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Pursuing the SDG11 Targets: The Role of the Sustainability Protocols

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Abstract: This paper is built on the following research questions: (i) What are the direct/indirect relationships between Sustainable Development Goal 11 (SDG11) and sustainability protocols? (ii) Could the sustainability protocols constitute a solution towards the achievement of SDG11? We underline that, on the one hand, the SDGs are guidelines to support the development of sustainable policies and thus address all elements that may affect them, and on the other hand, sustainability protocols are assessment tools to promote sustainability-conscious design while remaining focused on the built environment. In the Italian regulatory context, the paper highlights how this difference in terms of focus and scale means that they only overlap and mutually reinforce each other with regard to certain aspects, more related to energy and air pollution issues and less to the social aspects of sustainability. Even if there is not always a direct relationship between the evaluation criteria of the protocols and the indicators of SDG11, it is possible to conclude that the sustainability protocols can facilitate the achievement of the SDG11 targets, acting as a key for the implementation of sustainable cities and helping in structuring the process leading to sustainability in a broader framework.

Keywords: SDGs; SDG11 indicators; evaluation criteria and indicators; sustainability of cities; evaluation of urban sustainability; Italy

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1. Introduction

The need for sustainable development arises from an existing implicit conflict between the fast pace of human transformations and the slow pace of renewal of environmental resources [1]. This conflict is particularly evident within cities, where most of the transformations are carried out, making them the places where the challenge towards sustainability is both difficult and essential [2].

Moreover, the current COVID-19 pandemic is exacerbating these challenges by highlighting the shortcomings of the current economic system, which is rightly described as unsustainable in several respects [3–5]. Accordingly, many researchers are seeing the COVID-19 pandemic as a rare opportunity to build up a long-term resilient economic recovery. In order to achieve this objective, critical actions need to be taken that not only focus on safeguarding national economies during crises but also chart the course for broader economic transformation [3].

In order to design harmonious cities that can play a role in improving the quality of life of their inhabitants, the Ellen McArthur foundation [6] identified 10 policy levers the city governments can put into play. These are related to vision, engagement, urban management, economic incentives and regulation [6]. Among the "economic incentives" lever, one of the key actions suggested is a more widespread use of the protocols used to design, assess and certify the construction sector sustainability of both buildings and districts [7,8] through a series of performance indicators. In fact, in many countries the protocols are not normatively regulated; they are based on voluntary work and there are no charges or tax incentives to encourage the adoption of such programs in Italy. Despite

that these could be powerful tools for sustainability, being able to regulate a new approach to materials and long-term sustainable values, their use is often relegated to the assessment of large-scale urban interventions while their application in small-scale transformations is often ignored [9].

The importance of creating responsible consumption and production and taking a new approach to materials and values is also stressed by the international sustainable development policy of the 2030 Agenda [10,11], which established 17 Sustainable Development Goals (SDGs) [10] aimed at measuring and monitoring the sustainable development progress all over the world [7].

In this framework, the SDG11 "Make cities and human settlements inclusive, safe, resilient and sustainable" is of particular interest, considering cities not only in demographic terms, but also as the main containers of transformation processes in relation to the exploitation of resources useful to launch global development [10] through an assessment framework based on the use of indices and indicators. Accordingly, the construction sector plays a crucial role in the challenge of SDG11, considering the complex relationship between the human need for space and the limitation of this resource [12].

Despite that the sustainability protocols highlighted by the circular economy concept and the SDG11 have common theoretical origins and aim to pursue similar sustainability objectives, the formal relationships between them are alluded to but often not explicated [13]. The scientific research focusses more on the importance of the role of the construction and energy sector towards the pursuit of Agenda 2030 in a broader sense [14–16], never underlining the existence of a correlation between the assessment of building sustainability through sustainability protocols and the pursuit of SDG11 targets, considering how it can facilitate the achievement process.

Accordingly, the requirement of sustainability in buildings is very often reduced only to environmental or energy aspects, rather than to the identification of a good balance between the different elements related to the environmental, social and economic spheres of the sustainability concept, which reside in the SDG11 framework. This can be ascribed to an unclear and universal procedural reference in the assessment able to understand all aspects for the pursuit of sustainability in a building intervention and to a confused normative reference, especially considering the Italian case [12].

Focusing on the Italian context, this paper is built on the following research questions:

(i) What are the direct/indirect relationships between SDG11 and sustainability protocols?
(ii) Could the sustainability protocols constitute a solution towards the achievement of SDG11?

After this introduction, the paper is organized as follows: Section 2 briefly describes the context of both SDGs and protocols; Section 3 provides a cross-analysis of the two topics which are then discussed in Section 4; Section 5 concludes the paper by clarifying the main findings and tracing a path for the future.

2. Setting the Context: SDGs and Protocols

2.1. SDGs

In the current century, cities have been affected by new challenges that require a search for new solutions [8].

Accordingly, the 2000 Millennium Development Goals (MDGs) established during the United Nations Millennium Declaration [17] seemed inadequate to intercept the new changes taking place in the global scenario [10,18].

Hence, within the policy document resulting from the 2012 World Conference on Sustainable Development [19] the progress towards global sustainable development were verified, agreeing to sign new goals that could better address the challenges that each country in the world was facing by establishing a more inclusive definition process involving all UN members [10,20].

Moreover, the involvement of the private sector was needed to define the new goals to be achieved, considering its important role in the pursuit of environmental and social performance within the chain in which it operates [18].

The result of this process culminated with the adoption of the 2030 Agenda for Sustainable Development [21], which included 17 Sustainable Development Goals (SDGs) addressing environmental, political and economic issues, each consisting of specific interlinked targets and several indicators in order to monitor progress towards sustainable development [7].

Actually, the SDGs framework of Agenda 2030 outlines a reference of global guidelines which is not compulsory but helpful in supporting policy development at lower scales, down to the local level of cities [20].

Accordingly, and especially through the SDG11 which aims to make cities inclusive, safe, resilient and sustainable, the 2030 Agenda recognized the important role of cities as the main places where social, economic and environmental inequalities prevail, especially considering the exploitation of resources, making them key elements towards sustainable development [22].

In this perspective, the SDG11 of the 2030 Agenda is the result of a process that starts at the global level in the search for sustainable development in a broader sense, which has increasingly evolved to recognize the key role of cities [23], providing a comprehensive reference model for the pursuit of sustainable development addressing several interlinked issues, with a focus on urban sustainability [24].

The SDG11 consists of an assessment framework including targets and indicators, which have been revised since the original version of 2015 and are diversified by the competent bodies with respect to three scales of application in their latest version updated in 2020: global, European and national [7]

At the global level, the SDG11 assessment framework proposed by the Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs) identifies 14 indicators divided into 10 targets [25]. At the European level, the statistical office of the European Union Eurostat proposes 10 indicators appropriately aligned to the global ones, but better captures the European dynamics, while leaving the 10 targets identified at a global level unchanged [26]. Finally, at the national Italian level, in the latest Annual Research Report [27], within which statistical information of each year is collected for the 2030 Agenda, the national statistical institute—ISTAT—shows an expansion of the SDG11 indicators up to 30, while including 8 out of 10 targets defined at the global level. The ISTAT statistical indicators are developed by adapting the global development model to the context of Italy, also taking into account the availability of data for monitoring purposes [7].

2.2. Sustainability Protocols

In parallel to the global concern about the overall sustainability of the planet, a more focused ecological consciousness has emerged. The new needs highlighted at the global level by the Kyoto Protocol of 1997 developed an ecological conscience [28] with regard to design, leading to the awareness of the crucial role of the construction sector in the challenge towards sustainable development of cities, considering the complex relationship between the human need for space and the limitation of this resource [12].

Indeed, the integration of the concept of sustainable development in the design and construction sector [28] has improved the research activity in the field of assessing the environmental performance of buildings. In fact, the significant impact of buildings on the environment and people's lives in cities is progressively recognized, as is stimulating the interest in outlining tools for assessing the sustainability of buildings [29].

In this framework, the private research organization Building Research Establishment (BRE) developed the so-called "Building Research Establishment Environmental Assessment Method" (BREEAM) in 1990 in the United Kingdom, considered as the first sustainability protocol [30]. Subsequently, in 1993 the United States Green Buildings Council (USGBC) launched the Leadership in Energy and Environmental Design (LEED)

protocol, which quickly became a worldwide success and is actually the most widely used sustainability protocol [29].

Despite these first protocols having been developed with the aim of intercepting the specific sustainability needs of the territories where they were born, they are currently successfully applied all over the world, acting as a driving force for the fostering of further protocols which are often national extensions of these two.

In fact, at the start of the current century an increasing number of sustainability protocols were developed. In particular, in Italy the Green Building Council Italia (2009-GBC Italia) [31], the protocol of the Institute for Innovation and Transparency in Procurement and Environmental Compatibility (2004-ITACA) [32] and the protocol of the CasaClima Agency-KlimHaus (2002-CasaClima) were born [33].

The sustainability protocols have been conceived as voluntary assessment tools useful as design support tools for professionals, guidance tools for Public Administration (PA), choice support for the consumer and a means of enhancing the value of an investment for financial operators [34,35]. Moreover, the sustainability protocols aim at spreading the culture of sustainable construction, ensuring and evaluating the application of strategies to reduce environmental impact in the construction sector through a rating system [28,29,36].

Originally, the aforementioned sustainability protocols focused on achieving efficient energy performance in buildings, driven by the principle of the World Conservation Strategy [37] according to which the concept of sustainability was combined with energy saving and efficiency in resource exploitation [29].

However, during the first decade of the 2000s there was a change of perspective in the global scenario that emphasized the multidimensionality of the unsustainability of cities [38], bringing environmental, social and economic issues progressively into the framework of sustainability protocols [30,39].

While always maintaining their voluntary basis, the sustainability protocols have evolved over the last 30 years from a focus on saving energy resources from an environmental perspective to developing a more holistic assessment framework, which includes several criteria in order to measure various sustainability aspects and provide good quantitative and qualitative performance [40]. Moreover, in recent years the sustainability protocols have evolved to include a wider portion of territory in their assessment. In fact, the interest of the sustainability protocols has been enlarged to include not only single buildings but also the district and the city [38] (Figure 1).

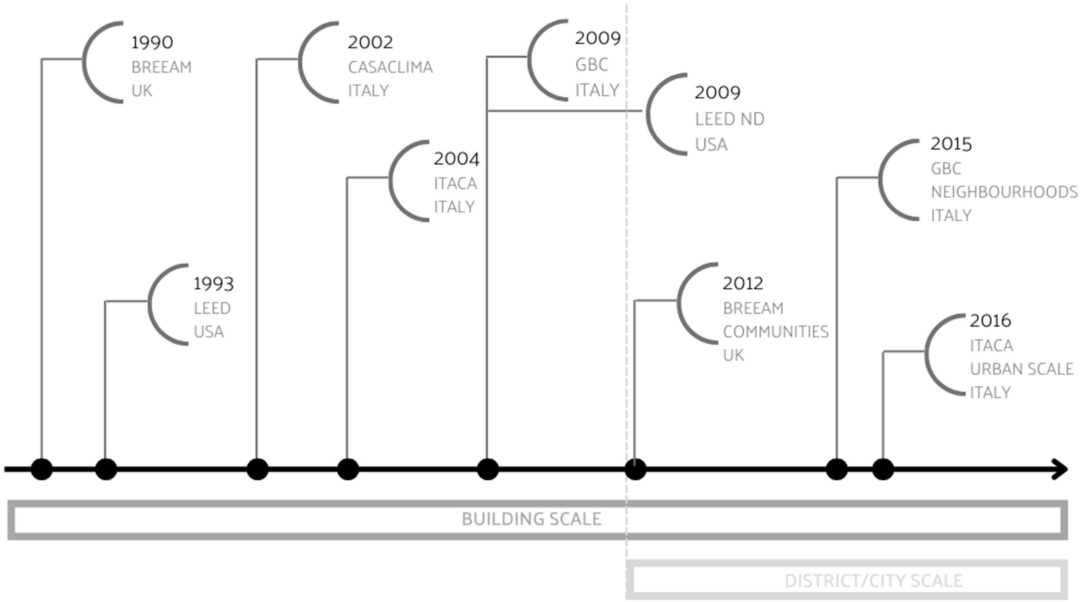

Figure 1. Broadening of sustainability protocol scale since their implementation.

Accordingly, Figure 1 shows how the scale of sustainability protocols has progressively expanded since the first decade of the 2000s. Considering the first sustainability protocols implemented, the LEED protocol in the United States of America found its expansion at the neighborhood scale through LEED for Neighborhood Development (LEED ND) in 2009, followed three years later by the BREEAM Community protocol in the United Kingdom. This is also underlined within the Italian context where in 2015, alongside the already existing sustainability protocols at the building scale, the broader scale protocol GBC was developed, followed by the ITACA Urban Scale protocol in 2016 (Figure 1). The rationale for this expansion of scale in the application of sustainability protocols can be imputable to the need to intercept the current challenges contemporary cities are facing in terms of urbanization [38], which require adequate planning and intervention tools able to apply a broader scale assessment system in order to provide a useful support in planning [41]. Moreover, the growing need since the 2000s for a useful reference in measuring all aspects of sustainability led to an awareness that the building scale was too limited [40,42,43] considering the broader sustainability concept that can only be implemented at a larger scale [43].

In this perspective, the new challenges facing cities in recent years which have led to the need for the development of the SDGs have also led to the evolution of sustainability protocols from tools for assessing the environmental impacts of buildings, to helpful tools to assess environmental, ecological and social quality within the construction sector [29,30,36]. This stresses a similarity in the process that led to the need of the SDGs and the evolution of sustainability protocols (Table 1).

Table 1. Sustainable Development Goals (SDGs) and sustainability protocols main characteristics.

	SDGs	**Sustainability Protocols**
Birth/Development	2015 (preceded by the MDGs born in 2000)	1990
Aim	Support sustainable development policies implementation	Promote sustainability-conscious design
Character	Guidelines	Assessment tools
Reference scale	Global, European and national	National
Sustainable development themes addressed	Environment; Society; Climate action; Resource consumption; Sustainable design; Managerialism; Well-being; Economy; Governance; Poverty and hunger; Health;	Environment; Society; Climate action; Resource consumption; Sustainable design; Managerialism; Well-being
Regulatory value	Voluntary	Voluntary

Table 1 highlights the main characteristics of SDGs and sustainability protocols. Although the sustainability protocols were developed in 1990 and the SDGs in 2015, the latter consist of an implementation of the existing MDGs developed in 2000 (Table 1) but resulted from a process that started in 1992 during the United Nations Conference on Environment and Development (UNCED) [44,45]. The need to find new solutions for the new challenges facing cities in the current millennium led to a change in route with the SDGs [1], considered as an evolution of the MDGs with the aim to better address the new issues in terms of sustainable development [46].

With the same logic during the first decade of the 2000s, a new generation of sustainability protocols were born, representing an evolution from the first ones developed during the 1990s (Table 1).

Accordingly, coinciding with the emergence of the SDGs in the first decade of the 2000s the sustainability protocols were also strongly implemented [29] in terms of contents on one hand, shifting the focus from the sole energy saving to more integrated aspects including economy and society, and in terms of scale on the other hand, expanding the application to the district and the city, driven by the awareness that the single building scale would not be sufficient to include all the multidimensional aspects related to the broader concept of sustainability [40,42,43].

However, despite this implementation, in terms of the sustainable development themes addressed, the sustainability protocols consider a narrower range of aspects compared to the SDG framework which addresses more sustainability issues than the sustainability protocols. Nevertheless, this may be due to the fact that the sustainability protocols highlight a specific focus on the sustainability of the built environment [36], whereas the SDGs takes sustainability into account in a more theoretical and broader sense [47].

Accordingly, considering the sustainable development themes addressed (Table 1), the sustainability protocols find affinity specifically with the SDG11, which through its targets deals with the sustainability of cities and urban systems [24].

Moreover, Table 1 underlines that on the one hand the SDGs are guidelines to support the development of sustainable policies and thus address all elements that may affect them, and on the other hand sustainability protocols are assessment tools to promote sustainability-conscious design, while remaining focused on the built environment.

In addition, the SDGs and the sustainability protocols have both voluntary and normative value, although they show some differences regarding the reference scale, which goes from global to European to national considering the targets and the indicators of the SDGs, while the sustainability protocols are developed at the national level considering specific local peculiarities, even though they are often exported and adapted from one country to another [48,49].

2.3. The Sustainability Protocols in Italy: Structure, Differences and Peculiarities

The most widely used sustainability protocols in Italy are: the LEED protocol in its Italian version of the GBC Italia [31], the ITACA protocol [32] and the CasaClima protocol [33,50].

The general objective of these sustainability protocol is twofold: (i) to spread the culture of sustainable building; (ii) to compare and examine the application of strategies for reducing energy and environmental impact in the construction sector [35,48,51]. The general configuration of the protocols is similar, presenting an initial introduction to the protocol's purpose, then providing guidelines for its application and an explanation of the evaluation methodology.

Moreover, the main evaluative structure of the analyzed sustainability protocols is similar, providing a hierarchical model [40] that conceptually includes macrothemes/areas, criteria, which deepen the macrothemes/areas and indicators, which can be quantitative but also qualitative. Accordingly, the first elements of the hierarchical model are conceptually the macrothemes/areas, which focus on the main topics covered within the sustainability protocol and which are subsequently deepened in the subsequent levels, until arriving at the indicators, which represent the last element of the hierarchical model and the quantities to which the evaluation starts [40].

The GBC Italia protocol is voluntary, and it is extended according to the type of building to be certified and the spatial reference of application, including four classifications: GBC Home for residential buildings; GBC Neighborhoods; GBC Condominiums; GBC Historic Buildings (Figure 2).

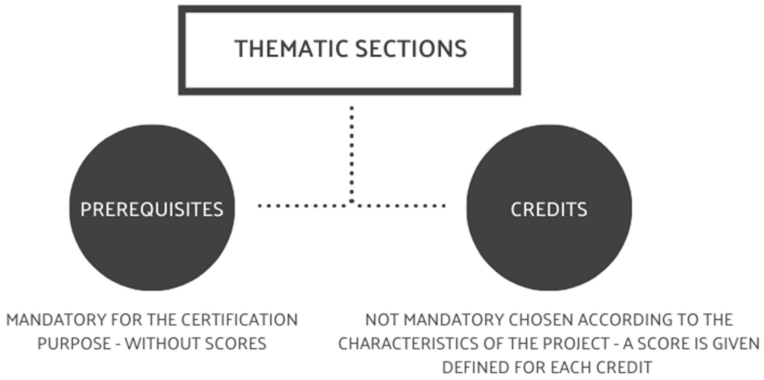

Figure 2. The GBC Italia protocol assessment framework.

Figure 2 shows that the main elements of the GBC Italy protocol assessment framework are the thematic sections, which change in terms of content and number depending on which category of the protocol is considered (e.g., the GBC Home protocol contains seven thematic sections). Each thematic section contains prerequisites and credits, which also vary in content and number according to the classification considered (e.g., the GBC Home protocol contains seven prerequisites and 26 credits). The prerequisites represent mandatory elements to be considered in order to obtain the certification, while the credits are not mandatory but are considered on the basis of the characteristics of the project (Figure 2). In addition, prerequisites are not given a score, unlike credits which are given a score based on certain requirements defined within the credits themselves.

Accordingly, from the sum of the credit scores derives the certification level obtained, which is in a range between 40 and 110 points and allows for certification on an increasing scale: base, silver, gold or platinum.

The ITACA protocol is also voluntary and it is expanded according to the type of building and spatial reference, including three main classifications: ITACA for residential buildings; ITACA for nonresidential buildings (industrial, commercial, educational, office and hotel buildings); ITACA Urban Scale.

The evaluation model of this protocol is strongly dependent on the regional territorial context to which it is applied and therefore its elements change according to the different regions within the Italian territory (Figure 3).

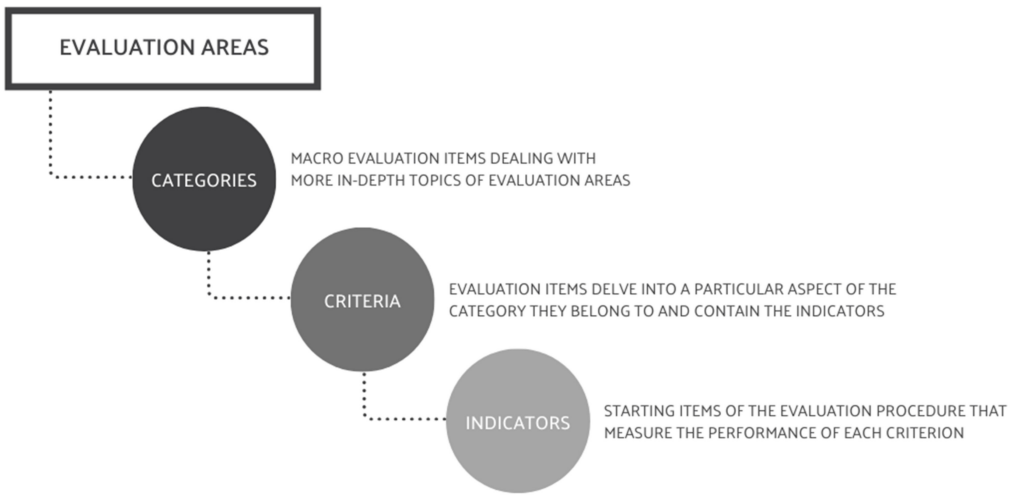

Figure 3. The ITACA protocol assessment framework.

Figure 3 shows how, similar to the GBC Italia protocol, the evaluation areas of the ITACA protocol are the main elements on which the evaluation is based, which change in

content and number when considering the region of application and not according to the classification of the protocol. Each evaluation area contains the following elements: the categories, dealing with a more in-depth related topic; the criteria, dealing with a particular aspect of the category considered; the indicators, which evaluate the performance of each criterion (Figure 3). The categories, the criteria and the indicators change both in relation to the region of reference and to the classification of the protocol. In fact, these three elements differ both in number and in contents when considering, for example, in the Piedmont region the ITACA for residential buildings, with 17 categories, 28 criteria and 28 indicators or the ITACA for nonresidential buildings, with 20 categories, 31 criteria and 31 indicators.

The evaluation procedure starts from the indicators contained in each criterion, to which an absolute value is attributed on the basis of comparison with certain reference performances identified in the normative framework and local building practice according to the region of application. The values of the indicators are then normalized in a range from −1 to +5. Subsequently the scores are aggregated creating the final score of each criterion. The scores of each criterion are then aggregated to form the final score of each category and the aggregate scores of each category form the overall score, which ranges from −1 to +5, where 1 and 2 are, respectively, slight and moderate improvements over 0, which is the standard performance, and 4 and 5 show, respectively, moderate and advanced increases, compared to 3 which overlaps the best practice.

Differently from the previous two protocols illustrated, the CasaClima protocol is compulsory in the Autonomous Province of Bolzano and voluntary in the rest of the national territory. It is extended according to the type of content and to the type of building. In fact, while the CasaClima Plus certificate relates to energy certification, CasaClima Nature contains environmental impact criteria, although both concern residential buildings. Moreover, further classifications according to the type of building include: the CasaClima Hotel; CasaClima Work&Life, which relate to buildings in the service sector; CasaClima School; CasaClima Wine, with a focus on wineries in the wine production chain.

Figure 4 shows how the main elements of the CasaClima protocol assessment framework are the evaluation areas, which change in terms of content and number depending on which classification of the protocol is considered (e.g., the CasaClima Nature protocol contains six areas). Each evaluation area contains requirements and indicators, which also vary in content and number according to the classification considered (e.g., the CasaClima protocol contains 13 requirements and 15 indicators). The requirements correspond to specific elements to be observed and analyzed in order to obtain the certification. In particular, each evaluation area can contain more than one requirement, but at least one must be met in order to obtain the certification (e.g., in the CasaClima Nature protocol the evaluation area "Natural lighting" has three requirements and at least one must be met). The indicators relate to the characteristics of the building (Figure 4) and report a value based on the parameters given by the protocols with reference to the evaluation area to which the indicator corresponds.

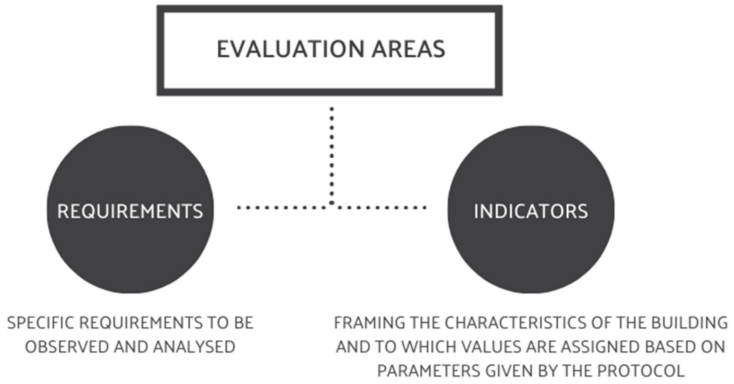

Figure 4. The CasaClima protocol assessment framework.

Accordingly, the score of each evaluation area is given by the sum of the values of the indicators. Consequently, the sum of the evaluation areas performs the overall certification score, which is divided into performance classes in relation to the degree of energy consumption of a building and goes from classes A to F, where C represents the minimum standard and class Gold the exemplary performance exception.

The GBC, ITACA and CasaClima protocols undoubtedly show some similarities.

First, they show similar structures of their assessment frameworks. Each framework is in fact structured into thematic areas that include some elements of evaluation used in different ways according to the specific protocol (thematic session in the GBC and evaluation areas in ITACA and Casa Clima) but conceptually representing the main criteria on which the evaluation is based and to which a score must be assigned according to a reference scale provided by the protocol itself.

Second, the assessment model relates to a scoring certification system, in which the protocol's certifying body defines a series of factors for which a score is obtained that makes it possible to measure performance of the different classifications according to the type of building (residential, schools, historic buildings, hotels). In fact, depending on the type of building the criteria of the sustainability protocols differ slightly to better capture the peculiarities of the intended use.

Despite the similarities in the structure and in the certification system, the GBC, ITACA and CasaClima sustainability protocols show some differences.

In fact, with reference to the spatial application, the GBC protocol is the most comprehensive, ranging from the single building to the city district scales, with even a particular classification for historic buildings [28,32]. The ITACA protocol does not present the district scale but the individual building and city scales [28], while the CasaClima protocol only focuses on the single building scale, differing in its classifications only by type of building and not by spatial application.

Finally, although the GBC and ITACA protocols are voluntary, the CasaClima protocol is compulsory for the Autonomous Province of Bolzano while it is voluntary for the rest of the national territory [52]. However, although the ITACA sustainability protocol is not nationally compulsory, it relies on the Reference Practice developed by the Italian Normative Institution (UNI) and ITACA on "Environmental Sustainability in Construction" [32], which is a document that is not normative but rather regulatory and prescriptive. Moreover, The ITACA protocol also has an aspect related to the regional level: each region in fact provides for its approval and updating.

The advantages provided by the adoption of the sustainability protocols are many: improve the collaboration among actors, control the design process, pursue sustainability objectives, reduce building maintenance costs, lower energy consumption, having access to financial benefits, increase the overall value of the building as a function of better building quality [34,35]. However, it should be underlined that the sustainability certifications in Italy are still not perfectly framed at the regulatory level. In fact, despite the existence of the mandatory energy certification from 2015 regulated within the Presidential Decree 380/2001 and Law 63/2013, the sustainability protocols are placed as voluntary instruments at the discretion of individuals.

Accordingly, the only normative reference at the national level resides within the "New Procurement Code", developed in 2016 [53]. Here, the integration of energy and environmental sustainability requirements in projects is considered a competitive element for the application of the criterion of the choice of the most economically advantageous offer for choosing who to contract for public works [53]. In fact, considering the life cycle of buildings the application of these criteria entails significant savings in management [54]. However, with regard to charges or tax incentives arising from the application of sustainability protocols, there is no national reference regulatory system, and this is demanded by the individual regions [55], thus creating a fragmentation and an absence of a unified body of national reference regulation.

3. Results

Despite the SDG11 having a large-scale goal with regard to cities, its targets and related indicators focus not only on the urban but also on building scale, such as the indicators of the Target 11.1 on affordable housing, which assesses the percentage of people who live in homes with structural, overcrowding and noise problems [7]. Similarly, the evaluation criteria of the most widely used sustainability protocols in Italy focus mostly on the building scale, but also include categories at the urban and district scales, showing an affinity with the targets and related SDG11 indicators.

This paper adopted an analytical approach to highlight the existence of formal relationships [56] between the evaluation criteria of the most used sustainability protocols in the Italian context and the SDG11 indicators at the national level. Therefore, the GBC Italia, ITACA and CasaClima sustainability protocols were analyzed in detail according to a cross analysis [56] that considered the ISTAT SDG11 indicators. All the classifications of the sustainability protocols focusing on the building, district and urban scales were considered, leaving aside those overly specific classifications considering particular types of buildings, such as schools, historic buildings and hotels.

The sustainability protocols considered in the research are the following:

(i) GBC
   1. Neighborhoods;
   2. Home;
   3. Condominiums.

(ii) ITACA
   1. Urban Scale;
   2. Residential Buildings.

(iii) CasaClima
   1. Nature;
   2. Plus.

The process that defined the existence of a relationship between the evaluation criteria of the sustainability protocols analyzed and the SDG11 indicators was divided into two main steps summarized below.

3.1. Existence of a Relationship between the Evaluation Criteria of the Sustainability Protocols and the SDG11 Indicators

First, in order to highlight the existence of a relationship between the SDG11 indicators and the evaluation criteria of the sustainability protocols, starting from the study of the 30 indicators of SDG11, 30 keywords have been identified (see "Attached 1" in Supplementary Material) considering the following cases:

(i) one SDG11 indicator can correspond to several keywords. For example, the indicator "Percentage of people in homes with structural problems or moisture problems" is related to both structural and mold problems, therefore the two keywords "Structural problems" and "Moisture problems" correspond to this indicator;
(ii) one keyword can correspond to several SDG11 indicators. For example, the keyword "Public transport" relates to the indicators "Families by level of difficulty in connecting to public transport in the area where they live" and "Students who routinely travel to the place of study by public transport only".
(iii) two keywords may be similar but have necessary specifications to be searched for within the SDG11 indicators. For example, the keywords "Air quality PM10" and "Air quality NO2" measure specificities in air quality, related, respectively, to particulate matter and nitrogen dioxide. Therefore, it would be inaccurate to consider the keyword "Air quality" alone.

Second, all the 30 keywords of the SDG11 indicators were searched within the evaluation criteria of the sustainability protocols, considering therefore the GBC Neighborhoods,

Home and Condominiums protocols, ITACA Urban Scale and for residential buildings protocols and CasaClima Nature and Plus protocols.

From the analysis it was found that 8 keywords out of 30 have explicit relationships with the evaluation criteria of the sustainability protocols analyzed (Table 2) and relate to nine SDG11 indicators. In fact, the keywords "Air quality PM10", "Air quality NO2", "Temperature" and "Green areas" each correspond to a specific, single indicator of SDG11, while the keywords "Public transport" and "Exposure to flood risk" each correspond to two different SDG11 indicators and finally the keywords "Moisture problems" and "Structural problems" both coincide with the same SDG11 indicator (see the "Attached 1" in Supplementary Material)

Table 2. Explicit relationships between the Sustainable Development Goal 11 (SDG11) indicator keywords and evaluation criteria of sustainability protocols.

Keywords	GBC			ITACA		CasaClima	
	Neighborhoods	**Home**	**Condominiums**	**Urban Scale**	**Residential Buildings**	**Nature**	**Plus**
Moisture problems		Ventilation and moisture control systems					
Structural problems			Structural optimization				
Public transport	Access to public transport			Access to public transport			
Exposure to flood risk				Trend reduction in population exposure to flood risk			
Air quality PM10			Air quality Air quality during the construction phase				
Air quality NO2				Air quality monitoring	Air quality and mechanical ventilation	High quality air and low-emission materials	
Temperature					Temperature during summer season		
Green areas		Rainwater and maximization of green areas		Availability of green areas			

Table 2 shows that the keyword "Air quality NO2" has the highest number of explicit relationships within the evaluation criteria of the sustainability protocols, related to the GBC Condominiums protocol, the ITACA Urban Scale and the residential buildings protocol and the CasaClima Nature protocol, thereby covering at least one category for each sustainability protocol considered. Actually, the sustainability protocols consider the strong impact of the construction sector on the environment as fundamental—in particular those issues related to air quality and greenhouse gas production—as well as the impact that the built environment has on cities in terms of increasing global warming [9,29,57,58]. Accordingly, among the evaluation criteria of sustainability protocols, particular attention is paid to air pollution, especially with reference to greenhouse gases and pollutants derived from both vehicular traffic and construction activities, such as nitrogen dioxide and particulate matter.

The keyword "Public transport" underlines three explicit relationships within the evaluation criteria of the sustainability protocols (Table 2) in relation to the GBC neighbor-

hood protocol and ITACA Urban Scale and for residential buildings protocols, covering 3 classifications out of 7 of the sustainability protocols considered similarly to the "Green areas" keyword which relates to the GBC Home and ITACA Urban Scale protocols.

Table 2 also underlines that the keywords showing the lowest number of explicit relationships with the evaluation criteria are, respectively, the "Moisture problems" related to the GBC Home protocol, the "Structural problems" within the GBC Condominiums protocol, the "Flood risk exposure", which refers to the ITACA Urban Scale, and "Temperature", related to the ITACA for residential buildings.

Moreover, it is interesting to note that the keyword "Green areas" shows an explicit relationship with the GBC Home protocol which focuses mainly on the building scale, not only on the urban classification ITACA Urban Scale, underlining that also within a building scale protocol the attention can be paid to the outdoor urban environment (Table 2).

3.2. Classification of the Relationship

Since explicit relationships were found, the next step was to underline any implicit relationship between the SDG11 indicators and the evaluation criteria of the sustainability protocols considered, understanding if they measure the same thing, although there is not a direct correspondence with an identified keyword.

Accordingly, within each evaluation criterion of the sustainability protocols the concept expressed by each SDG11 indicator was searched for using, for example, the following process: the keyword "Homes with noise problems" associated with the SDG11 indicator "Percentage of people in homes with noise problems from neighbours or the street" ("Attached 1" in Supplementary Material) showed no explicit relationship with the evaluation criteria of the sustainability protocols; however, the GBC Neighborhoods protocol provides the "Acoustic climate" among its evaluation criteria, which is aimed at measuring acoustic comfort as well as the SDG11 indicator.

Therefore, despite the nonexistence of a direct correspondence considering the keywords of the SDG11 indicators, this second step of the analysis showed an implicit relationship between 24 out of 30 SDG11 indicators and the evaluation criteria of the sustainability protocols (Table 3).

Table 3. Type of relationship between SDG11 indicators and sustainability protocols.

SDG11 Indicators (ISTAT)	GBC			ITACA		CasaClima	
	Neighborhoods	Home	Condominiums	Urban Scale	Residential Buildings	Nature	Plus
Percentage of people in homes with structural problems or moisture problems		●	●				
Percentage of people in overcrowded dwellings							
Percentage of people in homes with noise problems from neighbors or the street	○	○	○		○	○	
Families by level of difficulty in connecting to public transport in the area where they live	●			●	●		
People who routinely travel to the workplace by private means only							
Students who routinely travel to the place of study by public transport only	●			●	●		
Waterproofing and per capita soil consumption	○				○		
Construction Abuse							
Population exposed to landslide risk by region and by provincial capital city	○			○			
Population exposed to flood risk by region and by provincial capital city	○						

Table 3. *Cont.*

SDG11 Indicators (ISTAT)	GBC			ITACA		CasaClima	
	Neighborhoods	Home	Condominiums	Urban Scale	Residential Buildings	Nature	Plus
Population exposed to flood risk	○			●			
Population exposed to landslide risk	○						
Number of deaths and missing persons due to landslides	○						
Number of injured by landslides	○						
Number of deaths and missing persons due to floods/flooding	○			○			
Number of people injured by floods/flooding	○						
Municipal waste sent to landfill as a percentage of total municipal waste collected	○		○				
Urban population exposure to air pollution by particulate matter <2.5 µm	○	○	○	○	○	○	
Urban population exposure to air pollution by particulate matter <10 µm	○	○	○				
Urban air quality-PM10	○	○	●○	○		○	
Exceedances of the daily limit value for PM10 in provincial capital cities	○	○	○				
PM10 Average annual concentration in provincial capital municipalities	○	○	○				
PM2.5 Average annual concentration in provincial capital municipalities	○	○	○				
Urban air quality-Nitrogen dioxide	○	○	●○	●	●	●	
NO2 Average annual concentration in provincial capital municipalities	○	○	○				
OZONE daily number exceeding the target in the provincial capital municipalities	○	○	○	○			○
Indices of temperature and precipitation extremes for provincial capitals	○	○	○	○	○	○	○
Indices of temperature and precipitation extremes in the main provincial capitals/metropolitan cities. Climate value (CLINO) 1971- 2000	○	○	○				
Incidence of urban green areas on the urbanized surface of cities	○	●		●○			
People aged 14-65 who have suffered at least one sexual harassment in the last 12 months				○			

The different kind of relationships have been categorized in Table 3 as follows: (i) ●: explicit relationship; (ii) ○: implicit relationship.

Thus, in Table 3 are summarized the types of relationship between the SDG11 indicators and the evaluation criteria of the sustainability protocols.

4. Discussion

Table 3 underlines how 7 out of the 30 SDG11 indicators have explicit relationships with the evaluation criteria of the sustainability protocols.

In particular, the ITACA Urban Scale protocol is the one with more explicit correlations, showing 5 out of 7 indicators with explicit relationships, followed immediately by the classification for residential buildings. The GBC protocol shows explicit relationships with 3 out of 7 SDG11 indicators in GBC Condominiums and with 2 SDG11 indicators for both GBC Home and GBC Neighborhoods. Finally, the CasaClima Nature protocol stresses an explicit relationship with only 1 SDG11 indicator out of 7.

Moreover, Table 3 shows that SDG11 indicators with an implicit relationship are more than those with an explicit one, showing 24 implicit relationships against seven explicit relationships.

Accordingly, the GBC Neighborhoods protocol highlights the majority of the implicit relationships, with 23 SDG11 indicators, and is followed immediately by the GBC Home classification with 12 SDG11 indicators (Table 3). Furthermore, the ITACA protocol shows implicit relationships, respectively, with eight SDG11 indicators considering the ITACA Urban Scale and with four in relation to ITACA for residential buildings, while the CasaClima protocol provides the lowest number of implicit relationships, mainly focused on air quality and temperature indicators of the SDG11.

Considering the relationships that have emerged between SDG11 indicators and the sustainability protocols, Table 3 underlines that most of the SDG11 indicators can be applied at the urban scale. Therefore, the classification at the wider spatial scale of the ITACA Urban Scale protocol is the one that better intercepts the SDG11 indicators, showing most of the explicit relationships.

Similarly, the larger scale classification of the GBC Neighborhoods protocol stresses most of the implicit relationships with the SDG11 indicators (Table 3).

However, a surprising element relates to the GBC Home protocol at a single building scale, which is the protocol that provides the second highest number of implicit relationships after the GBC Neighborhoods protocol (Table 3), considerably surpassing the ITACA protocol in its urban classification. In fact, the GBC Home protocol, despite the smaller spatial scale, still takes into account criteria related to the outer space—for example, explicitly including green areas among its criteria (Table 2)—and is not limited to the single building.

In addition, Table 3 underlines that 4 SDG11 indicators out of 30 that have both explicit and implicit relationships with the criteria of the sustainability protocols, thus showing both a correspondence with regard to the keywords (Table 2) and with the concepts investigated. For example, this is the case of the SDG11 indicator "Incidence of urban green areas on the urbanized surface of cities", which has explicit and implicit relationships with the evaluation criteria of two classifications of the GBC protocol, (GBC Home and Neighborhoods) but also within the same classification of the ITACA Urban Scale protocol (Table 3). This is in line with the current research about the restraint of land consumption and urban sprawl, which is considered the future of urban and regional planning in relation to the survival of ecosystem services [59].

Furthermore, in Table 3 it is interesting to noe that the CasaClima protocol in both its categorizations (Nature and Plus) shows the lowest number of explicit and implicit relationships. Actually, the CasaClima protocol is still focused on energy and resource consumption issues and shows links with the SDG11 indicators only with regard to air quality issues and the use of materials that contrast high temperatures and favour cooling (Table 3).

With reference to the contents, Table 3 shows that most of relationships between SDG11 indicators and the sustainability protocols are highlighted for issues related to air quality and air pollution, followed by those related to temperature control and precipitation monitoring. This is aligned with the huge concern about the reduction in greenhouse gas emissions in cities [60], with the construction sector being responsible for around 39% of all carbon emissions in the world [61,62]. Moreover, this number is expected to increase in the future due to the growing urban population [63]. Actually, these issues are strongly considered within the sustainability protocols, paying close attention to criticalities related to the production of materials and to the construction operations, with the aim of minimizing the impact of the building on its surroundings by controlling emissions and air pollution [9].

Accordingly, an important common element of the sustainability protocols is the awareness that buildings are considered as factors strongly influencing cities [9,29], thus underlining their indisputable natures in the realization and in the construction of the sustainability of cities in all its meanings, carefully considering critical issues such as the

environmental degradation, resource depletion and the impact of buildings on climate change [9]. In fact, the sustainability protocols are primarily driven by the awareness of the strong impact that the construction sector has on the environment [64] and the fundamental role it plays within the challenge to reduce global warming [9,29,51,57]. In addition, the sustainability protocols also focus both on the materials used in construction and the increase in green areas with the aim of reducing the Urban Heat Island (UHI) phenomenon [65] and mitigating anthropogenic warming that impacts the global warming of cities [9,58].

Finally, Table 3 underlines the SDG11 indicator on sexual harassment shows only one implicit relationship with the ITACA Urban Scale protocol, which through its evaluation criterion "Crime Prevention" is the only protocol among those analyzed that deals with social issues.

5. Conclusions

This article aims to investigate the possible correspondence between the SDG11 and the sustainability protocols. In order to achieve the objective, this paper was built on the following research questions:

(i) What are the direct/indirect relationships among SDG11 and sustainability protocols?
(ii) Could the sustainability protocols constitute a solution towards the achievement of SDG11?

Concerning the first research question, which takes into account the SDG11 indicators and the evaluation criteria of the most widely used sustainability protocols within the Italian context, the analysis carried out here shows that most of the SDG11 indicators are involved in an explicit/implicit relationship with the sustainability protocols. This stresses a strong affinity of the sustainability protocols in terms of the pursuit of the SDG11 targets, highlighting the need of the sustainability protocol to cover the concepts investigated through the SDG11 indicators in a comprehensive manner.

Additionally, although sustainability protocols applied on a broader scale (city/ neighborhood) stress most of the explicit and implicit relationships with the SDG11 indicators, it is interesting to underline that the building scale sustainability protocols also have numerous relationships by focusing on elements related to external space and the urban context (Table 3). Accordingly, sustainability protocols strongly consider the impact buildings have on cities in the pursuit of sustainability, emphasizing their importance in relation to the external environment [9]. In fact, also within the sustainability protocol at a single building scale are issues related to the quality of the outdoor environment, which are widely considered, such as the impact of the buildings on the air pollution and of the construction materials used in relation to the heat island effect in cities [65].

A further interesting fact that emerges from the analysis is that the sustainability protocols do not focus on the same issues related to the environmental sustainability of buildings, with difficulties found in extending the concept of sustainability to many aspects. In fact, the analysis carried out clearly shows that some sustainability protocols are still focused on specific topics, related in particular to energy and resource consumption issues, thus showing a lack of flexibility in both explicit and implicit relationships with the indicators of SDG11, which instead refer to sustainability in a broader sense. This appears particularly evident considering the CasaClima protocol which shows the lowest number of both explicit and implicit relationships with the SDG11 indicators (Table 3). This could be imputable to the fact that CasaClima was born mainly as an energy protocol aimed at measuring the energy performances of a building in terms of energy consumption and savings [66] rather than an overall sustainability [67]. On the contrary, the ITACA and GBC protocols have been developed with a wider focus on environmental sustainability, therefore aiming to measure environmental sustainability in buildings in a broader sense considering also the environmental efficiency of the construction process [51], from the production of building materials to the calculation of the building's pollutant emissions.

Despite almost all the indicators of the SDG11 having a relationship with the evaluation criteria of the sustainability protocols analyzed, with at least one case for each, the following three SDG11 indicators do not have any:

(i) percentage of people in overcrowded dwellings;
(ii) people who routinely travel to the workplace by private means only;
(iii) construction abuse.

The crowding factor is never considered in the evaluation criteria of the sustainability protocols; nevertheless, this is an important element within the SDG11 as far as housing is concerned, especially with reference to the current problems deriving from the COVID-19 pandemic [7]. However, it should be considered that the sustainability protocols analyzed are not updated to the situation in 2020, thus they fail to grasp the new aspects emerging in the light of the current pandemic.

Moreover, despite that the sustainability protocols do not contain criteria related to the use of private means of transport, there are many evaluation criteria relating to public transport and its accessibility (Table 3). Similarly, despite that there are no evaluation criteria relating to the construction abuse, the issue of land consumption is very much addressed in the GBC and ITACA protocols (Table 3), with particular reference to the reuse of buildings.

A further interesting fact that emerges from the analysis is that, despite the progress made since the first decade of 2000s in order to bring environmental, social and economic issues progressively into the framework of sustainability protocols [30,39], they still show a gap in the assessment of sustainability in terms of social aspects.

Accordingly, Table 3 clearly shows that within the sustainability protocols analyzed in this paper the social issues of the SDG11 indicators are almost not considered but a considerable preponderance of environmental issues can be found, highlighting difficulties in conceptualizing and considering social aspects among the evaluation criteria of sustainability protocols, especially with reference to the classifications at the scale of a single building [40,42,68,69].

Although it is fully recognized that the construction sector has a strong impact on achieving the sustainability of cities, considering the environmental, economic and social spheres within the sustainability protocols [64], the environmental aspects still prevail over the economic ones and especially over the social issues [29,40]. In the last 10 years, it is increasingly recognized within the protocols that from the point of view of the sustainability of cities, buildings do not only have effects on environmental protection, but also on issues related to the social sphere [29]. However, the consideration of social aspects is struggling to establish itself within the criteria used by the sustainability protocols [29,40].

Referring to the second research question, the answer is positive. However, although SDG11 and protocols have important similarities in the pursuit of environmental, economic and social sustainability objectives, there seems to be a lack of a regulatory framework that makes the protocols operational in terms of achieving the SDG11. Within the Italian context, there are no economic or financial incentives to apply the sustainability protocols within the national legislative body, demanding the matter to the initiative of individual regions [55] and thus creating imbalances in their use and diversification within the national territory in terms of a univocal regulatory reference. Actually, the sustainability protocols are highly recommended by some regions (e.g., Piedmont, Lombardy and Apulia) but they are not compulsory, with the exception of CasaClima in the Province of Bolzano.

In this sense, a concrete intervention by the Italian PAs and government bodies would be fundamental in the activation of the political levers expanded by the theory of circular economy and, consequently, the sustainability protocols. It is proved that the use of financial support measures (e.g., taxes, penalties, charges) constitutes a powerful tool in achieving the goals of urban innovation and overall sustainability [6,54].

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/su13073858/s1, Attached 1: Keywords chosen in relation to SG11 indicators; these keywords

were chosen in relation to the SDG11 indicators in order to identify the existence of explicit relationships between the SDG11 indicators and the criteria of the most widely used sustainability protocols in Italy.

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