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Built Environment and Wellbeing—Standards, Multi-Criteria Evaluation Methods, Certifications

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Abstract: The debate on IEQ (Indoor Environmental Quality), with a focus on the healthiness of the built environment and its possible influence on the natural environment, has been a relevant topic for a decade. This interest has expanded to the quality of building technologies, specifically their performances and environmental effects. The objectives set by the 2030 Agenda have led to overcome the idea that sustainability is only related to environment; instead, a holistic vision aimed at human health has been affirmed (objective 3). The period marked by the Covid19 emergency contributed to strengthen the need for human well-being, as the "quarantine" made us observe our living spaces, reflecting on quality that we ourselves perceive. There is the need for a transition from a "Green" approach to architecture, toward a "Human Centered" approach with a user-centered design. The paper focuses on the factors that can affect users' well-being in their living space, by comparing the most common building environmental certifications (LEED, BREEAM) with WELL, a tool designed to verify the level of users' health and well-being. Specifically, the objective is to verify, within these methodologies, the presence and possible weight of the indicators that define a quality living space according to the user's perception.

Keywords: IEQ; well-being; certification tools; multi-criteria approach

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1. Introduction

Indoor Environmental Quality (IEQ) defines the level of compliance of a set of building performances to requirements related to users' needs. IEQ evaluation is a complex topic, because of the immaterial (psychological) and material (physical and environmental) characteristics involved. This topic has attracted an increasing interest: as a result, building regulations are now focused on users' health, in addition to the well-known aspects related to energy saving. The last European Directive on building energy performance (EPBD 2018/844) reports the concept of "indoor climate" and describes the elements that influence it; however, it does not include specific indicators, which would contribute to the creation of healthy and comfortable indoor environments [1]. Instead, tool-measurable indicators are defined by the UNI EN 16798-1:2019 standard [2]: the latter proposes an evaluation of building energy performance in relation to indoor air quality, thermal environment, lighting, and acoustics. In particular, the standard measures IEQ as a function of local discomfort factors (air currents, asymmetry of the heating surface, temperature differences of vertical air currents, floor surface temperature, etc.).

Albeit recent studies have led to an improved definition of these standards, by introducing more efficient parameters and acceptable ranges, other research works have shown that, even when all the indoor parameters fall within the correct ranges, not all the users of the buildings are satisfied about their environment. In addition to individual variability, the reason could be related to the presence of non-environmental factors with an influence on perception, in addition to physical conditions [3]. IEQ is related to the concept of social sustainability in a human-centered vision, determined by users' needs and by users' environmental perception. Perception depends on time and on users' adaptability to the environment [4] and can depend on countless factors (education level, psychosocial conditions at the workplace, urban context, age, birthplace, etc.). Hence, the possibility to control indoor environments improves general living quality [5].

Designing for an "average person" means to satisfy only 50% of the users; then, as in Design for All, the key is the control of elements. Architecture can truly become "for all" if space can be controlled as each one pleases. This concept implies overcoming the exclusively "green" architectural approach based on environmental sustainability, toward an approach that integrates the holistic "person-environment" concept, providing users with an active role in the management of the individual living environment. This is also confirmed by a large literature, as this topic is discussed in several research fields. In fact, the relation between building and health has been discussed when the World Health Organization created the term "Sick Building Syndrome" (SBS), relating users' sensorial discomfort to chemical compounds in indoor air, and in the materials used. As a consequence, ASHRAE coded the IAQ (Indoor Air Quality) standard, which defined an acceptable CO_2 level and a recommended air exchange rate. In this framework, some research works associate unsuitable thermo-hygrometric conditions with an increase in the risk of lung diseases in residential buildings, and with a drastic reduction in the attention level in workplaces [6]. A further indication from the field of Design is represented by the recent approach "User Experience (UX)", a significant branch of the Human-Centered Design (HCD) method, which provides a system of techniques aimed to the evaluation of the emotional dimension [7]. In architecture, UX can be applied to the spatial experiences (residential, working spaces, etc.), to smart environments (the so-called ubiquitous computing), to driving, orientation and safety systems, and to the building-nature interaction. The starting point for a UX Designer is to ask why, how and which the best product for their user should be. The design process starts with a research phase to collect data, understand the user's fundamental needs, perform user interviews, and set usability goals for the product within the project–in architecture, that corresponds to habitability. Recent survey methodologies have been successfully used in the co-design between designers and users, as a partial substitution for the measurement of parameters and aspects related to the use experience. However, the test of a single product is certainly simpler and more economical, than the comfort assessment of an indoor environment, with multiple elements and variables.

In the architectural field, the definition of quality has involved the entrepreneurial field and market strategies for building sale as well. In fact, enterprises compete in a global market; hence, they have started to make a voluntary use of building performance certifications. Over years, these have taken an increasingly crucial role as a guarantee of reliability and specificity of the performed work [8]. In the certifications proposed in the last decade, IEQ has been related to building projects with a high environmental sustainability, and to their realization in the building site; to the adoption of new technologies to increase the performance of the building system in terms of environmental comfort. The best-known tools–LEED, BREEAM, DGNB, etc. [9] are used to classify the performance level of new constructions, and of the existing ones, when subjected to a restoration intervention. Despite not being compulsory, they have been used for large-scale designs and constructions, making energy saving the main evaluation object; this is related to the economic advantage produced by the significant reduction in energy consumption for high-performance buildings. None of the most popular protocols envisages a specific evaluation area for social sustainability or–at least–for the human factor [10], even though the latter is crucial for the attractiveness of real estates. Moreover, certifications do not consider the substantial differences–demographic, physiologic, socio-cultural, etc. among building users, as they adopt the needs and expectation of a standard average user [11].

This research is aimed to support the definition of IEQ and its evaluation methodologies, by examining the indicators used by the best-known protocols: indicators are intended as minimum requirements for the evaluation of users' well-being in their living environments. For this purpose, the scope of the research is limited to in-use residential buildings. As premised, the literature review shows that the positive characteristics of a given location can turn into a disadvantage for another one and this leads to subjective results: then, an in-depth study in the present research is performed on the evaluation criteria based on soft data, that consider living spaces according to users' perception. For this purpose, the well-known protocols BREEAM and LEED have been compared with the more recent WELL, an evaluation tool generated through an interdisciplinary collaboration between researchers in architecture and clinical medicine, aimed to the transform the built environment in the name of human health and psycho-physical well-being [12].

2. Methods

Nowadays, the use of building quality evaluation tools is a consolidated practice, which has led to the development of one or more protocols in several countries (45 around the world). In order to carry out specific research on social sustainability and indoor quality, the starting point has been the analysis of the certification protocol WELL, managed by the International WELL Building Institute (IWBI). This choice has been performed as this protocol is constituted by indicators related to social aspects by 97%: this rate is significantly higher than all other protocols, which consider these aspects by the 30% in average [13]. Even though this protocol provides a huge quantity of information referred to the social dimension of IEQ evaluation by itself, the literature review was extended to at least two more protocols for completeness. The other 44 protocols consider the social dimension almost with the same percentages; so, the selection was performed according to the "crosswalk" initiative [14], developed by IWBI together with some partners among the main founders of international evaluation systems. This initiative was highly praised in the real estate as it was aimed at the obtainment of a double certification through the alignment between the WELL systems and additional protocols, by setting equivalences between the criteria of each comparative system. The alignments have been processed by the IWBI together with the Building Research Establishment (BRE) Global Ltd. and the Green Building Council (GBC). Among the most recent certification protocols, we have chosen those with specific features for the evaluation of existing residential building, to circumscribe the study to living environments. Hence, the protocols analyzed and compared are the following:

- WELL V2 pilot Q1: certification issued by GBC, managed by IWBI (USA), 2021, pilot project;
- LEED v4.1 O + M Existing Buildings: certification issued and managed by USGBC (USA), 2019 [15];
- BREEAM International In-Use v6: certification issued and managed by BRE (UK), 2020 [16].

WELL and LEED protocols have the same Certificate Authority, and their model structures have the same pre-requisites, credits, and scores. In the first phase of the research, the three protocols have been examined one by one to select evaluation indicators for social sustainability. These latter have been collected in summary tables, and classified by macro-category, purpose, evaluation criteria, credits, and weight on the whole evaluation process. Since the study focuses on user perception, it was checked whether the evaluation criterion of each indicator required quantitative information regarding Building Performance (BP), to be determined through observation, tool measurement, or qualitative information based on User Perception (UP): that is, hard data or soft data.

The second research phase focuses on research quality. The adherence between the protocols and the principles outlined in the last conference of the Architects' Council of Europe (ACE)–and expressed in the Declaration of Innsbruck of the 4 May 2019 [17]–was verified. The purpose of the Declaration is to provide reflection on the concept of the quality of the built environment, shedding lights on the good practices for its evaluation, by premising that this topic does not allow absolute truths, as these evaluations depends on the context, and on individual users' perception. The Document lists some essential characteristics (criteria) for places, which can serve as quality drivers, as they bring benefits to individuals and society.

The research verifies the correlation between such "essential characteristics" and the examined protocols. The realized summary table highlights the correspondence between the criteria listed in the Declaration and their presence in the evaluation process. If the outcome is positive, the indicators whose evaluation object matches the thematic area of the essential characteristic are specified.

3. Discussion

3.1. IEQ Evaluation According to Social Sustainability in WELL V2 Pilot Q1

WELL Building Standard is the first certification to measure and certify building characteristic according to their impact on human well-being, with a specific focus on the modalities of user comfort and health improvement. Based on the first, pioneering version of WELL v1, WELL v2 is the most tested and verified version of the WELL Building Standard as of today. The goal of this certification is users' satisfaction, and it is achieved through both conventional IEQ parameters (heat, light, sound, and air quality) and complex physio-psychological dimension.

In order to harmonize WELL to the main bio-building standards, the International WELL Building Institute (IWBI) has developed "crosswalks" together with the BRE (BREEAM) and the US Green Building Council (LEED). These report the synergies between the various building standards, in order to simplify the double certification of designs through the recognition of equivalent and aligned requirements. Like LEED and BREEAM certifications, WELL is a global tool, diffused in more than 50 countries. However, unlike the others, the evaluation methodology of WELL does not depend on the design typology (existing building, new construction), nor on the in-use destination. This evaluation tool has a univocal procedure, with flexibility and adaptability to any construction, without a fixed scorecard: it uses a score system, with 110 points available in each project scorecard. There are a number "precondition parameters", required to achieve the certification; the others are optimizations, chosen by the evaluator according to the building under certification. All optimizations are characterized by point values, which define the level of compliance of the building with a need, directly or indirectly related to the key needs of health and well-being. Projects that fulfill all preconditions and a given number of optimizations can achieve various certification levels: Silver (50 points), Gold (60 points), Platinum (80 points).

The goal of health and well-being, set by WELL for both resident and occasional users, is articulated into several items: Air, Water, Nourishment, Light, Movement, Thermal Comfort, Sound, Materials, Mind, and Community.

All the aspects show that the architectural quality of the house or workplace strongly affects life quality, with a deep influence on users' physical and psychological health. The nature of the precondition parameters also shows, in WELL's philosophy, a healthy building–both public and private–should guarantee all the quality levels indicated by the ASHRAE and UNI EN international standards. For example, the European standard EN16798 [2] defines minimum requirements for air quality and environmental parameters for thermal comfort, lighting, and acoustics. The WELL protocol establishes a no less than annual monitoring system for the evaluation of these parameters and refers to specific standards.

Thermal comfort is acceptable if the values correspond to those set by ASHRAE 55:2013 [18], ISO 7730:2005 [19] or EN 15251:2007 [20]. Concerning lighting, the following standards are considered: IES Lighting Handbook, EN 12464-1: 2011 [21], ISO 8995-1:2002 [22]. Air quality is verified if the building uses an effective mechanical or natural ventilation system, in compliance with the indications from the regulatory framework; it is evaluated through a constant monitoring of the values of particulate, organic and inorganic gases, radon. Air quality must be verified both at the operation stage and during maintenance activities: the maintenance plan must include the constant cleaning of filters, powder limitations, and the use of non-harmful materials and products (in particular, without asbestos, mercury, and lead).

Just like air, water is subjected to continuous performance tests as well, by monitoring the presence of contaminants. Times and modalities of control phases should be established in a specific management program, aimed at the prevention of risks related to the exposure to most common bacteria. WELL is the only certification to consider how an architectural project can influence a person's nourishment, on the basis of the distance of the building from healthy products, and on its availability of spaces for the cultivation of biological crops.

This view is similar to Design Thinking: its human-centered methodology integrates design skills with social sciences, through an interdisciplinary collaboration based on an iterative process, to realize innovative, user-centered products and systems. Compared to common certification standards, which focus on environmental sustainability, WELL has a different perspective as it shifts the concern from technological performances to users and their needs. In addition to the Nourishment item, this is demonstrated by the presence of several themes linked to the physical and psychological sphere.

Concerning physical health, the certification can only be obtained if the examined project has spaces and facilities for physical activities, and if it improves general well-being through an ergonomic design, aimed at a better comfort in living environments, and at an increased safety in workplaces. An architectural project can contribute to mental health by integrating green spaces in the adjacent lot. Indeed, WELL implements well-known concepts from studies that have been carried out since the '80s, concerning the effects induced by nature on mental and physical well-being. These findings lead to limit people's exposure to hostile environmental conditions by reducing crowding feeling, acoustic and atmospheric pollution; moreover, to generate restorative effects through the view of landscapes that induce a relaxation state.

Stakeholders' involvement during planning and operation phases is a precondition, aimed to encourage sociality. This must be demonstrated through a building management document that details the mission oriented to the consultation of the concerned parties: that is, it must outline occasions for the celebration of culture, art and/or the site itself, in one or more common spaces. Moreover, the management must include the diffusion of didactic material to inform users on the possible physical and psychological risks deriving from the use of the spaces; meetings with the users regarding their health and well-being must be organized several times a year, through surveys or focus groups. Surveys must assess the following items: indoor environmental quality of air, water, light, sound and thermal comfort (questions on thermal comfort must assess two yearly conditions, that is for the cooling and the heating season); ergonomics and esthetics, maintenance and cleaning, services (access to green areas and park areas, nutrition options), general building data, standard socio-demographic data and the time spent in the building.

The following summary table (Table 1) reports the precondition parameters for each issue, without an assigned score, together with the aims and the assessment criteria for each parameter.

Table 1. Precondition parameters of WELL V2 pilot Q1.

Env. Cat.	WELL Issue	AIM	Assessment Criteria	PB/UP *
Air	A01 Fundamental Air Quality	Ensure a basic level of indoor air quality that contributes to users' health and well-being.	Monitoring of fundamental Air Parameters (Particulate matter, organic and inorganic gases, radon)	BP
	A02 Smoke-Free Environment	Deter smoking, minimize occupant exposure to second-hand smoke and reduce smoke pollution.	Prohibition of smoking and e-cigarettes in indoor spaces and on all decks, patios, balconies, rooftops and outdoor galleries.	BP
	A03 Ventilation Effectiveness	Prevent indoor air quality issues through the provision of adequate ventilation.	Use of mechanical or natural ventilation in compliance with: EN 15251:2007 [19] or ASHRAE 62.2-2016 [23].	BP
	A04 Construction Pollution Management	Minimize the introduction of construction-related pollutants into indoor air and protect building products from degradation.	Verification the indoor air quality protect strategies during building renovation such as envelope protection, moisture and dust management, filter replacement, air flush, etc.	BP
Water	W01 Fundamental Water Quality	Limit the presence of sediment and waterborne bacteria levels in water for human contact.	Performance Test of turbidity and coliforms. The water contaminants are monitored at least once per year.	BP
	W02 Water Contaminants	Provide access to drinking water that complies with health-based limits on contaminants.	Performance Test of dissolved metal, organic pollutant, herbicide and pesticide, fertilizer, water additive. The water contaminants are monitored once per year.	BP
	W03 Legionella Control	Establish an effective management program that prevents or adequately controls the risk of exposure to Legionella bacteria.	Verification of the presence of a Legionella Management Plan.	BP
Nourishment	N01 Fruits and Vegetables	Promote the consumption of fruits and vegetables by making fruits and vegetables easily accessible.	Photographic Verification if fruits and vegetables are sold or provided on a daily basis within project boundary.	BP

	N02 Nutritional Transparency	Help individuals make informed food consumption choices through nutritional labeling and information.	Clear display of nutritional information and Ingredient (per meal or item) at point-of-decision on packaging.	BP
Light	L01 Light Exposure and Education	Provide access to indoor light exposure and light education.	Verification by Architectural Drawing if spatial daylight autonomy is achieved for at least 30% of the space. Transparent envelope glazing area should be less than 7% of the floor area. Visible light transmittance (VLT) of envelope glazing is greater than 40%.	BP
	L02 Visual Lighting Design	Provide visual comfort and enhance acuity for all users through electric lighting.	Verification of the compliance of all indoor and outdoor spaces with illuminance recommendations specified in: EN 12464-1: 2011 [20], ISO 8995-1:2002 [21].	BP
Movement	V01 Active Buildings and Communities	To promote movement, physical activity and active living through the design of built spaces.	Verification of the presence of physical activity spaces and equipment.	BP
	V02 Visual and Physical Ergonomics	Reduce physical strain and injury, improve ergonomic comfort and workplace safety and general well-being through ergonomic design and education.	Verification of user-appropriateness of education, workstations and type of work being carried out in the space.	BP
Thermal Comfort	T01 Thermal Performance	Ensure that the majority of building users find the thermal environment acceptable.	Verification of the compliance of the heating system with minimum temperature requirements from ASHRAE 55:2013 [17], ISO 7730:2005 [18] or EN 15251:2007 [19].	BP
Sound	S01 Sound Mapping	Incorporate strategic planning and mitigation required to prevent general issues of acoustical disturbance from both externally and internally generated noise.	Provision of an architectural drawing that indicates the projected background noise level (dBA or NC) and the acoustical performance of walls.	BP

Materials	X01 Fundamental Material Precautions	Reduce or eliminate human exposure to building materials known to be hazardous.	Verification of the absence of asbestos, mercury and lead in materials.	BP
	X02 Hazardous Material Abatement	Reduce or eliminate human exposure to hazardous material ingredient by products from renovation, repair or demolition work.	Verification of the presence of asbestos, polychlorinated biphenyl and lead risk management strategies.	BP
	X03 Exterior Materials and Structures	Mitigate environmental contamination and associated hazards resulting from treated outdoor structures and wood-plastic materials.	Examination of the quantity of lead in any synthetic grass and paints.	BP
Mind	M01 Mental Health Promotion	Promote mental health and well-being through a commitment to mental health education, programming and initiatives.	Verification of the presence of educational materials or measures (survey and focus group) to support the mental health of users.	**UP**
	M02 Access to Nature	Support occupant well-being by incorporating the natural environment through interior and exterior design.	Verification of the integration and encouragement of occupant access to nature within the project boundary	BP
Community	C01 Health and Well-Being Awareness	Promote a deeper understanding of factors that impact human health and well-being.	Verification of the provision of a digital and/or physical library of health and wellness educational materials to all occupants	BP
	C02 Integrative Design	Facilitate a collaborative development process and ensure adherence to collective well-being goals.	Verification of the engagement of stakeholders upon point of registration in project planning, of the incorporation of cultural celebration in common spaces, and of the presence of a document detailing project's health-oriented mission produced in consultation with stakeholders.	BP/**UP**
	C03 Occupant Survey	Establish minimum standards for the evaluation of experience and self-reported health and well-being of building occupants.	Feedback collection from building users on their health and well-being and on topics related to WELL.	**UP**

* Building Performance (BP) or User Perception (UP).

Concerning optimization parameters, some are more related with housing units, while others are meant for other in-use destinations. Each parameter can be applied both to the built environment, and to the building design stage. In order to use the same term of comparison as with the other standards here analyzed, the evaluation has been performed on a living environment, in an existing residential building. Out of n. 84 optimization parameters in WELL, n. 25 are user-centered: their weight is associated a significant incidence (49 out of 110: around the 45%) and they provide several opportunities for the involvement of stakeholders. The parameters suggest several user-centered measures to designers or site managers: for example, the diffusion of a digital or physical library concerning the impacts of thermo-hygrometric conditions, indoor air quality and water quality on human health, in addition to real-time monitoring data; measures to favor proper nutrition, with zero-kilometer food consumption (planting supplies, watering system and gardening tools).

Technology control is one of the key actions for user well-being: this is an evaluation parameter as well and is related to thermal systems (with a focus on thermal zoning) and to shading and lighting systems, including illumination level, temperature, and color.

Some indicators, added in the most recent versions, derive from the new needs of protection from health risks, induced by the pandemic. The management of the building can have a deep influence on group immunity, through a strategic plan that defines places for tests and vaccines and establishes rules for the use and cleaning of the tools shared by all the residents, with diffuse signals and indications to regulate users' behavior in common areas. Universal Design requirements are optimization parameters and have a scarce relevance (less than 3%) in the protocol, despite the high number of international regulations on some of its items, such as the elimination of architectural barriers.

WELL adopts one single item for the evaluation of: systems aimed at improving accessibility to all functions and areas, space flexibility, and usability; wayfinding strategies, which use color, consistency and other perceptible elements to support people with different cognitive skills; technologies to fulfill the needs of disabled people, at the free use of the residents. On the other hand, the need for spaces destined to physical activity and relax is strongly stressed: in addition to the abovementioned preconditions, several optimization parameters evaluate the presence of recreational spaces, setting a minimum of 7 m^2 per regular occupant, and further areas for sports, recreational areas, green areas, indoor and outdoor design aimed at integrating nature with houses.

WELL is founded on users' needs, and can verify if users are integrated and have an active role in the control of spaces. However, the collection of users perceptions, which occurs for almost all the abovementioned aspects, has a scarce incidence on the overall score of the evaluation, as its weight is around 10%. The following table (Table 2) reports the selection of the optimization indicators that can be used for the classification of the quality of a living environment, and for the evaluation of users' involvement in the management of the living space.

Table 2. Optimization parameters that imply an active users' involvement in WELL V2 pilot Q1.

Env. Cat.	WELL Issue	Assessment Criteria	Weight	PB or UP *
Air	A08 Air Quality Monitoring and Awareness	Monitoring of indoor air quality issues as well as information and education of individuals through educational training and a digital or physical library that includes data on the impact of indoor air quality on human health.	2%	BP/**UP**
Water	W05 Water Quality Consistency	Testing of water quality parameters; the results are made available to occupants through visual displays, prominently	2%	BP/**UP**

		located near sources of drinking water and on a website accessible to occupants.		
	W09 β Onsite Non-Potable Water Reuse	Provision of visual signals for occupants, to help them distinguish potable from non-potable water as well as informative displays to highlight safety features and conservation goals of the non-potable water system.	1%	BP
Nourishment	N07 Nutrition Education	Individual nutrition consultations by certified nutrition professionals on a quarterly basis, at minimum. Educational materials that promote healthy eating and nutrition.	1%	BP
	N12 Food Production	Training or educational opportunities for regular occupants (e.g., gardening workshops, plant harvesting guidelines). Provision of planting supplies, watering system and gardening tools.	1%	BP
Light	L04 Glare Control	Shading control by the occupants, where all shades can be raised either manual or automatically.	3%	BP
	L08 Occupant Control of Lighting Environments	Tunable and automated light systems, to meet the circadian and visual requirements of the occupants. Regular occupants' control of light levels, color temperature and color of electric light in their immediate environment.	3%	BP
Movement	V06 Physical Activity Opportunities	Age- and ability-appropriate physical activity/exercise opportunities, led by a qualified professional, are offered, either in-person or virtually at no cost.	2%	BP
	V08 Physical Activity Spaces and Equipment	Presence of a dedicated physical activity space (green space, recreational field or court, fitness center, play space geared toward children) per dwelling unit.	2%	BP
	V09 Exterior Active Design	Projects provide an outdoor plaza or similar open-air space or a walking path or trail that can be used year-round and contains seating, provides access to daylight.	1%	BP
Thermal Comfort	T02 Enhanced Thermal Performance	Implementation of a post occupancy survey at least twice a year. The survey includes an assessment of overall satisfaction with thermal performance and identification of thermal comfort-related issues.	3%	**UP**
	T03 Thermal Zoning	Control over temperature by all regular occupants through either thermostats	2%	BP

		located in each thermal zone or digital interface on pc or smartphone.		
	T06 Thermal Comfort Monitoring	Real-time display of dry-bulb temperature and relative humidity is made available to occupants through one monitor screen or website or phone application.	1%	BP
Materials	X14 Material Transparency	Provision of a digital or physical library to occupants on compliant products as part of the resource library required. The library is prominently displayed and easily accessible to occupants.	1%	BP
	X15 Contact Reduction	Establishment and communication of rules and expectations for the usage and cleaning of shared tools and devices for all regular occupants.	2%	BP
Mind	M07 Restorative Spaces	Presence of a designated indoor or outdoor space within the project boundary that is exclusively for contemplation, relaxation and restoration, with a minimum of 7 m^2 per regular occupant.	2%	BP
	M09 Enhanced Access to Nature	Access to proximate nature that incorporates nature through interior and exterior design, nature views.	1%	BP
Community	C04 Enhanced Occupant Survey	Annual Stakeholder interviews, focus groups and/or observation annually to discuss building features and wellness initiatives and their impacts on occupant health and well-being.	3%	**UP**
	C07 Community Immunity	Information on how the project facilitates vaccine availability is regularly provided to occupants. Regular occupants are encouraged and educated to receive the vaccine.	2%	BP
	C11 Civic Engagement	Communication of reminders to residents, to vote in local and national elections, including instructions on how to determine their voting station.	1%	BP
	C13 Accessibility and Universal Design	Space optimization with universal design requirements to meet occupant needs related to: safety, developmental and intellectual health, wayfinding, inclusion, technology.	3%	BP
	C15 Emergency Preparedness	Presence of an emergency management plan in the case of emergency situations within the building or surrounding community and educational resources are made available to all regular occupants.	3%	BP

C16 Community Access and Engagement	Shared, flexible public space for use by the surrounding community, and to offer programming that engages local individuals in managing or utilizing the space in diverse ways.	1%	BP
C17 Housing Equity	Designation of affordable housing units and housing cost reduction for low-income tenants.	3%	BP
C18 Emergency Resilience and Recovery	Availability of an outdoor or indoor space for emergency responders and presence of a shelter-in-place plan for emergencies in case occupants cannot leave the building. Projects located in a region with heightened risk of infectious respiratory disease transmission require proof of vaccination and face masks worn indoors.	3%	BP

* Building Performance (BP) or User Perception (UP).

3.2. Social IEQ Evaluation in LEED v4.1 O + M

The USA-native LEED (Leadership in Energy and Environmental Design) is the most used protocol in the world. The USGBC (US Green Building Council) has developed different versions according to the in-use destination of buildings; for each of them, the evaluation parameters are based on the American Technical Standard ASHRAE and on the European Standards EN and ISO. The certification considers the whole life cycle of the building and is aimed at guaranteeing the achievement of high performances in key areas of environmental and human sustainability (resource saving, site accessibility, energy efficiency, project innovation, material quality and IEQ). LEED has a credit-based rating system: some credits are compulsory (prerequisite), can be assigned for each category, and their sum determines the achievement of a certification level (certified 40–49, Silver 50–59, Gold 60–79, Platinum ≥ 80 points).

The protocol LEED v4.1 has a particular focus on IEQ, and several credits are related to accessibility, resource consumption (water, energy and materials), waste services, indoor air quality. The version LEED v4.1 O + M is specific for existing buildings in full operation and at least one-year occupancy. The document is divided into two sections: “Existing Building Scorecard” and “Interiors Scorecard”: the former performs a global evaluation of existing buildings, considering external areas as well; the latter is focused on the indoor environment. This research only considers the section on the indoor environment. IEQ evaluation is performed for most indicators, with a suggestion to the professional certifier to carry out an objective audit in order to verify the presence of measure for the improvement of indoor conditions. In some cases, these measures involve the performances of the building; in other case, they affect management policy.

Resource saving is a recurring theme for the evaluation, and the following items are estimated: water consumption (14%), energy consumption, annual gas emissions (33%), by also checking whether control and rationalization measure have been implemented for these resources. Moreover, the evaluation includes the outline of all annual purchases of consumption and construction material, in order to check whether they are recycled, rechargeable, biological, and if they have environmental product certifications (4%). The protocol also focuses on the management of services, such as waste disposal (8%) systems: in particular, verifications are related to the presence of specific storages for recyclable materials is recommended, and to the weight (in kg) of landfilled or incinerated materials, which must be under fixed thresholds. Other focused items include: the purchase of materials and products for building maintenance, which must be ecological and rationalized (prerequisite); the performance of maintenance and refurbishment actions according to a structured plan (prerequisite); the use of controlled procedures and non-hazardous products in ordinary cleaning, and the presence of a specific management plan for extraordinary cleaning (e.g., disinfestation of hazardous animal organisms) (prerequisite).

Air quality is the most relevant indicator in the whole evaluation procedure, and is analyzed according to several aspects: the calculation of the emissions from cooling systems, if present; the verification of the system of natural or mechanic ventilation; the measurement of VOCs, air inflows and outflows (prerequisite); the establishment of the smoking ban (prerequisite); the control on dangerous substances within the products for maintenance interventions, and within pesticides, when used (1%).

The philosophy at the foundation of the LEED certification is similar to WELL: the two standards are aligned in several aspects, and are designed to operate together, in a long collaboration aimed to orient the building environment toward a higher respect for human health and environment.

The minimum indoor air performances indicated in LEED perfectly match the requirement of proper ventilation, of implementation of filtering systems for polluting particles, and to the smoking ban in common areas indicated in the WELL certification.

Some credits were removed in version V4, compared to the version V2 of the LEED protocol, in order to simplify the certification procedure: this disadvantages LEED as compared to WELL in relation to thermal and visual comfort, for which WELL prescribes several in situ measurements (e.g., simulation of daylight improvement, occupants' control of light levels in all spaces, control and monitoring of thermal parameters). Regarding some items, such as those related to ecological cleaning management, WELL demands specific requirements for the formulation of the program, for the cleaning protocol and for product storage; conversely, LEED accepts any work plan, as long as there is one.

Basically, WELL evaluates users' opinions and includes their involvement in all parameters; in LEED, user surveys are carried out in a minor percentage, and have different typologies of question than WELL. In particular, in LEED v4.1 O + M user perception is collected through surveys only regarding waste production, accessibility of mobility services (14%), and indoor air quality (50% in combination with TVOC and CO2 measurement). The core of LEED is the measurement of the performances of technological systems (68%) and building management services (32%) through parameters that orient evaluations toward environmental sustainability, rather than social or economic sustainability. The following summary table (Table 3) reports the list of precondition and optimization parameters, along their weight on the overall evaluation, for the classification of the quality of living environments according to LEED v4.1 O + M.

Table 3. Precondition and optimization parameters of LEED v4.1 O + M Interiors Scorecard.

Env. Cat.	LEED Issue	AIM	Assessment Criteria	Weight	PB/UP *
Location and Transp. (14%)	LT Transport. Performance	Reduce pollution and land development effects from transportation.	Regular occupants' survey regarding their two-way commutes over one work week. The survey must be carried out at least once per year.	14%	**UP**
Water Effic. (15%)	WE Water Performance	Support water management and reduce water consumption.	Permanent installation of water meters that measure the total potable water use. Measurement of total potable water use on a monthly basis for twelve consecutive months.	15%	BP

Energy and Atmosphere (34%)	EA. 1 Energy Efficiency Best Management Practices	Promote continuity of information to ensure that energy-efficient operating strategies are maintained.	Energy audit to verify that the operations and maintenance plan meet the requirements of the ASHRAE preliminary energy use analysis or EN 16247-2:2014 [24].	Required	BP
	EA.2 Fundamental Refrigerant Management	Reduce stratospheric ozone depletion.	Confirmation that no CFC-based refrigerants are included in any new mechanical cooling and that comprehensive phase-out plan for CFC-based refrigerants is in place. Confirmation that refrigerant leakage rate has been met.	Required	BP
	EA.3 Energy Performance	Support energy management and reduce environmental and economic harms associated with excessive energy use.	Permanent installation of energy meters or submeters for the measurement of total building energy consumption. Measurement of greenhouse gas emissions and source energy for twelve consecutive months.	33%	BP
	EA.4 Enhanced Refrigerant Management	Eliminate ozone depletion and minimize direct contributions to climate change.	Option 1: Verification of the absence of refrigerants or of the use of low-impact refrigerants. Option 2: Calculation of the impact of refrigerants used in heating, ventilating, air-conditioning, and refrigeration equipment.	1%	BP
Materials and Resources (12%)	MR.1 Purchasing Policy	Reduce the environmental harm from purchased materials and products.	Establishment of an environmentally preferable purchasing (EPP) policy for materials and products purchased for the project during regular operations.	Required	BP
	MR.2 Facility Maintenance and Renov. Policy	Reduce the environmental harms with purchased and disposed materials.	Establishment of a facility maintenance and renovation policy to be implemented at the discretion of building owners, operators, or tenants.	Required	BP

	MR.3 Waste Performance	Track and reduce the waste that is generated by building occupants.	Selection of storage locations for recyclable materials. Measurement of the total weight of waste that is generated, and the total weight that is diverted from landfills and incineration facilities for full year.	8%	BP/**UP**
	MR.4 Purchasing	Reduce environmental harm from materials and products used and disposed.	Tracking of all ongoing consumable and building materials purchases, to verify if they are recycled, rechargeable, Bio-based, and if they have any certifications such as EPD.	4%	BP
Indoor Environmental Quality (24%)	EQ. 1 Minimum Indoor Air Quality	Contribute to the building occupants' comfort and well-being.	Mechanical or natural ventilation of spaces. Measurement of the quantity of outdoor air delivered and of exhaust ventilation rates.	Required	BP
	EQ.2 Environmental Tobacco Smoke Control	Prevent building occupants' exposure to environmental tobacco smoke.	Activation of a no-smoking policy, smoking ban in the building or compartmentalization of smoking areas.	Required	BP
	EQ.3 Green Cleaning Policy	Reduce levels of chemical, biological, and particulate contaminants.	Activation of a green cleaning policy or a Certified Cleaning Service for the green cleaning procedures, materials, and services that are within the project and site management's control.	Required	BP
	EQ.4 Indoor Environmental Quality Performance	Assess how well the building is performing in terms of indoor air quality and comfort.	Occupant satisfaction survey and/or indoor air quality evaluation. Indoor air measurements in representative locations.	20%	**UP**/BP
	EQ.5 Green Cleaning	Reduce levels of chemical, biological, and particulate, by implementing effective cleaning procedures.	Routine inspection and monitoring of the facility's green cleaning policy to verify that the defined strategies are being used and to identify areas in need of improvement.	3%	BP
	EQ.6 Integrated Pest Management	Minimize pest problems and exposure to pesticides.	Implementation of an integrated pest management (IPM) plan or a Certified IPM service for the building and grounds within the project boundary.	1%	BP

Innovation (1%)	IN Innovation	Encourage projects to achieve exceptional or innovative performance.	Presence of a LEED AP in the project team as a main participant. Achievement of significant environmental performance using a strategy that is not addressed in the rating system.	1%	BP

* Building Performance (BP) or User Perception (UP).

3.3. Social IEQ Evaluation in BREEAM In-Use v6

The British certification BREEAM (Building Research Establishment Environmental Assessment Method) has been the first system ever for the evaluation of the environmental and social impacts of buildings and has represented a model for the following certification systems. BREEAM In-Use International Residential outlines a performance standard, which allows evaluating existing residential buildings and living environments; the last published version is V6, and dates back to May 2020. BREEAM assigns reward scores through a rating system with 8 categories: health and well-being, energy, transports, water, resources, resilience, soil consumption and ecology, pollution. One or more credits are attributed for each good practice, according to the relevance of the category of the action, for the achievement of the building sustainability goal. Hence, requisites and categories have heterogeneous weights within the evaluation. The sum of the points in all categories represents the total score, which determines the final rating: Acceptable > 10%, Pass > 25%, Good > 40%, Very Good > 55%, Excellent > 70% or Outstanding > 85%; a building whose score is below 10% cannot be classified. The certification is divided into two parts: the first one, "Asset Performance", analyzes the intrinsic performances of the buildings, while the second one, "Building Management", examines the quality of building management and operation. As for the other evaluation systems described above, the scope of the analysis is here limited to the study of building performances.

The highest number of social aspects can be found in the category "Health and Wellbeing" (with a 17% incidence on the total evaluation). Visual comfort is evaluated by measuring glazed area (HEA 01), shading systems (HEA 02), indoor and outdoor lighting levels (HEA 03), artificial lighting quality (HEA 05), view out (HEA 06). With reference to thermal comfort, the presence of user control for temperature and humidity levels is verified (HEA 07). Air quality is verified: by checking whether in the house–or in the housing complex–there are sensors for CO and CO2 detection (HEA 09–10), whether the ventilation system, if present, is in compliance with USE and ANSI/ASHRAE standards (HEA 08); by performing the ISO 11,665 standard [25] test for the presence of radon (HEA 13); by checking for the storage of chemical substances, if present (POL 02), whether cooling and hearing systems are in compliance with the standards, concerning VOC emissions (POL 03), and whether there are systems for the detection of hazardous gases (POL 05). The first part of the document does not consider acoustic comfort, as it is evaluated within the building management. Concerning user's health and comfort, other indicators evaluate the presence of recreational spaces (HEA 11) and presence of inclusive features (horizontal and vertical accessibility, assistive technologies and wayfinding, etc.) in living spaces (HEA 12). Sustainable mobility is considered too, as its advantages benefit both the environment and users: the presence of some features (proximity to public transport nodes, separate cycling and pedestrian routes, recharge stations for electric vehicles), can lead to an easy, healthy and safe use of public transport and personal electric vehicles (TRA 01–04). Economic sustainability, which has a significant impact on users' psyche, is evaluated by verifying the presence of preventive actions for resource consumption, such as: planned maintenance (in order to avoid unexpected and costly interventions), waste recycle and reuse, building resources inventory (RSC 01–03). Moreover, a good number of indicators (14.5%) is related to users' safety, through the evaluation of flood risk (RSL

01–02), risk by natural calamities (RSL 03), building durability and resilience (RSL 03), and by verifying the presence of an alarm system (RSL 05). The category "land use" includes the evaluation of the percentage of cultivated area: apparently, this is related to environmental sustainability, but actually it influences users' well-being, as it affects several factors, such as air quality, shading, thermal comfort, psyche (LUE 01). Other indicators are related to environmental sustainability and have not been listed as the paper deals with social sustainability; likewise, a relevant part of the document deals is focused on the evaluation of building energy performances (ENE 28,5%) and on sustainable water use (WAT 9%) but this has not been examined in-depth.

Hence, the weights can be summarized as follows: a weight of 40% (ENE + WAT + POL02) is exclusively related to environmental sustainability; a weight of 32.5% is distributed among indicators focused on both environmental and social sustainability (HEA09-10 + HEA13 + TRA01 + LUE + POL01 + RSL01-03); finally, a weight of 27.5% is attributed solely to social sustainability. Users' involvement is almost absent: the analysis of the evaluation method of each indicator shows that user perception is considered by less than 5%, within the evaluation process (see Table 4). The comparison between BREEAM and WELL highlights the lower focus to social sustainability in the British protocol. For several items, WELL requires the execution of on-site performance tests by third parties, in addition to instrumental measurements. WELL often refers to the man-nature couple, by suggesting the use of natural materials, patterns, forms, colors and sounds within housing units, and recalling the supportive role of nature toward indoor and outdoor, thermal and visual comfort. The control of parameters by users is a fundamental element in both protocols; moreover, WELL encourages "shared control" for multiple users. Among the activities carried out in proximity of living environments, WELL suggests additional services, such as common recreational spaces (common vegetable gardens and kitchens, green areas, and spaces for physical activities), and defines several specifications for services located in closer proximity (e.g., a minimum size for common areas, in relation with living space; a minimum number of stations for sustainable mobility, or a maximum distance for public transports). WELL also includes an annual resource inventory, aimed at quickly providing information for maintenance and emergencies, in addition to practical training and frequent communication between users and technical experts. The following summary table (Table 4) reports the selection of precondition and optimization parameters, together with their weight on the overall evaluation, used to classify the quality of living environments according to BREEAM In-Use.

Table 4. Precondition and optimization parameters of BREEAM In-Use Asset Performance.

Env. Cat.	BREEAM Issue	AIM	Assessment Criteria	Weight	PB/UP *
Health and Wellbeing (17%)	Hea 01 Daylighting	Ensure residents have access to good levels of daylight.	Evaluation of the glazed area to room area ratio, in comparison with minimum performance requirements for the asset's latitude.	5.7%	BP
	Hea 02 Avoiding overheating from solar gain	Recognise and encourage external shading features.	Photographic evidence of external shading features on all windows where there is a risk of overheating.	5.7%	BP

Hea 03 Internal and external lighting levels	Ensure appropriate lighting to residents.	Measuriment (lux) of the light falling on a surface using calibrated illuminance meters with a photocell that is both colour/spectrally and cosine corrected.	11.4%	**UP**
Hea 05 Minimize flicker from lighting systems	Minimise the impact of flicker on asset users.	Visual inspection and verification of technical specifications for the installed lighting.	5.7%	**UP**
Hea 06 View out	To evaluate the quality of the external view.	Visual inspection of the adequateness of the view out of the rooms (8 m distant from the surrounding wall, etc.) and a view of a natural outdoor environment.	11.4%	**UP**
Hea 07 User comfort control, and maintenance	To recognise the ventilation systems that are easy to control.	Verification of the presence of control tools (manual or automatic) for the ventilation system, regarding ventilation rate and temperature level, and humidity sensors.	8.6%	BP
Hea 08 Ventilation system air intakes and exhausts	To ensure that the asset's ventilation system minimizes external sources of air pollution.	Compliance verification of the location of the air intakes with either EU or ANSI/ASHRAE standards; alternatively, verification of minimum 10 m horizontal distance from the pollution sources of other buildings.	5.7%	BP
Hea 09 Carbon dioxide sensors	Monitor internal conditions to ensure that a healthy indoor environment is provided.	Verification of the presence of sensors that monitor the levels of carbon dioxide in indoor air, of their connection to the ventilation system and of the alert system for the excess of dioxide levels beyond the recommended set point.	5.7%	BP

	Hea 10 Carbon monoxide detection	Protect users from harmful levels of carbon monoxide.	Verification of the presence of a carbon monoxide detection system for the containment of combustion appliances.	5.7%	BP
	Hea 11 Indoor and/or outdoor space	Recognize the provision of outdoor recreational space, promoting community activity.	Verification of the area of recreational indoor and outdoor spaces for residents (min. 25 m^2) and private terraces (min. 4 m^2 per apartment)	17.1%	BP
	Hea 12 Inclusive design	Recognize and encourage assets that are inclusive for all residents.	Verification of the presence of at least 50% accessibility features. The indicators regard: access, horizontal and vertical circulation, sanitary accommodation, orientation, wayfinding, assistive technologies, inclusive spaces.	11.4%	BP
	Hea 13 Radon risk management	Assess radon exposure risk.	Radon test performance according to ISO 11,665 standard [25] series.	5.7%	BP
Transport (7%)	Tra 01 Alternative modes of transport	Verify the sustainable transport measures in the proximity of the site.	Verification of the number of compliant electric charging points and of compliant cycle storage facilities.	39.1%	BP
	Tra 02 Proximity to public transport	Ensure thar public transport is available to building occupants.	Measurement of the distance of public transport nodes via safe pedestrian routes.	34.8%	BP
	Tra 03 Proximity to amenities	Ensure building users have access to local amenities.	Measurement of the distance of amenities via safe pedestrian routes.	17.4	BP
	Tra 04 Cyclist safety	Encourage safe access around the site and outdoor space.	Verification of the presence of safe pedestrian routes from the cycle storage to the entrance of the asset.	8.7	BP
Resources (10,5%)	Rsc 01 Condition survey	Encourage planned maintenance.	Verification of the implementation of a condition survey within the last 5 years and of the detected defects.	38.8	BP

	Rsc 02 Reuse and recycling facilities	Facilitate the reuse and recycling of waste from the asset.	Verification of the availability of suitable facilities for waste storage from the asset near or within the building and suitable neighbourhood recycling.	38.8	BP
	Rsc 03 Resources inventory	Enable asset owners from the value of resources.	Verification of the implementation of a resource inventory in a building information model within the last 5 years.	22.4	BP
Resilience (14.5%)	Rsl 01 Flood risk assessment	Encourage the identification of flood risk and implement mitigation measures.	Verification of the implementation of a flood risk assessment (FRA) by a relevant authority and acknowledgement of the flood risk level assigned to the asset.	26.3	BP
	Rsl 02 Surface water run-off impact mitigation	Avoid rainfall discharge to public sewers, minimizing on-site flooding.	Verification of the measures to minimise the rate of surface water runoff (Drainage; Permeable surfaces; Infiltration trenches; Green or Blue roofs; etc.)	10.5	BP
	Rsl 03 Natural hazard risk assessment	Identify natural hazards and recover capacity.	Verification of the implementation of a risk assessment on current natural hazards by a relevant authority.	21.1%	BP
	Rsl 04 Durable and resilient features	Protect exposed elements of the building from pedestrian traffic and external vehicular collision.	Verification of the presence of suitable protection measures (hard-wearing and easily washable floor finishes; bollards, barriers or raised kerbs; robust external wall construction, up to 2 m high).	21.1%	BP
	Rsl 05 Alarm systems	Ensure that alarm systems can prevent damage to property within the asset.	Verification of the presence of fire and intruder alarm systems and of their certification according to a National or International standard.	21.1%	BP

Land use (4%)	Lue 01 Planted area	Encourage planted areas within the adjacent lot of the asset.	Calculation of the green area footprint and of the percentage of plantations (green walls included).	57.1%	BP
Pollution (9%)	Pol 02 Chemical storage	Reduce the impact of a chemical leak by minimising impact of the building.	Verification of the storage of all hazardous chemicals in areas with containment capacity ≥110% of the chemicals stored.	12.5%	BP
	Pol 03 Local air quality	Reduce local air pollution by using no or low-emission heating and hot water systems in the asset.	Comparison of the emissions of nitrogen oxides, particulate matter or volatile organic compounds of the asset's heating and hot water systems with the limit values (mg/kWh).	25%	BP
	Pol 05 Refrigerant leak detection systems	Reduce level of greenhouse gas by refrigerants leakage.	Verification of the presence of an automated refrigerant leak detection system in place for all equipment.	25%	BP

* Building Performance (BP) or User Perception (UP).

4. Baukultur Criteria in the Declaration of Innsbruck vs. Evaluation Methods

The culture of quality design for living environments contributes to the pursuit of the common good and is the main subject of the conjunct Declaration signed in Davos in 2018 [26], by the Ministers of the States that have joined the European Cultural Convention. The document highlights the need o introduce a high-quality Baukultur at a political and strategic stage. The term "Baukultur" includes every human activity that transforms the built environment, and influences design and construction quality and processes [27].

The Declaration of Davos states that a construction quality culture does not only fulfill functional, technical and economic needs, but also social and psychological needs, and that this should be included in regulatory frameworks. Construction quality has a fundamental impact on the people's behavior and daily life: in fact, it strengthens the sense of belonging and allows users to identify with their living environment, improving integration and civic sense.

More recently, the Declaration of Innsbruck (May 2019) "How to Achieve Quality in the Built Environment: Quality assurance tools and systems", presented at the Conference of the Architects' Council of Europe (ACE), cites the previous Declaration, and marks a further fundamental step to clarify the good practices for the evaluation of quality in the built environment. The ACE Declaration highlights the complexity of this evaluation process with respect to specific factors, among which the context, which is always different: that is, advantageous characteristics in one location can represent disadvantages in a different one. Moreover, the quality of the built environment partly depends on one hand on the perception of the individuals who evaluate it; however, some essential characteristics are indeed inherently associated with attractiveness, with economic, social, environmental, and cultural benefits to individuals and society. The Declaration lists the following essential characteristics for the evaluation of the quality of a place: aesthetics, habitability, environment friendly, accessibility and mobility, inclusiveness, distinctiveness and sense of place, affordability, integration into the surrounding environment.

The ACE declaration also suggests the following principles for the evaluation process: quality must be determined through interdisciplinary discussions, with the involvement of political actors and citizens, through a place-based (taking into account the specificity and the history of a place), holistic (considering all the social, environmental, cultural, and economic impacts) and "live" (the reuse of the existing built environment must be promoted) approach, with more flexible regulatory frameworks.

The evaluation indicators certification standards, analyzed in this paper, can be associated with almost all essential characteristics, yet with a heterogenous incidence (see Table 5, which reports the correspondences between indicators of each certification system, with essential characteristics). Hence, it seems that certification systems are aligned with the ACE criteria–aside from place aesthetics as in each certification system there is at least one indicator per criterion. However, the calculation of the weight distribution in the overall evaluations shows that most indicators evaluate Habitability (40% WELL; 33,5% LEED and 26,7% BREEAM) (see Figure 1a,b) and Environment Friendly (4% WELL; 52% LEED and 50,2% BREAAM). The correlation between indicators and items of the characteristics matches the propension of each certification toward a specific dimension of sustainability: the main goal of BREEAM and LEED is to assess the design of a building allows a high efficiency, a reduced quantity of polluting emissions, and high resistance to climate change during its whole life cycle; WELL attributes a higher weight to the technical characteristics of the building that provide safety, healthiness, and comfort. The analysis of the weight of the indicators shows inhomogeneity between certification systems with respect to Accessibility and mobility (0.5% WELL; 7% LEED and 7% BREEAM), Distinctiveness and sense of place (2% WELL; 0.5% LEED and 0% BREEAM), Affordability (1.5% WELL; 7% LEED and 6.8% BREEAM), and Integration into the surrounding environment (2.5% WELL; 0% LEED e 4.5% BREEAM).

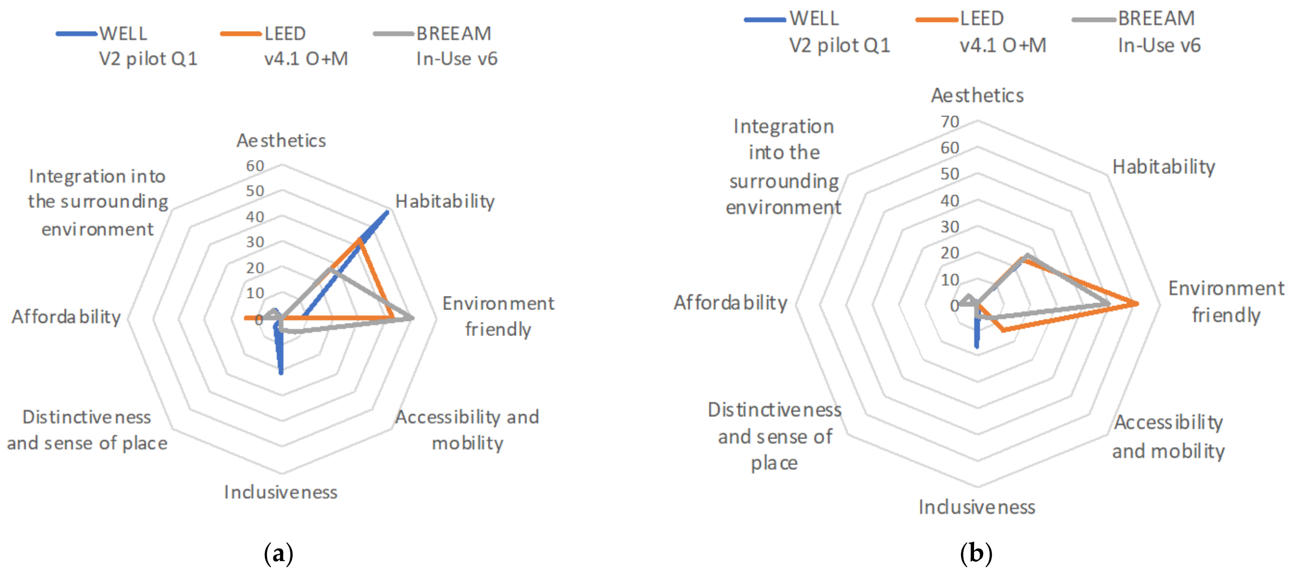

Figure 1. Thematic areas of the certifications, compared to the criteria from the Declaration of Innsbruck 2019 (**a**) Comparison of precondition parameters. (**b**) Comparison of optimization parameters.

Table 5. Comparison between the essential quality characteristics from the Declaration of Innsbruck 2019 and the indicators in quality certifications WELL, LEED and BREEAM.

Criteria	**Description**	**WELL V2 Pilot Q1**	**LEED v4.1 O + M**	**BREEAM In-Use v6**
Aesthetics	The place has an artistic dimension; buildings and cities must be beautiful and exciting.	-	-	-
Habitability	The place has technical characteristics that make it safe, healthy and comfortable. It is well-maintained and provides a feeling of safety.	**A01; A02; A03**; A08; **W01; W02; W03**; W05; W09; **N01; N02**; N07; N12; **L01; L02**; L04; L08; **T01**; T02; T03; T06; **S01**; **X01; X02**; X14; X15; C18	**EQ.1; EQ.2; EQ.3**; EQ.4; EQ.5; EQ.6	Hea 01; Hea 02; Hea 03; Hea 05; Hea 06; Hea 07; Hea 08; Hea 09; Hea 10; Hea 13; Rls 01; Rls 02; Rls03; Rls 04; Rls 05
Environment friendly	The place is designed to be low-carbon, energy-efficient and resilient to climate change throughout its life-cycle.	**A04; X03**	WE; **EA.1; EA.2**; EA.3; EA.4; **MR.1**; MR.3; MR.4	Rsc 02; Pol 01; Pol 02; Pol 03; Pol 04; Pol 05; Ene 01–18; Wat 01–10
Accessibility and mobility	It is easy to move using public or soft transports (walking, cycling). The distribution of volumes and spaces is straightforward.	V09	LT	Tra 01; Tra 02; Tra 03; Tra 04
Inclusiveness	The place is designed for all: everyone, regardless of age, gender and ethnicity must feel welcome.	**V01; V02**; V06; V08; **M01**; M07; **C01; C03**; C04; C07; C11; C13; C15; C16	-	Hea 11; Hea 12
Distinctiveness and sense of place	The place is specific, fitting the local context, has distinctive characteristics and a sense of place.	**C02**	IN	-
Affordability	There is a strong compatibility of the programme with the place and the budget of the user.	C17	**MR.2**	Rsc 01; Rsc 03
Integration into the surrounding environment	The place is integrated into its built, natural and cultural environment in a harmonious and coherent manner.	**M02**; M09	-	Lue 01; Lue 02

Inclusivity (18.5% WELL; 0% LEED and 4.8% BREEAM) is one of the main purposes of WELL for the achievement of the main goal of health and well-being; the focus on the Design for all, which is present in several criteria within the evaluation process, clearly shows that. The abovementioned percentages have been calculated according to the mean of the values of the precondition and optimization parameters. The value leads to acknowledge a gap between European theoretical systems, synthetized in the Declaration of Innsbruck, and the real evaluation tools in use. This shows the need for a harmonization, considering the vast use of certification systems and the economic interests associated with them within the real estate market.

5. Conclusions

The literature review has shown a wide agreement regarding the influence of living environments on people's well-being; however, the evaluation and the realization of healthy and comfortable buildings can be a complex task for administrations and professionals. Building certification standards assist designers in taking into account aspects related to sustainability, and orient interventions toward technological solutions that increase living comfort. Moreover, certifications influence choices in the real estate sector, by guaranteeing valid design choices and a correct management; from the collectivity's standpoint, they are a conventional declaration of building quality. High-quality built environments raise interest and attract investors; stakeholders' appreciation toward certified buildings is reported in recent research. For example, the real estate value can increase by 7–11% as a function of the judgement of LEED evaluation; the certification does not affect only market value, but also the time-to-market [28].

The most diffuse building sustainability certification protocols, which have been examined in this paper, are WELL, LEED and BREEAM: their evaluation criteria consider design, construction and management from an environmental, economic and social standpoint, and in relation to well-being, yet in different ways and with different weights. Apart from the individual differences of the three examined standards, mostly related to the rating systems, all of them are based on hard data, and mainly evaluate building performances. The constant reference to international standards orients the evaluators toward the collection of measurable performance parameters, to be compared with those fixed by regulations. This is particularly related to environmental aspects (energy and resource consumption), and as a consequence a smaller focus is given to social sustainability, and even a smaller one to users' survey.

A useful evaluation must effectively respond to stakeholders' needs; however, the stakeholders are a multitude, with diverse interests, objectives, restrictions, and preferences, and they all require a specific, non-assimilable evaluation perspective [29]. Discussing and sharing design choices with users, through iterative and interdisciplinary processes, can lead to unstandardized, customized participative solutions, with a stronger grip on users' interests.

In such evaluation processes, users' involvement can be defined as "passive": that is, users are sensibilized, receive information on environmental parameters, and services that fulfill their daily needs. However, the collection of their opinion (user experience) is still a scarcely pursued path (in the examined standards, in the overall evaluation: 11% precondition parameters in WELL, 10% optimization parameters in WELL; 0% precondition parameters in LEED, 28% optimization parameters in LEED; 10% BREEAM) (see Figure 2a–d). For example, parameters regarding health rarely involve user perception, which could be helpful to avoid pathologies such as Sick Building Syndrome; instead, the highest weight is attributed to contaminant measurement, to the verification of ventilation technologies that determine indoor air quality and to the relationship with outdoor spaces.

Concerning "passive" involvement actions, WELL has the highest number of indicators, specifically aimed at users' well-being and health: for this reason, it often integrates the other two certification systems through the so-called "crosswalk" plans to harmonize evaluations.

Figure 2. Weight of "user experience" in the examined standards, in the overall evaluation. (**a**) Comparison of WELL V2 pilot Q1 precondition parameters. (**b**) Comparison of WELL V2 pilot Q1 optimization parameters. (**c**) Comparison of LEED v4.1 O + M optimization parameters. (**d**) Comparison of BREEAM In-Use parameters.

Furthermore, in none of the three certification protocols there is an interrelation between some of the analyzed factors: for example, the light which is linked to the external and internal shading and partly affects the temperature and humidity.

There are some cultures that use housing only for sleeping and some that live most of the year inside the buildings. This is another aspect that the protocols do not investigate, and which is closely related to the user. Moreover, depending on the "time of confinement "some aspects should have a greater weight than others.

Moreover, all three certification standards share a limited applicability on the most diffuse typology of built environment, that is modern buildings in reinforced concrete. These buildings are far from the concept of environmental sustainability, as they have null energy performances; lack economic sustainability since they require a continuous maintenance on materials; are often located in dense and overcrowded areas, and this has a strongly negative effect on social sustainability. Through aimed restoration interventions, these buildings could host high-quality spaces; however, the presence of excessively restrictive compulsory requirements–as shown by some of the criteria in the examined evaluation processes–excludes the possibility to valorize these buildings in the future. As an example, a residential building might hardly have a specific plan for legionella; in most cases, it is rare to find common areas for sport activities, for the in situ cultivation of biological products or for the local conversion of waste into resources. Presumably, the regeneration of this heritage could be effectively encouraged by adapting the base level of the certifications to the maximum potential of the existing building stock through customized solutions, more oriented toward final users' needs, than to standardized parameters that involve complex technologies.

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