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How can CASBEE contribute as a sustainability assessment tool to achieve the SDGs?

G Miyazaki^{1*}, S Kawakubo², S Murakami³, T Ikaga⁴

¹ Graduate Student, Graduate School of Engineering and Design, Hosei University, Japan

² Associate Professor, Faculty of Engineering and Design, Hosei University, Japan

³ Institute for Building Environment and Energy Conservation, Japan

⁴ Professor, Faculty of Science and Technology, Keio University, Japan

*E-Mail: genki.miyazaki.8a@stu.hosei.ac.jp

Abstract. The purpose of this research was to understand the relationship between assessment items of the Comprehensive Assessment System for Built Environment Efficiency (CASBEE) and the UN's Sustainable Development Goals (SDGs). The SDGs, the core of the 2030 Agenda for Sustainable Development, were adopted in 2015. In response, social demand for sustainable buildings, urban districts, and cities has grown. New assessment tools have been developed to quantitatively evaluate the sustainability of individual buildings, building clusters, urban districts, and cities worldwide. CASBEE was developed in Japan, with assessment items suited to each scale, from individual buildings to entire cities. These assessment items are expected to contribute to SDG 11 "Sustainable Cities and Communities" as well as the other 16 goals. However, the degree of correspondence between assessment items and SDGs remains unclear. Therefore, the relationships between CASBEE assessment items and SDGs were investigated to confirm their effectiveness as a tool for sustainable design. In this analysis, the number of corresponding goals increased as the scale became broader. At the scales of individual buildings and building clusters, many assessment items contributed indirectly to SDG 12 "Responsible Consumption and Production" while many assessment items contributed directly to SDG 11 in urban districts and cities.

1. Introduction

1.1. Overview of the SDGs

In September 2015, a political agreement on the future global sustainability was reached at the United Nations Sustainable Development Summit held at the United Nations headquarters in New York; the 2030 Agenda for Sustainable Development (2030 Agenda) [1] was unanimously adopted by member states. The core of the 2030 Agenda is the Sustainable Development Goals (SDGs), a set of 17 goals and 169 targets that summarize the items to be executed and achieved by 2030. An overview of these 17 goals is provided in table 1. In addition, 232 indicators [2] have been proposed by the United Nations Statistics Committee to quantitatively measure progress toward SDG achievement. These frameworks have been adopted by national governments, but the involvement of local governments, citizens, companies, nonprofit organizations (NPOs), non-governmental organizations (NGOs), and other stakeholders will also be required.



Table 1. Summary of 17 SDGs.

SDG #	Concept	
1	No Poverty	End poverty in all its forms everywhere
2	Zero Hunger	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3	Good Health and Well-being	Ensure healthy lives and promote well-being for all at all ages
4	Quality Education	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5	Gender Equality	Achieve gender equality and empower all women and girls
6	Clean Water and Sanitation	Ensure availability and sustainable management of water and sanitation for all
7	Affordable and Clean Energy	Ensure access to affordable, reliable, sustainable and modern energy for all
8	Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9	Industry, Innovation and Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10	Reduced Inequalities	Reduce inequality within and among countries
11	Sustainable Cities and Communities	Make cities and human settlements inclusive, safe, resilient and sustainable
12	Responsible Consumption and Production	Ensure sustainable consumption and production patterns
13	Climate Action	Take urgent action to combat climate change and its impacts
14	Life Below Water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15	Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16	Peace, Justice and Strong Institutions	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17	Partnerships for The Goals	Strengthen the means of implementation and revitalize the global partnership for sustainable development

1.2. Relationships between “individual buildings, urban districts, and cities” and SDGs

The planning and design of individual buildings, urban districts, and cities is closely related to SDGs. This relationship is easy to understand in the cases of " Goal 11: Sustainable Cities and Communities" and " Goal 12: Responsible Consumption and Production." These two goals are directly linked to activities related to various scales, such as buildings, urban districts, and cities. The design of sustainable buildings, urban districts, and cities is related to many economic, social, and environmental issues, the so-called triple bottom line (TBL). As such, it is necessary to proactively work toward achieving SDGs. For this purpose, existing assessment tools, such as CASBEE [3] (assessment tools that enable users to understand the environmental performance of various scales of built environments) are reasonable to use when comparing philosophies and items with SDGs.

CASBEE is based on Q (Environmental Quality) and L (Environmental Load), and it is reasonable to say that Q assessment items are relate to improving the quality of life (QOL) of humans and L assessment items relate to the protection of the global environment. As described in the 2030 Agenda, SDGs are also focused on human prosperity while protecting our planet under peace and global partnership (5Ps: People, Planet, Prosperity, Peace, and Partnership). Accordingly, there are similarities in the viewpoints of CASBEE and SDGs. Therefore, using CASBEE, it may be possible to measure the progress of efforts made toward achieving SDGs at each scale (i.e., buildings, urban districts, and cities).

2. Research method

2.1. Organization of items related to CASBEE and SDGs

Figure 1 shows a Venn diagram of the assessment items related to CASBEE and SDGs. The assessment contents for CASBEE (assessment viewpoints) include built environment issues (for buildings, urban, and city scales), contributing to the sustainability of humanity (Q) as well as the global environment (L), illustrated as (1) in figure 1. Items to assess (1) are illustrated as (2). The set of goals and targets of SDGs is illustrated as (3), while extracted goals and targets related to built environment issues are illustrated as (4). Corresponding items to assess (4) are illustrated as (5). As mentioned above, CASBEE and SDGs are both fundamentally focused on the sustainability of humanity and the planet; therefore, the relationship between (2) and (5) should be considered. However, there are also differences in the composition of assessment items for each CASBEE assessment tool and the basic philosophy of SDGs. Therefore (in the union of (2) and (5)), (8) in figure 1 shows the common area for the CASBEE assessment items and SDGs. (6) shows more concrete items specific to each scale (buildings, urban districts, and cities) not specified in the 17 SDGs, while (7) shows assessment items related to built environments.

The purpose of the research was to clarify the relationship between the assessment items for each assessment tool of existing the most recent version of CASBEE and the 17 SDG (i.e., to identify (6), (7), and (8)).

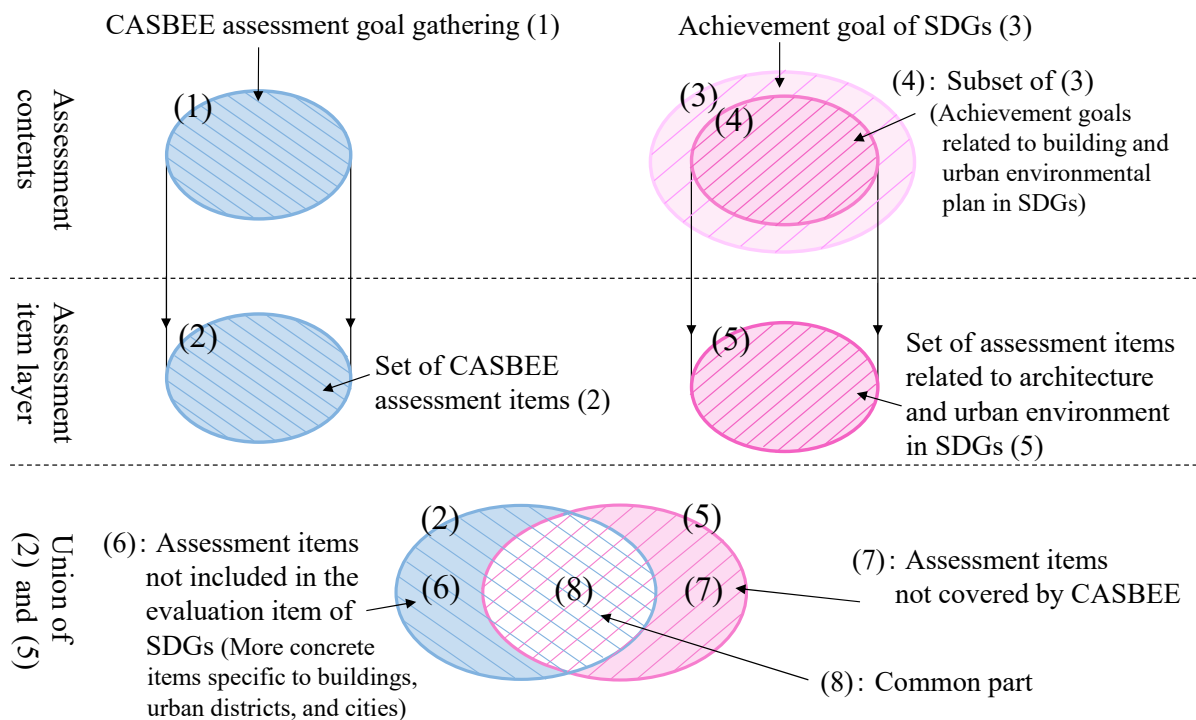


Figure 1. Items related to CASBEE and SDGs.

2.2. Research methods for clarifying the relationships between CASBEE assessment items and SDGs

Table 2 shows each CASBEE assessment tool included in this research. CASBEE has undergone multiple revisions in order to meet changing demands. In this research, the latest version of each CASBEE assessment tool was used. In addition, among the items within each CASBEE assessment tool, the correspondence between the most fine-scale items and each SDG was investigated and categorized as follows.

Category 1. Direct contributions to the achievement of goals

Category 2. Indirect contributions to the achievement of goals

Category 3. The effect of achieving the goal is unclear

In this research, the relationships between CASBEE assessment items and SDGs 17 goals (classifying the CASBEE assessment items into three categories, as described above) was investigated independently by multiple investigators to minimize bias due to subjectivity. The 169 targets and 232 indicators for SDGs were referenced while classifying CASBEE assessment items into the three categories.

The method for investigating these relationships is described below, using assessment items for "LR1.1 Control of Heat Load on the Outer Surface of Buildings" of CASBEE for New Construction as an example. The purpose of this item is to reduce the amount of energy used for heating and cooling; this can be accomplished by obtaining heat from solar radiation and installing highly efficient insulation to reduce heat loss. In this case, assessment item LR1.1 is assigned to category 1 as it directly contributes to the achievement of Goal 7 (Affordable and Clean Energy). However, LR1.1 is classified as category 2 at the same time because it indirectly contributes to the mitigation of climate change (Goal 13: Climate Action) by reducing energy consumption. The relationships between CASBEE assessment items and each SDG were investigated in this manner.

Table 2. CASBEE assessment tools.

Scale	Assessment tool	Publication year
Individual buildings (residential buildings)	CASBEE for New Detached Houses ^[4]	2018
Individual buildings (non-residential buildings)	CASBEE for New Construction ^[5]	2016
Urban districts	CASBEE for Urban Development ^[6]	2014
Cities	CASBEE for Cities (worldwide-use version) ^[7]	2017

3. Research results

The following summarizes the results from analyses of the relationships between CASBEE assessment items and SDGs ((8) in figure 1).

3.1. Relationship between CASBEE for New Detached Houses and SDGs

Figure 2 shows the results for the correspondence between each CASBEE assessment item for New Detached Houses and each SDG. For CASBEE for New Detached Houses, Goal 12 (Responsible Consumption and Production) is the most closely related assessment item that contributes directly to the achievement of SDGs. This result is based on the number of items to assess the use of building materials that can be used for a long time (item Q_H2.1) and efforts to conserve resources and waste (item LR_H2). Furthermore, there are a number of assessment items that contribute indirectly to the achievement of Goal 3 (Good Health and Well-being), which focuses on measures to control negative health impacts (item Q_H1.1 and others) by maintaining comfort in indoor environments.

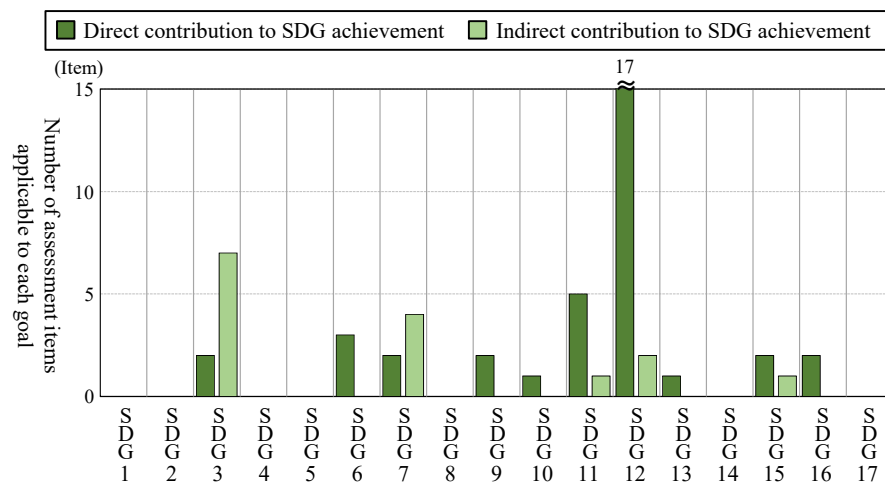


Figure 2. Summary of the correspondence between CASBEE for New Detached Houses and SDGs.

3.2. Relationship between CASBEE for New Construction and SDGs

Figure 3 shows the results for the correspondence between each CASBEE assessment item for New Construction and each SDG. In CASBEE for New Construction, Goal 12 is the most closely related assessment item that contributes directly to the achievement of SDGs; it shows a similar trend to that described in section 3.1. This result was obtained because there are many items to assess the useful life of building materials (item Q2.2) and the use of reusable building materials (item LR2.2). There are also many items that directly and indirectly contribute to the achievement of Goal 3, which focuses on maintaining and promoting the health of building users (item Q3.3.2).

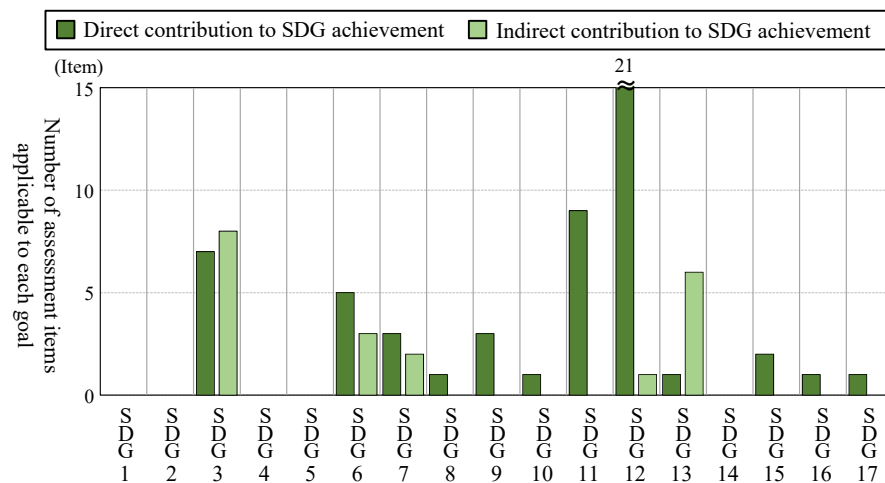


Figure 3. Summary of the correspondence between CASBEE for New Construction and SDGs.

3.3. Relationship between CASBEE for Urban Development and SDGs

Figure 4 shows the results for the correspondence between each CASBEE assessment item for Urban Development and each goal of SDGs. In CASBEE for Urban Development, SDG Goal 11 (Sustainable Cities and Communities) is the most closely related assessment item that contributes directly or indirectly to the achievement of SDGs. This result is based on the close relationship between Goal 11 and the promotion of sustainable urban planning, an aim of CASBEE-urban development.

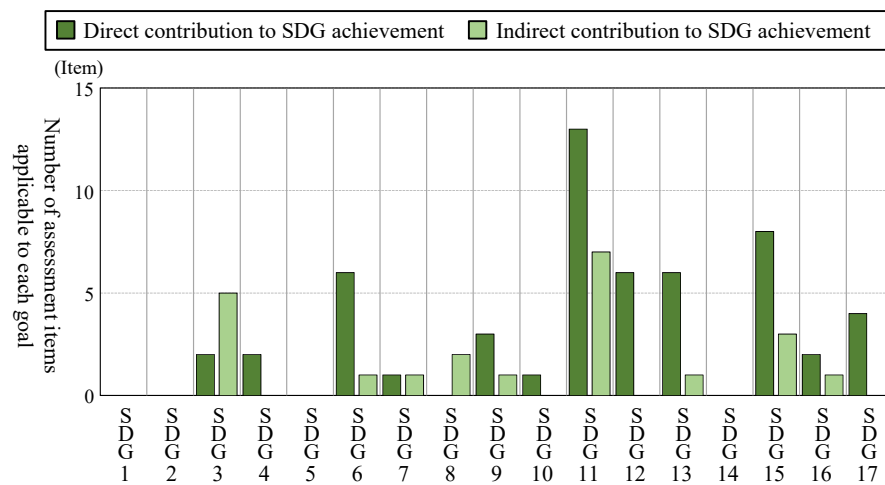


Figure 4. Summary of the correspondence between CASBEE for Urban Development and SDGs.

3.4. Relationship between CASBEE for Cities (worldwide-use version) and SDGs

Figure 5 shows the results for the correspondence between each CASBEE assessment item for Cities (worldwide-use version) and each goal of CASBEE for Cities (worldwide-use version). SDG Goal 11 is the most related assessment item that contributes directly to the achievement of SDGs. It also resulted in a perfect response to all goals. This is because CASBEE for Cities (worldwide-use version) was developed to correspond to SDGs from the tool development stage.

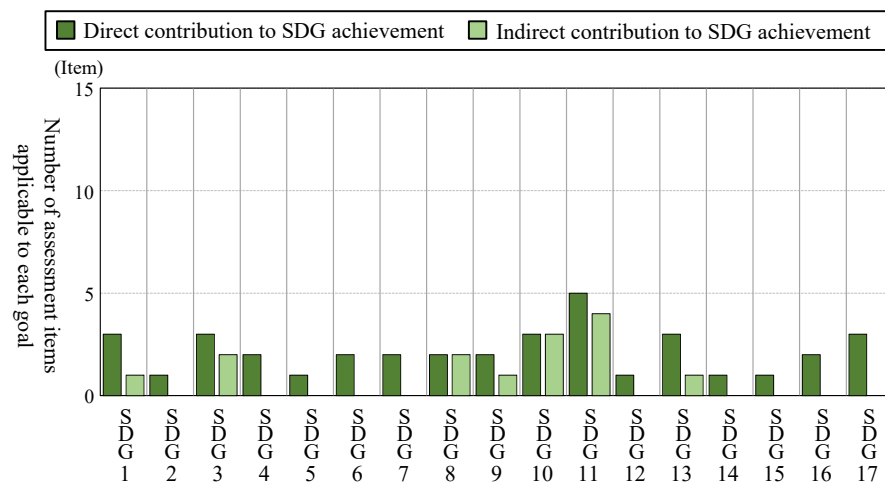


Figure 5. Summary of the correspondence between CASBEE for Cities (worldwide-use version) and SDGs.

4. Comparison of the degree of correspondence of each assessment tool with SDGs

Table 3 shows the degree of correspondence between each assessment tool of CASBEE and SDGs. The number of SDGs with direct contributions increased as the scale of the assessment target increased. Furthermore, since CASBEE for New Construction has a large number of assessment items and more detailed assessment items specific to buildings, the proportion of goals of the corresponding SDGs is slightly lower than that of other tools. For the other assessment tools, the assessment items corresponding to SDGs exceeded 90%.

Table 3. Degree of correspondence between CASBEE assessment items and SDGs.

Assessment tool	Number of assessment items	Percentage of assessment items corresponding to SDGs	Number of goals of corresponding SDGs		Percentage of SDG goals covered directly by the tool
			Directly	Indirectly	
CASBEE for New Detached Houses	48	96%	11	5	65%
CASBEE for New Construction	96	72%	12	6	71%
CASBEE for Urban Development	53	95%	13	9	76%
CASBEE for Cities (worldwide-use version)	32	100%	17	7	100%

5. Conclusion

In this study, the relationships between the assessment items of each CASBEE assessment tool and the issues related to buildings, urban, and city environments in SDGs were evaluated. The SDG that was most closely related to CASBEE for New Detached Houses and CASBEE for New Construction (to assess buildings) was Goal 12 (Responsible Consumption and Production), while the most closely related SDG to CASBEE for Urban Development and CASBEE for Cities (worldwide-use version) was Goal 11 (Sustainable Cities and Communities). CASBEE assessment tools can be used to measure efforts or progress toward achieving SDGs based on the strong relationship between CASBEE assessment items and the 17 SDGs (i.e., users of this tool can contribute to the achievement of SDGs by obtaining better assessments). Verification of results obtained in the study in cooperation with experts and other stakeholders is essential. Further studies necessary, including analyses of the relationship between other assessment tools (e.g., BREEAM, LEED, and Green Stars) and SDGs, are necessary to clarify the differences and key features of CASBEE among various assessment systems. It is also important to review assessment items for CASBEE tools from the viewpoint of SDGs.

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