assigned mostly a score of 1 point.

Indoor Environmental Quality						
UNSDG's	**Indoor Environmental Quality**			**Inspired by LEED**	**Inspired by WELL**	**Average Weight (w)**
UNSDG 3- UNSDG7-UNSDG8	EQp1	Min Indoor Air Quality Performance		UCS-E12-Air Quality: Low Co2 and other pollutants- High ventilation rates		0.93
UNSDG 3- UNSDG7-UNSDG8	EQp2	Environmental Tobacco Smoke Control		UCS-E14-Smoke free environment		0.88
UNSDG 3-UNSDG8	EQc1	Enhanced Indoor Air Quality Strategies	**Option 1.** Enhanced IAQ strategies **1 point**	UCS-E12-Air Quality: Low Co2 and other pollutants- High ventilation rates		0.93
			AND/OR Option 2. Additional enhanced IAQ strategies **1 point**		UCS-IN02-Operable Windows	0.84
UNSDG 3-UNSDG8	EQc2	Low Emitting Materials	**Option1.** Product category Calculations **(1-3 points)**	**UCS-E11**-Reduced exposure to hazardous building material ingredients **UCS-E12**-Air Quality: Low Co2 and other pollutants- High ventilation rates		0.91-0.93
			Option 2. Budget Calculation Method **(1-3 points)**	**UCS-E11**-Reduced exposure to hazardous building material ingredients **UCS-E12**-Air Quality: Low Co2 and other pollutants- High ventilation rates		0.91-0.93
UNSDG 3-UNSDG8	EQc3	Construction Indoor Air Quality Management Plan	**1Points**	UCS-E12-Air Quality: Low Co2 and other pollutants- High ventilation rates		0.93
UNSDG 3-UNSDG8	EQc4	Indoor Air Quality Assessment	**Option 1.** Flush-out. Path1. Before Occupancy **1 Point**	UCS-E12-Air Quality: Low Co2 and other pollutants- High ventilation rates		0.93
			OR Option 1. Flush-out. Path2. During Occupancy **1 Point**	UCS-E12-Air Quality: Low Co2 and other pollutants- High ventilation rates		0.93
			OR Option 2. Air testing **2 points**	UCS-E12-Air Quality: Low Co2 and other pollutants- High ventilation rates		0.93

Figure 3. Average user preference weights of aspects related to Indoor Environmental Quality category and credits contribution to UNSDG's

Indoor Environmental Quality							
UNSDG's	Indoor Environmental Quality			Matching LEED credits	Matching WELL credits	Average Weight (w)	
UNSDG 3- UNSDG7-UNSDG8	EQc5	Thermal Comfort	**Thermal comfort Design Option 2.** ISO and CEN Standards **1Point**	UCS-E09-Thermal comfort-personal control		0.9	
			Thermal comfort Design Option 1. ASHRAE Standard 55-2010 **1Point**	UCS-E09-Thermal comfort-personal control		0.9	
			Thermal comfort Control	UCS-E09-Thermal comfort-personal control		0.9	
UNSDG 3- UNSDG7-UNSDG8	EQc6	Interior Lighting	**Option 1.** Lighting control **1Points**	UCS-E10-Lighting- personal control		0.84	
			And/OR Option 2. Lighting quality **1 point**				
UNSDG 3- UNSDG8	EQc7	Daylight	**Option 1.** Simulation: Spatial Daylight Autonomy **55%-2points**	UCS-IN01- Layout design - Aesthetics- Connecting to nature: views of nature, daylight, proximity to windows		0.94	
			Option 1. Simulation: Spatial Daylight Autonomy **75%-3points**	UCS-IN01- Layout design - Aesthetics- Connecting to nature: views of nature, daylight, proximity to windows		0.94	
			Option 2. Simulation: Illuminance Calculations **75%-1 point**	UCS-IN01- Layout design - Aesthetics- Connecting to nature: views of nature, daylight, proximity to windows		0.94	
			Option 2. Simulation: Illuminance Calculations **90%-2 point**	UCS-IN01- Layout design - Aesthetics- Connecting to nature: views of nature, daylight, proximity to windows		0.94	
			Option 3. Measurement **75-2 points**	UCS-IN01- Layout design - Aesthetics- Connecting to nature: views of nature, daylight, proximity to windows		0.94	
			Option 3. Measurement **90-3 points**	UCS-IN01- Layout design - Aesthetics- Connecting to nature: views of nature, daylight, proximity to windows		0.94	
UNSDG 3- UNSDG8	EQc8	Quality Views	**1Point**	UCS-IN01- Layout design - Aesthetics- Connecting to nature: views of nature, daylight, proximity to windows		0.94	
UNSDG 3- UNSDG8	EQc9	Acoustic Performance	**1Point**	USC-E13-Acoustical comfort: sound barriers, absorption, masking		0.85	

Figure 4. Average user preference weights of aspects related to Indoor Environmental Quality category and credits contribution to UNSDG's

Figure 5 refers to the average user weights of aspects and factors related to LEED Location and Transportation credits. Access to outdoor green spaces, recreational fields or courts scored the highest, with an average weight of 0.87. This was followed by Proximity to walkways with 0.86. These two aspects were connected to LTc1 credit (LEED for ND Development) and Access to the gym and other physical activity spaces. The latter achieved 0.79 as a given average weight. Proximity to public transportation scored 0.85 as close to Proximity to different uses with a score of 0.84. The two factors were linked to Access to Quality Transit and Surrounding Density and Diverse Uses, respectively.

The results represent that the users did not assign the maximum weight to these two credits, unlike LEED rating system. Proximity to bicycle network was given 0.70. However, users assigned low importance to showers on-site as a condition and have assessed Access to showers and cycle storages

as the least important with an average of 0.64. The Users within the region have not connected these aspects directly to their area of comfort.

Location & Transportation							
UNSDG's		Location & Transportation			Inspired by LEED	Inspired by WELL	Average Weight (w)
						UCS-E03 Proximity to walkways	0.86
						UCS-E06 Access to outdoor green spaces, recreational field or court	0.87
UNSDG 11- UNSDG13-UNSDG15		LTc1	LEED for ND Development Location	Certified / silver / Gold / Platinium		UCS-E08 Access to Gym, other physical activity spaces	0.79
UNSDG 11- UNSDG13-UNSDG15		LTc2	Sensitive Land Protection	1Point			
				Option 1. Historic district 1 point			
				OR Option 2. Priority designation 1 point			
UNSDG 11- UNSDG13-UNSDG15		LTc3	High -Priority Site	OR Option 3. Brownfield remediation 2 points			
				Option 1. Surrounding density 2 points			
				Option 1. Surrounding density 3points			
				And/OR Option 2. Diverse uses 1points			
UNSDG 7- UNSDG8-UNSDG9-UNSDG 11- UNSDG 12-UNSDG13-UNSDG14-UNSDG15		LTc4	Surrounding Density and Diverse Uses	Option 2. Diverse uses above 8meter 2points	UCS-E01 Proximity to different uses		0.84
				for projects with multiple transit types (bus, streetcar, rail, or ferry) 1point			
				for projects with multiple transit types (bus, streetcar, rail, or ferry) 3points			
				for projects with multiple transit types (bus, streetcar, rail, or ferry) 5points			
				for projects with commuter rail or ferry service only 1point			
				for projects with commuter rail or ferry service only 2point			
UNSDG 7- UNSDG8-UNSDG9-UNSDG 11- UNSDG 12-UNSDG13-UNSDG14-UNSDG15		LTc5	Access to Quality Transit	for projects with commuter rail or ferry service only 3point	UCS-E02 Proximity to public transportation		0.85
				1Point	UCS-E04 Proximity to bicycle network		0.7
UNSDG3-UNSDG 7-UNSDG9-UNSDG 11- UNSDG 12-UNSDG13-UNSDG14-UNSDG15		LTc6	Bicycle Facilities		UCS-E05 Access to showers and cycles storage		0.64
UNSDG13-UNSDG14-UNSDG15-UNSDG16		LTc7	Reduced Parking Footprint	1Point	UCS-E07 Availability of Car parking slots		0.8
				Option 1. Electric vehicle charging 1Point			
UNSDG3-UNSDG 7-UNSDG9-UNSDG 11- UNSDG 12-UNSDG13-UNSDG14-UNSDG15		LTc8	Green Vehicles	OR Option 2. Liquid, gas, or battery facilities 1Point			

Figure 5. Average user preference weights of aspects related to Location & Transportation category and credits contribution to UNSDG's

Figures 6 and 7 present the average user weights of different factors and their relation to LEED Material & Resources and Innovation categories. Reduced exposure to hazardous building material ingredients was one aspect that fell under Materials & Resources credit with averages of 0.91. This aspect was linked to credit MRc4. However, LEED assigns credit MRc4 a score of 1 point. The Green Cleaning and green products are still not perceived as highly essential and were given 0.78 and associated under Innovation credit.

Figure 8 represents the average user weights of aspects related to LEED Site Selection credits. Access to outdoor green spaces, recreational fields or court was associated with credits SSc2, SSc3, and SSc4 with an average of 0.87. Finally, aspects related to Nourishment, Wellbeing Initiatives and Layout Design- Aesthetics areas consisted part of the study. Figure 9 presents aspects that were inspired by WELL standards to improve the social implications of sustainable developments. The focus is to consider the additional categories labelled as great contributors to user satisfaction and comfort in an equally effective manner and as essential to implement through the accreditation

process. Results show that all the aspects were almost equally important to the users. However, Access to healthy food with pricing incentives and Office interior layout: workstations configuration and density achieved the highest with an average of 0.85 and 0.84, respectively.

6.3 Linking LEED Credits to UN Sustainability Development Goals (UNSDG's)

The United nation 17 sustainable development goals (UNSDG's) were created in 2012 in Rio de Janeiro Conference on Sustainable Development and were implemented in the 2030 Agenda to be taken as commitment and prompt implementation by each country at different levels (United Nations, 2015). Participating in the achievements of these goals is essential to overcome the current environmental, social and economic challenges by considering all 3D aspects through the credits selection process. It is crucial to understand each LEED credit, its related aspects and the additional proposed aspects towards the 17 UN sustainable development goals (UNSDG's) to support the experts and better engage the clients. Thus, relying on the understanding of the credit intent and requirements on the one hand and each of the UN Sustainability Development Goals will achieve the desired aim. At the early stage of the project, this understanding is crucial to bring the client on board with the rest of the sustainability team members. As each organisation adopts a strategy to fulfil its vision, creating the link to the UN sustainable development goals attracts clients to work on the desired aimed impact rather than the accreditation level. This step is crucial to balance the users' satisfaction and comfort with client aspiration and goal.

These relations were made based on understanding both the UN sustainable development goals and LEED credits and options requirements. Credits of LEED framework that have proven to contribute to users' satisfaction and comfort at various levels and the aspects from WELL framework, all were linked back to the UNSDG's considering credits' need and intent and the possibility of supporting the achievement of UN sustainable development goals. The association was made based on the direct influence on UNSDG's only instead of direct and indirect as most of the credits are connected and intersected in a way or another. Figures 3, 4, 5, 6, 7, 8 and 9 show LEED credits under LEED categories and their contribution to the UNSDG's achievement under the first column. Under LEED Innovation category, some variations in the contribution to UNSDG's related to each innovation option were presented in Figure 7, as there are some disparities between Exemplary performance credits under Option 3, Pilot credits in Option 2 and Innovation in Option 1.

Material Resources							
UNSDG's		**Material Resources**			**Inspired by LEED**	**Inspired by WELL**	**Average Weight (w)**
UNSDG3-UNSDG 8-UNSDG9-UNSDG 12- UNSDG13-UNSDG14-UNSDG15		MRp1	Storage and Collection of Recyclables				
UNSDG3-UNSDG 8-UNSDG9-UNSDG 12- UNSDG13-UNSDG14-UNSDG15		MRp2	Construction and Demolition Waste Management Planning				
UNSDG 8-UNSDG9- UNSDG 12-UNSDG13-UNSDG14-UNSDG15		MRc1	Building Life-Cycle Impact Reduction	**Option1.** Historic Building Reuse **(5points)** **OR Option2** Renovation of Abandoned or Blighted Building **(5 points)** **OR Option 3** Building and Material Reuse 25%-**2 points** 50%-**3points** 75%-**4points** **OR Option 4.** Whole Building Life-Cycle Assessment **(3 points)**			
UNSDG 8-UNSDG9- UNSDG 12-UNSDG13-UNSDG14-UNSDG15		MRc2	Building Product Disclosure and Optimisation-EPD	**Option 1** Environmental Product Declaration **(1point)** **AND/OR Option2.** Multi-Attribute Optimization **(1 point)**			
UNSDG 8-UNSDG9- UNSDG 12-UNSDG13-UNSDG14-UNSDG15		MRc3	Building Product Disclosure and Optimisation-Sourcing of Raw Materials	**Option1:** Raw material source and Extraction Reporting **(1 point)** **OR Option2:** Leadership Extraction Practices Possible **(1Points)**			
UNSDG3- UNSDG 12-UNSDG13-UNSDG14-UNSDG15		MRc4	Building Product Disclosure and Optimisation-Material Ingredients	**Option1.** Material Ingredient Reporting **(1point)**	UCS-E11-Reduced exposure to hazardous building material ingredients		0.91
				AND/OR **Option2.** Material Ingredient Optimization **(1 Point)**	UCS-E11-Reduced exposure to hazardous building material ingredients		0.91
				AND/OR **Option3.** Product Manufacturer Supply Chain Optimisation**(1 Point)**	UCS-E11-Reduced exposure to hazardous building material ingredients		0.91
UNSDG 12- UNSDG13-UNSDG14-UNSDG15		MRc5	Construction and Demolition Waste Management	**Option1.** Diversion Path 1. Divert 50% and three material streams **(1 point)** **OR Option1.** Diversion Path 2. Divert 75% and Four material streams **(2 point)** **OR** Option2. Reduction of Total waste material **(2 point)**			

Figure 6. Average user preference weights of aspects related to Material & Resources category and credits contribution to UNSDG's

Innovation						
UNSDG's	Innovation			Inspired by LEED	Inspired by WELL	Weight (w)
UNSDG7-UNSDG 8-UNSDG9-			**Option 1.** innovation **1 point**	UCS-E16 Indoor Air Quality- Green Cleaning		0.78
UNSDG 2- UNSDG3-UNSDG6-UNSDG7-UNSDG8-UNSDG9-UNSDG11-UNSDG12-			**And/Or Option 2.** pilot **1 point**			
UNSDG8-UNSDG9-UNSDG11-UNSDG12-UNSDG13-UNSDG14-UNSDG15	INc1	Innovation	**And/Or Option 3.** additional strategies **3 points**			
\	INc2	LEED Accredited Professional	**1Point**			

Figure 7. Average user preference weights of aspects related to Innovation category and credits contribution to UNSDG's

Site Selection						
UNSDG's	Sustainable Site			Inspired by LEED	Inspired by WELL	Average Weight (w)
UNSDG3-UNSDG 7-UNSDG9-UNSDG 11-UNSDG 12-UNSDG13-UNSDG15	SSp1	Construction Activity Pollution Prevention				
UNSDG 11-UNSDG15	SSc2	Site Assessment	**1Point**	UCS- E06 Access to outdoor green spaces, recreational field or court		0.87
UNSDG3-UNSDG 11-UNSDG 12-UNSDG15	SSc3	Site Development-Protect or Restore Habitat	Preserve 40% of the greenfield area **AND** Option1. On-site Restoration **(2points)**	UCS- E06 Access to outdoor green spaces, recreational field or court		0.87
			OR Preserve 40% of the greenfield area **AND** Option2. On-site Restoration **(1points)**	UCS- E06 Access to outdoor green spaces, recreational field or court		0.87
UNSDG8-UNSDG 11-UNSDG 13-UNSDG14-UNSDG15	SSc4	Open Space	**1Points**	UCS- E06 Access to outdoor green spaces, recreational field or court		0.87
UNSDG3-UNSDG 7-UNSDG 13-UNSDG14-UNSDG15	SSc5	Rain Water Management	**Option1.** Percentile of Rainfall Events. Path1. 95th Percentile **(2 points)**			
			OR Option1. Percentile of Rainfall Events. Path2. 98th Percentile **(3 points)**			
			OR Option1. Percentile of Rainfall Events. Path3. Zero lot line projects only-85th Percentile **(3 points)**			
			OR Option2. Natural Land Cover Conditions **(3 points)**			
UNSDG3-UNSDG 7-UNSDG 12-UNSDG13	SSc6	Heat Island Reduction	**Option1.** Nonroof and roof **(2 points)**			
			OR Option2. Parking under cover **(1 points)**			
UNSDG 7- UNSDG 9	SSc7	Light Pollution Reduction	**Uplight** Option1. BUG rating Method			
			OR Uplight Option2. Calculation Method			
			AND Lighttrespass Option1. BUG rating method			
			OR Lighttrespass Option2. Calculation Method			
			AND Internally Illuminated Exterior Signages			

Figure 8. Average user preference weights of aspects related to Sustainable Sites and credits contribution to UNSDG's

Health & Wellbeing in Buildings- Inspired by WELL Framework		Average Weight (w)	Health & Wellbeing in Buildings- Inspired by WELL Framework		Average Weight (w)	Health & Wellbeing in Buildings-Inspired by WELL Framework		Average Weight (w)
UNSDG's	Wellbeing Initiatives		UNSDG's	Layout design - Aesthetics		UNSDG's	Nourishment	
UNSDG3	UCS-WB06 Financial rewards for physical activity-incentives in your organisation	0.76	UNSDG3- UNSDG8	UCS- IN03 Access to indoor common space	0.78	UNSDG1-UNSDG 2	UCS-WB01 Access to healthy food with pricing incentives	0.85
UNSDG3- UNSDG4	UCS-WB07 Availability of education on common mental health conditions: depression, anxiety, stress and substances use	0.79	UNSDG3- UNSDG8	UCS-IN04 Availability of social interaction space in Office- e.g., cafe'	0.82	UNSDG4	UCS-WB02 Access to Nutrition Education	0.77
UNSDG5	UCS-WB08 Availability of education on mental health distress (how to identify emotional distress and how to respond)	0.77	UNSDG3- UNSDG8	UCS-IN05 Office interior layout: workstations configuration and density	0.84	UNSDG2	UCS-WB03 Nutritional labeling and information on food for sale	0.83
UNSDG3	UCS-WB09 Availability of an on-site childcare facility with a policy supporting breaks for breastfeeding in your organisation	0.79	UNSDG3- UNSDG8	UCS-IN06 Indoor design elements: natural plants and water features, music, artworks,..etc	0.82	UNSDG1-UNSDG 3	UCS-WB04 Opportunities to produce food on-site: edible landscaping, fruit, herbs, green Houses,..etc	0.71
UNSDG3	UCS-WB10 Proximity to free on-demand health service facility or through digital provider in your organisation	0.76	UNSDG3- UNSDG8	UCS-IN07 Adjustable workstations to sit or stand	0.78	UNSDG4	UCS-WB05 Availability of education on dietary habits and eating behaviors	0.76
UNSDG9	UCS-WB11 Productivity through measures of hours worked in your organisation	0.78	UNSDG3- UNSDG8	UCS-IN08 Indoor visual privacy in Office	0.77			
UNSDG3- UNSDG6	UCS-WB12 Water quality : filtration system	0.88	UNSDG3- UNSDG8	UCS-IN09 Indoor calming colors, textures, forms	0.81			

Figure 9. Average user preference weights of aspects related to
Layout Design- Aesthetics, Nourishment, and Wellbeing Initiatives and its contribution to UNSDG's

7 Conclusions and Further Research

The study aimed to optimise the sustainability value by creating an innovative method to sup-port the environmental consultants with their decisions on different sustainability solutions. These decisions are essential to be looked at from the perspective of the desired impact of that particular project than its accreditation level and achieved score. However, the lack of aware-ness of the social implications of these decisions and the structure of sustainability assessment frameworks have hindered capturing the potential sustainability benefits. The literature showed that organisations like M&S have tried to include user perceptions to empower their business case. Moreover, researchers like Attalah, et al. in (2017) created a specific hierarchy between clients, experts and end-users preferences. However, the researchers gave the end-user satisfaction the least weight. Therefore, the study has created an innovative process of three steps to implement the users' comfort and satisfaction as they were proven to increase productivity and contribute towards more social and economic benefits.

The first step was to survey end-users to generate a broader understanding of credit's contribution to user comfort and satisfaction. The survey consisted of 5 sections, including the introduction and a total of eight (8) survey questions. Sixty-five 65 participants from the UAE region have filled a questionnaire and assessed various environmental, physical, and wellbeing factors from 1 to 5, where 5 is highly important. All aspects were inspired by LEED and WELL frameworks categories and aspects. The study helped to understand users' perception of these factors and aspects better through their assigned average weight. Users gave higher importance to some environmental factors, reflecting the improvement in users' awareness and understanding of the impact of these factors on users' health in an indoor environment. Factors inspired by WELL standards related to Nourishment, Wellbeing Initiatives and Layout Design-Aesthetics areas were also part of the study to improve the social implications of sustainable development. Results showed that most of these aspects were assigned almost equal importance yet equal average weight to users satisfaction and comfort. Access to healthy food with pricing incentives and Office interior layout: workstations configuration and density were crucial to users. The next step was linking these aspects and the related average weight from the survey back to LEED credits. The last step was to connect credits from step one to UN

sustainable development goals (UNSDG's) to prioritise credits contribution to a particular goal. These steps help support practitioners in the UAE on LEED accreditation decisions by emphasising the social aspect and integrating it as a lead role through the credits selection process. The study survey showed two main obstacles towards capturing 3D benefits in the UAE market; the lack of knowledge on the impact of green buildings solutions on business value and the lack of public awareness on sustainable developments. By emphasising the social dimension, sustain-able developments will strengthen the business case by aligning the client aspiration with the desired impact and contribution towards UN sustainable development goals (UNSDG's).

A more intensive study is undergoing to expand the work and acquire more data of additional factors crucial to the client, the sustainability consultant and the occupants. The information will then be implemented to support achieving the potential sustainability benefits under the three sustainability aspects.

8 Acknowledgement

This research was supported by Heriot-Watt University's funding at the school of Energy, Geoscience, Infrastructure and Society.

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