The Pre- Covid-19 Standardization System of Sustainable Construction (SSSC)

مقومات المعايير الدولية لتقييم البناء المستدام في زمن ما قبل جائحة كورونا

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Abstract:

This study discusses the standards of sustainable construction during the pre-Covid-19 years. It examines the certification systems of Germany, Britain, USA, Australia and Japan to demonstrate the bases on which they were indexed. Likewise, it demonstrates the Ortlieb's Bottling House Project, in Philadelphia, as an effective green experience.

This article concludes that the standardization of sustainable buildings submitted to a set of conventional norms such as: energy and water consumption, toxic emissions, and materials. Even though western countries adopted different rating systems, they share two basic principles; these are: less ecological footprints and less economic requirements.

***Keywords**:*

Sustainable construction; Certification system; Life-Cycle Assessment; The Ortlieb's Bottling House Project; Pre-Covid-19 era.

الملخص:

تناقش هذه الدراسة معايير البناء المستدام المعتمدة خلال سنوات ما قبل جائحة كوفيد-19. يبين هذا البحث معايير شهادات الاعتماد في ألمانيا وبريطانيا والولايات المتحدة الأمريكية وأستراليا واليابان كخطوة لاستنباط المبادئ التي تأسست عليها. وكخطوة لإثبات ذلك، تتناول هذه الدراسة تقيم مشروع اورتلب بوتلنغ هاوس في فيلادلفيا كتجربة خضراء فعالة.

وتخلص إلى أن توحيد معايير المباني المستدامة يتم وفقا لمجموعة من الاسس التي تقرها حكومات كل دولة؛ منها: استهلاك الطاقة والمياه، الانبعاثات السامة، والموارد. على الرغم من أن الدول الغربية تبنت أنظمة تصنيف مختلفة، إلا أنها تشترك في مبدأين أساسيين؛ هما: آثار البصمة البيئية وتقنين المتطلبات الاقتصادية.

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كلمات مفتاحية: البناء المستدام، نظام الاعتماد، دورة حياة المشروع، مشروع اورتلب بوتلنغ هاوس فيلاديلفيا، مرحلة ما قبل جائحة كورونا.

1. INTRODUCTION

1.1 Purpose of the Study

The construction field is a significant sector that plays a crucial role in the development of the economies of nations. Each year, governments pass plans to invest in construction projects that cost hundreds of thousands of dollars. In addition to the heavy expenditures, the process of construction relies on huge quantities of natural resources like water and wood. This impelled engineers and architects to innovate eco-friendly construction materials to reduce water consumption and construction wastes as well. It is important to note that this study considers assessment criteria and sustainable buildings pertaining to the pre-Covid-19 years. In other words, currently, the propagation of pandemics impel states to amend assessment charts. This makes the pre- Covid-19 standardized assessment of sustainability subject to further refinements. For this, this study answers the following question: What are the criteria of the rating system by which a building can be assessed sustainable during the pre- Covid-19 years? Moreover, to answer this research question, this study defines conventional and sustainable buildings. Then, it demonstrates and evaluates the bases of the standardization of sustainable construction. Further, it discusses the Ortlieb's Bottling House Project, in Philadelphia, as an example for successful sustainable building projects. It concludes that despite the wide variety of the established certification programs, they all have common foundational principles and objectives; these are: less ecological footprint (EF) and less economic requirements. In essence, the standardization of sustainable construction norms endorses their internalization as durable solutions to preserve the natural ecosystem and humanity as well.

1.2 Literature Review

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Moreover, to delineate the criteria of the standardization of sustainable construction, this study relies on a variety of recent studies, publications and official documents. These are: National Register of Historic Places Registration Form: Henry F. Ortlieb Company Bottling House (2014), US Green Building Council's LEED v4 for Building Design and Construction (2015), the book of both architects of the Kieran Timberlake Stephen Kieran and James Timberlake Loblolly House: Elements of a New Architecture (2008) and Michael Bauer's Green Building: Guidebook for Sustainable Architecture (2010).

1.3 Methodology

Besides, to depict the convergences and divergences between certification systems of sustainable construction, this study uses the comparative method. It also relies on the analytic method to depict and discuss the bases on which the SSSC was established.

2. Identifying Conventional Construction

Discussing sustainable construction requires defining the life-cycle of the conventional one. Conventional construction is a modern concept that refers to a building system with critical environmental impacts. Explicitly, experts identify it with conventionalism as a step to distinguish it from the sustainable building system. Obviously, they set such typology in the construction field to emphasize the impacts of building systems on the natural resources. Here, one denotes that without the innovation of sustainable buildings, the term "conventional" would not be used to identify a type of construction. Further, conventional construction projects share one common criterion; they are commercially oriented systems of building. Explicitly, the success of any conventional construction project is measured by its profitability. In other words, despite of its huge consumption of the natural resources, like water, the project managers prioritize the

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accomplishment of the building process according to the designed plan and to the calculated budget[1].

Moreover, the construction projects require a systematic coordination between the involved parts such as the company, the contractors, the architects and engineers, the legal authorities, the craftsmen and the materials suppliers. They require heavy expenditures in order to pay for the logistic activities such as the transportation means and other construction engines. In essence, conventional buildings require higher energy consumption, thus, higher expenditures. In this, Charles J. Kibert argued: "In 2000, the typical office building in the United States consumed over 300 kilowatt-hours per square meter per year (kWh/m2/yr) or 100,000 BTU/square foot/year (BTU/ft2/yr). Today's high-performance buildings are approaching 100 kWh/m2/yr (33,000 BTU/ft2/yr)"[2]. Besides, the following section examines the life-cycle of conventional construction projects and discusses its elementary phases as well.

3. The Phases of Conventional Construction

The construction field is a vital sector that determines the economic situation of nations. Governments pass agreements to establish huge construction projects as a step to supply the growing demands on habitations. However, the building projects require a long period for their accomplishment because of the long and hard stages in which they pass through. Generally, conventional construction projects around the world share common phases; these are: the pre-

[1] Pica, Massimo (2015) "Planning for the Project Life Cycle of Constructions and Facilities". *Project Life Cycle Economics: Cost Estimation, Management and Effectiveness in Construction Projects*. England: Gower Publishing, 201.
[2] Kibert, Charles J. (2016) *Sustainable Construction Green Building Design and Delivery*. 4th ed. New Jersey: Wiley, 6.

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project phase (PPP), planning and conception, contractors selection, mobilization, operational phase, and the termination phase.

The construction projects involve a wide variety of types of buildings such as dwelling buildings, commercial and industrial structures, administrative blocks, and military infrastructures. They can be categorized into three major types: residential building, industrial and heavy construction. In fact, despite of their different characteristics and the duration of their realization, the three types of construction share approximately the same phases. In essence, the project managers are required to adopt new technologies in the construction methods and selecting new equipment as well.

In this section, we tend to examine the life-cycle of residential construction; we also aim to demonstrate the importance of its phases and the manner by which they are interrelated. The first phase of any construction project is the PPP (the Pre-Project Phase). The latter involves several significant procedures. Indeed, any project starts from the stage of ideation. In this phase, the owner must analyze and evaluate the needs that he wants from the construction firm. In other words, he had first to decide whether the design of his house will be realized by a design office or he provides the conception and the building processes to a construction company. Here, he must consider his budget as well. The owner exposes his idea about his project before his contractors; he also agrees with them about the budget as well as the payment procedures. During this phase, both the owner and the contractors approve whether paying the risks' pre-estimated fees before or after the construction phase. In addition, the owner must be informed about the materials that will be selected for the building as well as their estimated total fees[3].

[3] Montanari, Francesca (2015) "Projects and Their Life Cycles: Some Current Views" *Project Life Cycle Economics : Cost Estimation, Management and Effectiveness in Construction Projects*. England: Gower Publishing, 28.

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After the feasibility assessment, the preliminary phase takes place; it allows both the owner and the contractors to determine the objectives as well as the following steps to carry out their project. In fact, the fulfillment of the other phases of the construction project is determined by the manner by which the contractor and the owner discussed their visions about the way the building should look like at the closeout phase. The preliminary phase is a significant step in the construction project; it determines the general perspectives of the building on the technical and budgetary bases. Indeed, the owner decides about the main characteristics of the building that he desires; then, he chooses the type of contracts by which his project will be realized through. Afterwards, he discusses with his contractors (architects or the construction company) how he envisions his building and the budgetary requirements of the project. Then, they both move to the next phase which is: the Planning Phase (PP)[4].

In fact, the planning phase is the step in which the manager and his team highlight the necessary steps to achieve the objectives of the construction project. At this stage, all the necessary aspects of the building must be well defined. Then, the team responsible for the project presents detailed plans and files for the project that cover several aspects; these are: construction requirements, budget costs, and schedule. In addition, as a step to reduce potential losses, the project managers propose a risk management strategy to prevent or reduce eventual risks that can emerge before or during the construction procedures. The risk management planning plays a significant role in the success of the project because it sets solutions to potential risks that can require additional expenditures such as damaged materials of construction, site makeover losses or hiring additional labor. It also requires the inclusion of insurance, a detailed communicative report and plans. In this, Charles J. Kibert claimed: “It has become clear over time that … transportation energy can amount to two times the operational energy of the

[4] Prat, David J. (2012) *Estimating for Residential Construction*. 2nd edition. Ney York: Delmas, 3.

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building... Not only does this significant level of energy for commuting have environmental impacts, but it also represents a significant cost for the employees who make the daily commute"[5].

After the preparation of a detailed report with plans, the next stage of the project is the Execution Phase. During this phase, the project manager and his team hold regular meetings to discuss the process of the execution of the construction. They get reports from the responsible of the construction site through which they get information about the advancement of the project. Their primary task is to evaluate and to discuss the challenges that can hinder the achievement of the project. Indeed, this phase involves a continuous appraisal and constant modifications on the project's plan as well. All of those updates are necessary to meet the objectives of the project that had already been signed with the owner during the preliminary phase. Yet, disputes, often, occur during this phase that, sometimes, end up with judiciary pursuits. In this, Professor F. Lawrence Bennett, a researcher in engineering management at Alaska University, avowed that delays constitute a frequent trigger of disagreements between the owner and the contractor. He asserted: "Two types of delays are of special interest … The first is … caused by the contractor and for which the owner expects some sort of compensation. The second type is caused by the owner; in this case the contractor may expect both additional time to complete the project and some amount of monetary payment. Each of these types of delays can result in complicated legal entanglements"[6].

The last stage of the conventional construction project is the closeout phase. During the final stage, the managers of the project develop a recapitulative report of detailed description of the finalization stages before the deliverance of the building to the owner. The company assesses the technical and budgetary

[5] Kibert, Charles J. (2016) *Sustainable Construction Green Building Design and Delivery*. 4th ed. New Jersey: Wiley, 7.
[6] Bennett, Lawrence F. (2003) *The Management of Construction: A Project Life Cycle Approach*. Burlington: Butterworth-Heinemann, 272.

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aspects of the project in order to communicate it to the owner. Besides, there are several construction firms that offer ASS (After-Sales Services) for their clients as a measure to establish long-term relations with them. In other words, they tend to keep in touch with their clients to ensure if they have further needs or requirements to be applied to the newly delivered building. For example, the owner may need to modify his kitchen; as a matter of fact, he contacts the ASS of the contractor company to carry out the makeover procedures. Then, the construction firm re-opens the closed cycle of the construction and starts a new cycle of makeover with its ex-client. This would increase the profitability of the construction projects for the companies on a long term. In addition, construction companies grant warranty contracts, for a determined period, for the owner to fix post-construction errors[7].

4. The Certification System of Sustainable Construction

4.1 The Terminology of Sustainable Construction

The concept of sustainable construction refers to a modern system of building; it is a set of construction strategies developed by experts as solutions to the damaging impacts of the conventional building. It provides innovative ideas involving the pre and post phases of the construction projects. In other words, in order to claim a building sustainable, several factors should be considered such as the architectural concept, the interior and exterior design, the materials and the logistics. The primary objective of sustainable construction is to establish buildings with less toxic impacts on the ecosystem; it aims to elaborate eco-friendly houses and shelters with less costs, less construction wastes, less energy and water consumption[8].

[7] Sutt, Jüri (2011) *Manual of Construction Project Management for Owners and Clients*. UK: Wiley, 116.
[8] Bauer, Michael et al. (2010) *Green Building: Guidebook for Sustainable Architecture*. Germany: Callwey Verlag, 12.

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4.2 The International Standards of Sustainable Construction

Several experts refer to the sustainable buildings with green buildings. Sarcastically, this label does not indicate that they are colored with green; however, they possess certain characteristics that qualify them to be eco-friendly. Explicitly, the green building is constructed through a well defined plan and criteria that are in turn ratified by internationally recognized commissions. In order to classify a building green, it must conform to a set of international standards of sustainability. Besides, the construction norms of sustainability differ slightly from a country to another. The following table illustrates the systems of the evaluation of the sustainability of buildings in five countries; these are: Germany, Great Britain, United States of America, Australia, and Japan.

Table.1. Rating Systems for Sustainable Buildings

DGNB (Germany 2007)	Ecological Quality Economical Quality Social Quality Technical Quality Process Quality Site Quality	DGNB for: - Offices - Existing Buildings - Retail - Industrial - Portfolios - Schools
BREEAM (Great Britain 1990)	- Management - Health & Well-being - Energy - Water - Material - Site Ecology - Pollution - Transport - Land consumption	BREEAM for: Courts, Eco Homes, Education, Industrial, Healthcare, Multi Residential, Offices, Prisons, Retail
	- Sustainable Sites - Water Efficiency - Energy & Atmosphere -	

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LEED (USA1998)	Material & Resources - Indoor Air Quality - Innovation & Design	LEED for: New Construction, Existing Buildings, Commercial Interiors, Core and Shell, Homes, Neighborhood Development, School, Retail
Green Star (Australia 2003)	- Management - Indoor Comfort - Energy - Transport - Water - Material - Land Consumption & Ecology - Emissions - Innovations	Green Star for: - Office – Existing Buildings - Office – Interior Design - Office – Design
CASBEE (Japan 2001)	Main Criteria: (1)Energy Efficiency (2)Resource Consumption Efficiency (3)Building Environment (4) Building Interior	BEE=Q/L Q … Quality (Ecological Quality of buildings) Q1 - Interior space Q2 - Operation Q3 - Environment L … Loadings (Ecological effects on buildings) L1 - Energy L2 - Resources L3 - Material

Source : Bauer, Michael et al., 2010, p.15

The illustration above represents five different scaling systems; these are: Germany's DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen), Britain's BREEAM (Building Research Establishment Environmental Assessment Method), the American LEED (Leadership in Energy and Environmental Design), Australia's Green Star, and Japan's CASBEE (Comprehensive Assessment

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System for Built Environment Efficiency). These rating systems appraise four main aspects of the building: energy consumption, ecological footprints, economical requirements and social and cultural demands. To rate the sustainability of a building, construction professionals evaluate the performance of the building through counting points; they assess, for example, the energetic performance in reference to the standardized rate of sustainability. In other words, the building is assessed according to the number of points that the experts give; therefore, sustainability experts count the number of points of the evaluation and then classify the project in reference to the certification system. For example, the American LEED system certifies a building that earned between 40 and 49 points and grants golden class to the one that reached 60 points. The main objective behind this rating system is to professionalize the sustainability assessment systems in architecture and construction fields[9].

Table.2. Levels of Certification for Sustainable Buildings

	DGNB (Germany)	**BREEAM (GB)**	**LEED (USA)**	**Green Star (Australia)**	**CASBEE (Japan)**
Level of Certification	Bronze Silver Gold	Pass Good Very good Excellent Outstanding	Certified Silver Gold Platinum	**4 Stars**: Best Practice **5 Stars:** Australian Excellence **6 Stars:** World Leadership	C (poor) B B+ A

[9] US Green Building Council (2021) "LEED rating system" https://www.usgbc.org/leed

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					S (excellent)

Source : Bauer, Michael et al., 2010, p.15

Besides, the table above represents the levels of certification in Germany, GB, USA, Australia and Japan. These nations rate their buildings differently. For example, in Australia, there are three major levels of certification: 4 Stars, 5 Stars and 6 Stars. The projects that are evaluated with a lower ecological footprint (EF) get the higher number of stars. However, in Japan, there are five levels of certification; these are: C, B, B+, A and S. The assessment classifies projects with higher ecological footprint starting from C; then, the more the ecological impact decreases, the project will be rated until the S level. It is very important to note that despite of the divergent levels of certification between Australia and Japan, both converge in the measurement criteria of sustainability. They assess energy consumption, natural resources requirements and toxic emissions of a building[10] .

In addition to other human factors, conventional construction is responsible for carbon dioxide emissions that increase the global warming process. This impelled legislative measures around the globe. For instance, the US Congress passed several environmental laws and executive orders that involved deforestation, animals and insects extinction, water sources, petroleum related pollution and others. In 1970, the Environmental Protection Agency (EPA) was established in the United States for the aim of supplying official authorities with environmental analytic data to be used for amending laws. Moreover, several orders were passed such as Resource Conservation and Recovery Act (1976),

[10] Bauer, Michael et al. (2010) *Green Building: Guidebook for Sustainable Architecture*. Germany: Callwey Verlag, 15.

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Clean Water Act (1972) and Green Building Act (2006)[11] . Besides, the German federal government passed the new Buildings Energy Act in (2020) that endorses the use of clean energy in construction and sets up regulations on energy performance of buildings[12] . In addition, as a step to endorse sustainability, the Australian legislators passed the Queensland Government Sustainable Planning Act (2009) as well as the Renewal SA Urban Design Guidelines for Bowden Village[13].

4.3. A Comparison between the American LEED and the German DGNB

In fact, both the United States and Germany substituted their rating systems of sustainability from the four aspects of building. For example, the Leadership in Energy and Environmental Design is a rating system that is widely used by professionals in construction. It was issued in the United States in 1998. The LEED is a system of measurement that is structured from six main criteria that involve the sustainability of the construction site, water, energy, ventilation, the quality of design and interior atmosphere.

Moreover, in Germany, construction professionals refer to the DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen), the English translation: The German Sustainable Building Council. It was established in 2007. This came as a measure to improve the building quality and to reduce the consumption of the natural resources like water and wood as well as the high levels of energy supplies consumed by the construction sector in Germany. It classifies buildings with three levels of certifications: Bronze, Silver and Gold. However, the LEED divides the rating system into four major levels: LEED Certified, LEED Silver, LEED Gold

[11] Cornell Law School (2021) “Environmental Law” http://www.law.cornell.edu /wex/environmental_law

[12] Federal Ministry of the Interior, Building and Community (2020) “The new Buildings Energy Act” http://bmi.bund.de/EN/topics/building-housing/building/energy-efficient-

[13] Green Building Council of Australia (2021) “state and territory government” http:// new.gbca.org.au/advocate/state-and-territory-government/

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and LEED Platinum. The building projects that have lower levels of ecological impacts are rated Gold or Platinum projects[14].

Furthermore, both rating systems emphasize that all types of buildings, including residential, storage, commercial spaces, administrative and industrial buildings must be assessed according to the rating systems certified by their local authorities. Both the American LEED and the German DGNB consider the EF (ecological footprint) of buildings during three main phases; these are: Pre-Construction Phase, the Construction Phase and Post-Construction Phase[15]. The following section illustrates the certification method of sustainable construction in the United States.

5. The SSSC: The Case Study of Ortlieb's Bottling House Project, Philadelphia USA

According to official statistics, the United States registered more than 67 LEED certified buildings in 2018. Clients and construction professionals became more selective in their projects as they preferred eco-friendly building materials. Moreover, recent studies show that sustainable construction market reached more than $80 Billion in 2018. According to statistics, performed in 2015, the green construction sector marked sharp increases in the period between 2005 and 2014. Indeed, the Statista Research Department's report and chart revealed that in 2005 the sustainable construction sector reached $ 03 Billion. Ten years later, it attained $ 48 Billion. Then, by the end of 2014, it exceeded $80 Billion[16]. This

[14] Deutsches Gütesiegel für Nachhaltiges Bauen (2021) "The DGNB system" https://www.dgnb-system.de/en/system/index.php
[15] US Green Building Council (2015) "LEED v4 for Building Design and Construction". USA: UGBC, 46.
[16]Statista Research Department **"**U.S. green construction market by sector 2015" (2020) https://www.statista.com/statistics/240300/value-of-green-building-market-in-the-us-by-sector/

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demonstrates the significant growth in the market of sustainable building in the United States.

The United States is pioneer in the construction of green buildings. According to recent statistics of the sponsor of the LEED program USGBC, United States Green Building Council, more than 97 450 buildings were certified LEED in the United States[17]. They involved a large variety of building types such as residential, commercial, institutional and industrial spaces. Among the highly rated green buildings in the United States there are: Bullitt Center – Seattle in Washington, DPR Construction's Phoenix Regional Office – Phoenix in Arizona and The One Bryant Park building in Manhattan.

We have selected Ortlieb's Bottling House for demonstration, for it was rated among the best sustainable buildings in the United States. The building was originally built in 1948. It was conceived by architect Richard C. Koelle[18]. Historical records revealed that a German immigrant named Trupert Ortlieb put the founding stones of the OBH in 1869. It was a brewery factory that achieved high levels of revenues from selling beer in the United States. The factory was named after Tupert's oldest son Henry Ortlieb[19].

Besides, in 2014, the National Park Service Certification registered OBH a patrimonial building under the National Register of Historic Places Registration Form OMB N° 1024-0018[20]. Today, it bears the label of Kieran Timberlake and transformed into an architecture firm. It is owned by both architects Stephen Kieran and James Timberlake. Both architects led renovation works on the old OBH with a strategically calculated design process and set sustainability their primary objective. In this, Stephen Kieran emphasized the significance of green

[17] USGBC "Why LEED" (2020) https://www.usgbc.org/leed/why-leed
[18] National Park Service Certification (2014) "National Register of Historic Places Registration Form: Henry F. Ortlieb Company Bottling House". Philadelphia: NPSC, 08.

[19] Ibid., 08.
[20] Ibid., 01.

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architecture and construction on the environmental, economic, social, and health aspects; he argued: "The mandate of sustainability is threefold: improve the productivity of design and construction, enhance affordability and quality, and do so in an ethical and aesthetically moving manner."[21]. The illustrations below demonstrate the interior second floor of the OBH before and after the transformation retrofit into the Kieran Timberlake (KT) architecture firm.

Fig. 1: Ortlieb's Bottling House interior, 1950

Source: NRHPR Form: Henry F. Ortlieb Company Bottling House (2014), 41.

[21] Kieran, Stephen and James Timberlake (2008) *Loblolly House: Elements of a New Architecture*. New York: Princeton Architectural Press, 19.

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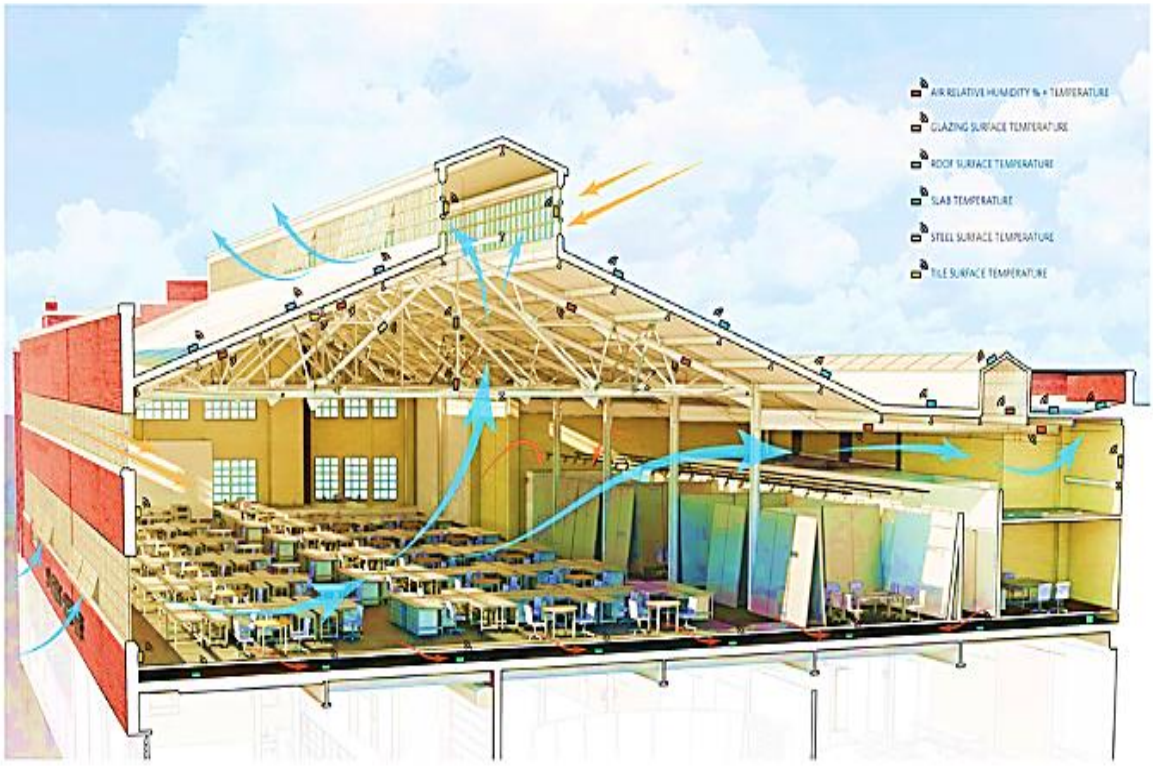
Fig. 2: Sustainable Retrofit System of the renovated OBH, 2018



Source: Ortlieb's Bottling House kierantimberlake.com, (2021).

In fact, KT was awarded by the American Institute of Architects (AIA) as a successful model for sustainable makeover projects in 2018[22]. James Timberlake and Stephen Kieran intended to renovate the OBH by preserving its industrial and historic structures. The exterior, as shown in **Fig.2**, has not been altered. The red brick wrap represents the old Pennsylvanian architectural style. This emphasizes that an old building can be revived sustainably with less transformations and less expenditures. Moreover, the clerestory and ribbon windows on the three façades of the building are strategic for they provide the interior spaces with natural

[22] AIA: "Ortlieb's Bottling House" (2018) https://www.aia.org/showcases/186146-ortliebs-bottling-house

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lighting and favors airflow across them through passive ventilation. This reduces the formation of moisture, energy consumption and electric bills and creates comfort indoors. Besides, the retrofitted building is equipped with sensor system -See **Fig. 2**- to assure thermal comfort. The 400 installed sensors transmit collected data about humidity and temperature on a real-time basis[23].

To conclude with, the thermal features of the Kieran Timberlake firm provide the occupants of the building with favorable workspace comfort. Likewise, in his Loblolly House: Elements of a New Architecture, the co-founder of KT firm, Kieran defined the pillars of sustainable construction; he asserted: "Sustainability's three main objectives—cost, quality, and the environment—are interdependent. Instead of prolonging our current paralysis, we must seek ways of understanding how these crises connect, rather than confound"[24]. Accordingly, Kieran's vision of sustainable building is clearly endorsed in his energy-saving retrofitted OBH.

6. CONCLUSION

This article discussed the standardization of sustainable construction. It revealed the bases on which the international norms of sustainable buildings were established. It discussed the different rating systems of the American LEED (Leadership in Energy and Environmental Design), Germany's DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen), Britain's BREEAM (Building Research Establishment Environmental Assessment Method), Australia's Green Star, and Japan's CASBEE (Comprehensive Assessment System for Built Environment Efficiency). It also depicted the bases on which the American architecture firm Kieran Timberlake was certified eco-friendly. It concluded that the pre-Covid-19

[23] AIMM-Group "10 Best Eco-design Projects" (2018) https://aimm-group.com/en/news/inspiration-10-best-eco

[24]Kieran, Stephen and James Timberlake (2008) *Loblolly House: Elements of a New Architecture*. New York: Princeton Architectural Press, 19.

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sustainable building certification involves three major norms; these are: ecological design, energy efficiency and low costs and expenditures. These norms imply several features such as passive ventilation, thermal performance, insulation materials, recycling materials, waste reduction, renewable energies, indoor air quality, and energy and water efficiency. However, the rapid propagation of the Corona virus marked an important turning point in architecture and the construction sector. Social distancing became a sustainable norm by imposition. This opens the door for further post- Covid-19 certification norms.

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