
Exploring the utilisation of theoretical basis in existing campus sustainability appraisal tools

Yusuf A. Adenle* and Edwin H.W. Chan

Department of Building and Real Estate,
Hong Kong Polytechnic University, Hong Kong
Email: yusuf.a.adenle@connect.polyu.hk
Email: bsdchan@polyu.edu.hk
*Corresponding author

Abstract: A theoretical perspective is a key in the categorisation, structuring, interpretation of methodological research findings, and explanation of campus sustainability studies. A comprehensive review of existing campus sustainability appraisal tools reveals limited utilisation and non-specification of theoretical basis in driving campus design and appraisal for sustainability. The review also shows the absence of a theoretical basis for guiding assessment of higher education institutions' sustainability performance based on social media user-generated content. In addressing these research gaps, the authors extensively studied five main social theories that aim at the socialisation and challenges of human societies. The outcome led to the adoption of symbolic interactionism as a theoretical basis for campus sustainability. A study was conducted to test for the applicability of the theoretical basis in campus planning and design for sustainability in Nigeria where the practice of sustainability in higher education is at a fledgling stage. The result led to the identification of localised sustainability attributes and the development of an approach that could assist in advancing sustainability practices if integrated into existing campus sustainability assessment tools.

Keywords: higher education institutions; HEIs; twitter; social science theories; elastic stack; social media.

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Biographical notes: Yusuf A. Adenle holds a BSc in Urban and Regional Planning from the prestigious University of Lagos, Nigeria in 2012 with First Class Honours. Thereafter, he received the King Fahd University of Petroleum and Minerals Graduate Scholarship from Saudi Arabia in 2014 to study city and regional planning, and graduated in 2017. In September 2017, he joined the Department of Building and Real Estate of the Hong Kong Polytechnic University as a research personnel and a recipient of the International Postgraduate Studentship (IPS) award.

Edwin H.W. Chan studied architecture in England and then learned law at London University and Hong Kong University. He obtained his PhD degree from King's College, London University. He is a Chartered Architect (Authorised Person), Chartered Surveyor, and also a Barrister-at-Law called to the UK and Hong Kong Bars. Before joining the Hong Kong Polytechnic University, he had worked in the industry for over ten years with practical experience in property development and building control in the UK and

Hong Kong. He is currently involved with teaching research and consultancy on urban studies, urban community planning, urban renewal, etc. He has published over 100 international journal papers and serves as an editorial board member of research journals. He also serves as a committee member of several government committees and professional bodies.

1 Introduction

There has been huge contention in the literature on the applicability and adoption of both qualitative and quantitative research methods in urban and regional planning discipline (Dong et al., 2019; Kaufmann, 2016). This has created what can be referred to as an artificial boundary among the scholars of urban planning and campus design even though both methods contribute different leverage to the advancement of theories and development in the field. These scholars are not supposed to be concentrating on the right or wrong method neither are they supposed to be creating boundaries between these methods since one of the objectives of the field is the development of theories. Merging the two methods when solving the challenges of campus neighbourhoods has the potential of increasing our understanding of the behaviours and preferences of humans toward campus design and appraisal for sustainability as well as reduces the limitations of each method.

Several studies have provided various pragmatic approaches to assist in combining both qualitative and quantitative methods when conducting urban planning research (Hewlett and Brown, 2018; Yu, 2018). Irrespective of qualitative or quantitative, the core of any study should be a theory as major guidance for the research process. The discussion of a phenomenon with the omission of a theory could be referred to as talking about things that cannot be regarded as a well-grounded study. Although, several challenges such as differentiating/merging the philosophical approaches or various assumptions of different theories are still being experienced. The identification and rectification of diverse theoretical basis during the process of conducting sustainability performance appraisal of higher education institutions (HEIs) campuses is important most especially for scholars utilising the triangulation research approach. In ensuring the advancement of the field of campus planning and development in a scholarly manner, there is the need for a theoretical basis for the structuring and interpretation of index and management of campus sustainability from the perspective of quantitative and qualitative methodology.

Due to the diverse nature of most campuses of HEIs and the complex process involved in sustainability assessment, several challenges of appraising sustainability performance (Dijk et al., 2017; Rodríguez López and Fernández Sánchez, 2011) especially within HEIs have been recorded. The utilisation of an appraisal tool for monitoring and evaluating the level of sustainability accomplishment and most importantly a theoretical foundation for the explanation of the overall or parts of the appraisal process can overcome these challenges. Within the built environment and social sciences disciplines, theoretical perspective studies are undoubtedly major components. Several scholars of repute within the disciplines are known to have conducted their studies based on either the adoption of a theoretical basis or they are proponents of certain theories. However, recently, studies and scholars without theoretical basis,

theoretical development, theoretical adoption, theoretical school of thoughts have become dominant and preferences for only experimental and quantitative research methods have become the order of the day. Some of the cons of this recent trend especially in campus sustainability appraisal (CSA) endeavours include but not limited to lack of appropriate framework/methodology, inability to interpret and discuss campus issues with persistent philosophical guidance, and difficulties in differentiating various campus events.

A review of extant literature reveals that the majority of campus planning researchers tend to approach the studies relating to sustainability appraisal on HEIs campus based on the analytic hierarchy process (AHP) (Lukman et al., 2010), expert scoring, survey, fuzzy TOPSIS (Mahmoud et al., 2019), etc. without a theoretical basis or the utilisation of HEIs relevant stakeholders information available on social media platforms. The rise in studies, articles, and interest in campus sustainability reporting, auditing, tracking, assessment, certification, etc. within the last few years warrant for the review of existing CSA tools to identify theories utilised in driving their framework development, identification, and selection of sustainability attributes, and sustainability appraisal process. The identification of these utilised theories/theoretical basis within these existing tools in guiding their efficient development, innovative approach of implementing and interpreting appraisal outcome is paramount for campus planners, scholars, policymakers, administrators, and politicians involved in campus planning, administration, designing, and development most importantly in developing countries with the absence of country specific-appropriate model and sustainability performance record.

2 Background to CSA and study justification

The trend and focus of professionals in the built environment such as architects, builders, civil and structural engineers, and most importantly the urban planners have been on sustainability design, performance, and practices within the campuses of HEIs in recent years. There are several studies, research, and projects that indicate the link that exists between the HEIs campuses sustainability quality, performance, wellbeing, and most importantly the health of students, staff, and non-teaching staff in different parts of the world (Alshuwaikhat and Abubakar, 2008; Sonetti et al., 2016; Velazquez et al., 2006). The justification of some of these professionals for conducting and implementing sustainability initiatives at the HEIs level is to ensure that the principles of sustainability are enshrined on the students during their stay on the campuses. While some perceived it as an avenue to improving the performance and management of the facilities and infrastructure that are owned and operated by the HEIs, others perceived it as a positive solution to implementing sustainable community service.

The existing studies show that it is important to ensure that the environment of HEIs is healthy because some of the toxics and pollutant causing health challenges are prevalent on campuses. Others reveal the low motivation and productivity among students and staff, the high rate of absenteeism, and the rise in respiratory diseases due to poor indoor environmental quality within the offices and classrooms of some of these campuses. Several other studies have been conducted that show the correlation that exists between the well-being, performance, and health of the students and the quality of the campus environment (Taylor et al., 2019).

Many studies in extant literature also show the impacts of lighting and air quality on students within the school campus. The study conducted by Mahone (2003) to

demonstrate the relationship that exists between indoor environment and the academic performance of students shows that students in campuses with better daylighting and environment with the quality environment have test scores that are higher when compare to those students in classrooms with no assess to daylighting. Mendell and Heath (2005) research findings show that there is low performance and high rate of absenteeism among students with a poor indoor environment and low rate of ventilation when compared with their counterparts with high ventilation rate, air circulation rate. Also, the International WELL Building Institute (2017) states that there is a strong link between an indoor environment daylighting and the circadian rhythm that seeks to improve the performance, health, and the reduction in stress among the students and staffs within school campus premises. Research also found that young HEIs students have a higher rate of experiencing both short and long-term health-related diseases such as asthma and rhinitis when exposed to poor classrooms indoor air quality when compared to aged students due to their young and fragile organs.

Still, several studies have shown that the thermal comfort of the classrooms of campuses affects students' performance and general well-being. The study conducted by Wargocki and Wyon (2007) confirms that there is a significant negative impact on students' performance when the temperature of their classrooms increases when compared to a classroom with moderate temperature. Other research has also shown that campuses that are designed and planned in such a way that they encourage sufficient space for physical activities improve the cognitive performance as well as the physical and mental wellbeing of the students.

In addressing the challenges highlighted above, HEIs in different parts of the world within the last few years have been aiming to ensure their campuses are environmentally friendly with a series of sustainability policies, projects, course works, and plans. A higher percentage of these sustainability initiatives within various campuses are due to the numerous important roles that HEIs have played in places like the USA and the UK (Elder, 2008). Aspects of HEIs campuses such as operations, development, research are also currently undergoing modification that entails the introduction of sustainability concepts in different parts of the world. This restructuring is necessary and inevitable because of the various negative impacts of the developmental activities and operations within HEIs campuses on the environment in addition to ensuring that the students within these institutions embrace a sustainability mindset and culture during their stay on campus. In the developed countries, sustainability appraisal initiatives have been proposed for implementation while a reasonable amount of institutions have carried out a sustainability appraisal of their campuses backed with necessary mitigation measures. The signing of different sustainability declarations (i.e., Talloires Declaration and Abuja Declaration on Sustainable Development in Africa) by management or heads of HEIs in addition to demands by stakeholders of these HEIs have increased the implementation of sustainability strategies and programs at multiple institutions across the globe (Cortese, 2003).

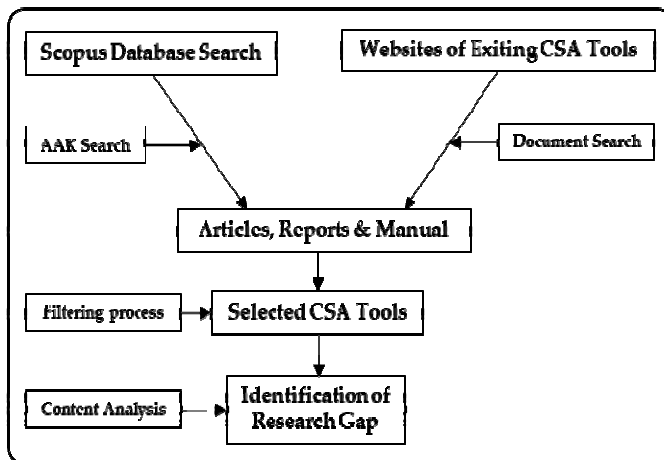
Besides, a couple of appraisal tools have been developed specifically for monitoring the sustainability attainment of HEIs (Grindsted, 2011; Grindsted and Holm, 2012; Lozano et al., 2013; Tilbury, 2011; Wright, 2002, 2004). Several limitations of these tools have been identified, discussed, and documented in extant literature (Alghamdi et al., 2017; Ceulemans et al., 2015; Kamal and Asmuss, 2013; Shriberg, 2002; Sonetti et al., 2016; Yarime and Tanaka, 2012). However, a review of the utilised theory/theoretical basis in the existing tools is missing. As such, the justification for this

study. A comprehensive review of the existing tools to identify the explanation and theoretical approach/framework regarding sustainability issues in HEIs is important at this stage to provide a foundation for CSA and framework development, especially in the global south.

2.1 Review of existing CSA tools

In an attempt to identify trends, research gaps, and future direction within a research field, the most used and highly recommended approach is a comprehensive/systematic review and analysis of extant literature. A systematic review is defined as “a specific methodology that locates existing studies, selects and evaluates contributions, analysis, and synthesises data, and reports the evidence in such a way that allows reasonably clear conclusions to be reached about what is and is not known” [Denyer and Tranfield, (2009), p.671]. The first stage of a systematic review adopted in this study was an in-depth search for articles specifically published to present CSA tools. This search was carried out on ‘Scopus’ which has a huge publication coverage (Bice and Coates, 2016). The search was carried out based on the article title, abstract, and keywords (AAK) of articles and from 1972 to 2019. Also, the webpages of all the existing appraisal, rating, ranking, and auditing tools were searched to obtain their manuals and/or reports for review and analysis purposes. The research approach is depicted in Figure 1.

Figure 1 Research approach



Although there were many papers relating to campus sustainability, however, the focus of this study is limited to documents (articles, manuals, and reports) specifically on CSA tools. At the end of this stage, 13 existing CSA tools documents were selected for further analysis. The criteria for their selection are as follows:

- a *Availability in document format*: the CSA tools whose reports or technical manual could not be retrieved from their official website were excluded for further analysis.
- b *Within the scope of tertiary institution*: the tools considered for content analysis are those whose scope are within the context of HEIs campuses. Appraisal tools that are

developed for utilisation within the coverage scope of cities, regions, countries, or public and private institutions were therefore excluded.

- c *Written in English language*: tools whose documents are written in languages that are not English were excluded for further analysis.
- d *Indicator approach*: tools designed based on account or narrative approaches were excluded for further analysis.

Table 1 Comparison of the selected appraisal tools

<i>CSA tool</i>	<i>Theory/framework</i>
Sustainability Assessment Questionnaire (ULSF, 2009)	-
Graphical Assessment of Sustainability in University (Lozano, 2006)	-
Sustainable University Model (Velazquez et al., 2006)	1 General systems theory 2 Benchmarking process 3 The Plan-Do-Check-Act (PDCA) Cycle
University Environment Management System (Alshuwaikhat and Abubakar, 2008)	-
Assessment Instrument for Sustainability in Higher Education (Roorda et al., 2009)	1 EFQM excellence model 2 The PDCA cycle
Unit-based Sustainability Assessment Tool (Togo and Lotz-Sisitka, 2009)	-
Three dimension University Ranking (Lukman et al., 2010)	-
DPSEEA-Sustainability index Model (Waheed et al., 2011)	Linkage-based frameworks
Graz Model for Integrative Development (Mader, 2013)	-
Sustainable Campus Assessment System (Hokkaido University, 2013)	-
Adaptable Model for Assessing Sustainability in Higher Education (Urquiza-Goméz et al., 2015)	-
Green Metric – UI’s GreenMetric University Sustainability Ranking (Universitas Indonesia, 2019)	Three E’s framework: environment, economics, equity and education
Sustainability Tracking Assessment and Rating Systems (STARS Technical Manual, 2019)	-

Thereafter the selected existing CSA tools were subjected to content analysis. The review shows that none of the selected appraisal tools used social theories that ensure continuous review, adjustment, and selection of indicators via the utilisation of social media user-generated content (UGC). As shown in Table 1, the review identified the use of a model [i.e., European Foundation for Quality Management (EFQM) Excellence Model], framework (i.e., link-based framework), and theory (i.e., general systems theory). The link-based framework could be in the form of pressure-state-response (PSR), driving force-pressure-state-impact-response (DPSIR) or (driving force-pressure-state-expose-

effect-action (DPSIR). Specifically, the DPSIR was utilised in the identified tool. The remaining tools were neither driven nor design based on a sound theoretical framework but rather driven by limitations of the existing tools and the availability of sustainability indicators for HEIs. As such, the authors conducted a review of theories that focus on society, socialisation, human interaction to identify the one that could fill the identified research gaps and serve as a theoretical basis for CSA especially for countries without any tool/model or record of sustainability appraisal.

3 Identification of a theoretical basis for CSA

Theory development entails the formulation and investigation of hypotheses or premises, designing these premises into a conceptual framework or theoretical large-scale systematic plan and thereafter critically examine and test the theoretical systematic plan via rigorous statistical analysis of the data or empirical validation. This study aims to identify social theories that are adaptable as a theoretical basis for campus appraisal, planning, and design for sustainability due to the gaps identified in existing tools. In an attempt to adopt a theoretical basis for CSA, five theories were selected because of their focus on society, socialisation, human interaction with their external world from both positive and negative outlooks. In the next section, a brief description of the selected main social theories relating to the structuring and functioning of the societies was discussed. Thereafter, based on their ability to appraise sustainability in HEIs campus concerning social media UGC, one was selected as a theoretical basis.

3.1 Description of the reviewed five main social theories

The main social theories selected are:

- 1 Marxism
- 2 functionalism
- 3 Anthropocene
- 4 symbolic interaction
- 5 interactionist theories.

Their brief description is as follows:

- 1 *Marxism*: The first main social theory with a philosophical approach that aims at solving the challenges of human society that was considered in the process of adopting a theoretical basis for CSA is Marxism. The theory concentrates on the analysis of social development such as definitions of society, possibilities for development, and directing change. Its central point is the identification and overcoming of the various shades of societal imbalance. Its paramount aim is the identification and the eventual defeat of the injustice (alienation or imbalance) that exists in virtually all modern society. One advantage of Marxism to campus sustainability research is its focus on identifying human societal challenges.
- 2 *Interactionism*: This theory is mostly concerned with the rationalisation of human activities and processes within the society to bring about orderliness and the

avoidance of chaos (Tavory, 2018). The application of this theory is very relevant in the field of campus planning, campus design, and architecture as evident in the life of Georg Simmel. Interactionists views socialisation as the continuous interaction that exists between every member of the society that mostly ends with some consequences due to behavioural imitation. The theory can be adopted to guide research in assessing the sustainability practices of individuals (students, staff, and all stakeholders) in the university campus to understand how behaviours affect their sustainability performance. This can be followed by the assessment of the individual university campuses’ sustainability practices to observe their impact and the eventual consequences on the global village. The theory also aims to create ideal types (patterns) of behaviour, definitions of social actions, and historical explanations of society (i.e., causal chains of social actions) which directly overlaps with some of the objectives of CSA.

3 *Functionalism*: The strands of this theory are:

- an objective description of societies
- the definition of human societies
- identification of problems in societies
- the proposal of sustainable solutions for the development (progress) of societies.

Some of its pros are the utilisation of a system-oriented (evaluation, improvement), repeatable research (observations, analysis, theorising), and its applicability by any discipline. The theory is based on a flexible system for the study and description of societies known as the AGIL system (Izadi et al., 2020) as depicted in Figure 2. All societies can be plotted using the AGIL system and can be applied to societies or parts of societies. The task of researchers using this approach is to analyse societies and their constituent parts thereafter identify and suggest sustainable solutions to the AGIL deficiencies or tensions. The overall aim of using this system is to improve society. Its applicability is very pertinent and appropriate in the field of campus planning and green campus. The theory perceives socialisation from the concept of institutionalisation where different specialised organs (i.e., school system) of the society handle socialisation (Musgrave, 1971).

Figure 2 Parsons’s AGIL system

	INSTRUMENTAL	CONSUMMATORY
EXTERNAL	<ul style="list-style-type: none"> • Adaptation <ul style="list-style-type: none"> - The ability of a society to interact with its environment <ul style="list-style-type: none"> ✓ Natural environment ✓ Neighbors ✓ Systems of collecting and distributing resources 	<ul style="list-style-type: none"> • Goal Attainment <ul style="list-style-type: none"> - Being able to set goals and to make decisions to achieve them <ul style="list-style-type: none"> ✓ Political systems ✓ Societal organizations
INTERNAL	<ul style="list-style-type: none"> • Integration <ul style="list-style-type: none"> - Including everybody in society - Balancing different groups - ‘Fairness’ <ul style="list-style-type: none"> ✓ Common language ✓ Common access to resources ✓ Common goals 	<ul style="list-style-type: none"> • Latency (=Pattern maintenance) <ul style="list-style-type: none"> - Institutions that reproduce society <ul style="list-style-type: none"> ✓ Family ✓ School - Institutions that maintain stability <ul style="list-style-type: none"> ✓ Legal system ✓ Belief system

- 4 *Anthropocene*: The concept of the Anthropocene mostly seeks an understanding of the consequences of human actions that include energy consumption and changes in various land uses (Lövbrand et al., 2015). The focus of the researchers is always on the thorough understanding of the negative impacts of man on the whole world as well as ensuring that humans are re-embedded in the planet they are destroying. The whole essence of the Anthropocene is the changing of people's negative behaviours. The rich concept of the Anthropocene has gained wide application in numerous academic disciplines since the beginning of the current millennium (Lövbrand et al., 2015). The core scientific narrative of the Anthropocene is the merging together of the system of humans and nature (Oldfield et al., 2014). The emergence of the concept of the Anthropocene was a result of the rapid large-scale negative change the planet was beginning to witness due to the activities of humans (Zalasiewicz et al., 2010). The major negative global effect on the planet that gave rise to the emergence of Anthropocene is climate change which is the ultimate challenge for most environmental CSA.
- 5 *Symbolic interactionism*: The theory of symbolic interactionism started during the 20th century as a way of describing the urbanisation and the industrialisation challenges of that period. Sociologists such as Mead, Dewey, and Cooley during the 20th century are of the perspective that the meaning of an object is not within the object but rather in the mindset humans have toward the object. A couple of scholars are in agreement that these sociologists' views have the highest substantial basis for the symbolic interaction theory (Charon, 1995). The theory is based on three underlying tenets (Benzies and Allen, 2001). These are:
- people, individually and collectively, act based on the meanings that things have for them
 - meaning arises in the process of interaction among individuals
 - meanings are assigned and modified through an interpretive process that is ever-changing, subject to redefinition, relocation, and realignments [Shalin, (1984), p.544].

These tenets bind together the stages/process of developing a flexible model that matches the nature and cultural norms of a specific society such as the HEI campuses. This model flexibility could be based on the individual and collective choice that could be modified via an interpretive procedure that continuously changes subject to necessary realignment.

After a comprehensive review and comparison of the main social theories (see Table 2), the findings reveal the perspectives of the selected five social theories. This shows the validity and reliance on their outcomes when adopted in CSA research. However, the adopted theory as a theoretical basis for CSA research is based on the authors' aim of the study which is subjected to the participants of sustainable campus appraisal which are mainly social media users.

Table 2 Comparison of the selected main social theories

	<i>Functionalism</i>	<i>Marxism</i>	<i>Interactionist theories</i>	<i>Symbolic interactionism</i>	<i>Anthropocene</i>
Emergence	Early 19th century	Late 19th century	Late 19th century	Early 20th century	Early 21st century
Target	Society	Society	Individuals	Individuals	Society
Perspective	Positive	Negative	Positive	Positive/negative	Negative
Research object	Social facts	Dialectic	Social actions	Individual actions	Human actions
Research methods	Extrapolation, extinction, deduction	Relations of production, classes, class struggle	Direct observation, explanatory, understanding, casual understanding	Focus group observation, interview, questionnaire survey	Collaborative, international solution-oriented
Output/outcome	Scientific descriptions	Revolution	Historical explanation	Behavioural descriptions	Deconstruction
Major proponents	Talcott Parsons, Auguste Comte, Emile Durkheim, Claude Levi-Strauss	Karl Marx, Vladimir Lenin, Antonio Gramsci	Max weber, Erving Goffman, Mikhail Bakhtin	Charles Horton Cooley, George Herbert Mead, Williams James, Everett Hughes	Eduard Seuss, Vladimir Vernadsky, Gorge Perkins Marsh
Applicable to	Physical sciences, psychology, engineering	Social and political activists	Psychology and social scientists	Numerous disciplines	Numerous disciplines
Sustainability pillar	Social	Economic	Economic, social	Social	Environment

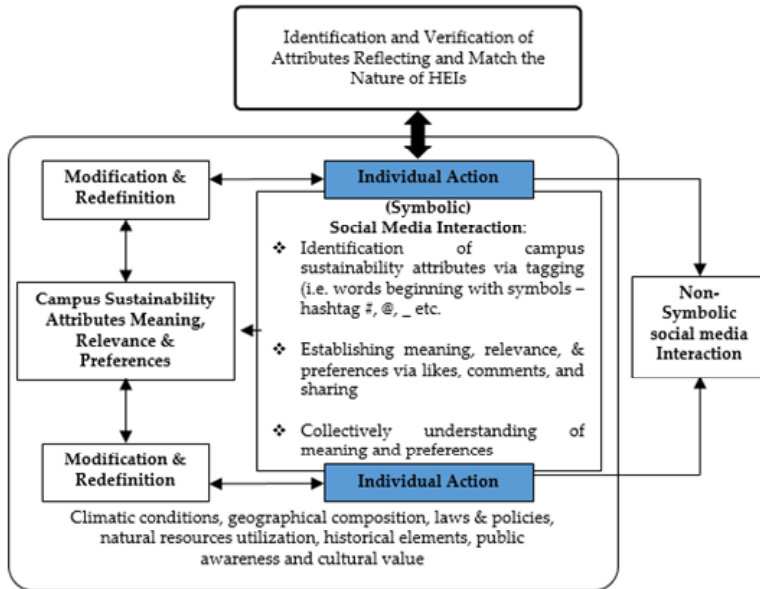
3.2 *Adoption of symbolic interactionism*

After the critical appraisals of the five main social theories, the theory of symbolic interactionism was adopted for the interpretation and context for CSA, model development, and campus design for sustainability. Different methodological approaches within the perspective of symbolic interactionism provide room for different scholars to conducting CSA and determine the level of awareness, priorities, and localisation of campus sustainability attributes based on the UGC of HEIs stakeholders on various social media platforms. The understanding of the level of importance or preferences that humans attach to things within their external environment is paramount within the tenets of symbolic interactionism. This perspective is relevant and needed in the appraisal and management of sustainability achievement in HEIs. Obtaining information and a huge volume of data from different contexts about the concept of sustainability within HEIs from social media platforms and opinion surveys from experts in the field will provide a better understanding of indicators or topics that stakeholders attached importance to.

The theory of symbolic interactionism has strong epistemological assumptions that ensure smooth incorporation with other philosophical and theoretical bases (Benzies and Allen, 2001). For scholars that utilise more than one methodology to validate their

hypotheses or arrive at their research conclusion, a theoretical perspective for logical and comprehensible results are provided by symbolic interactionism. If the concept of sustainability is integrated with the theory of symbolic interactionism, it has a higher tendency of ensuring the fulfilment of sustainable assessment in developing countries at an early stage of sustainability implementation.

Figure 3 Campus sustainability attributes and symbolic interaction (see online version for colours)



Individual perceptions and interpretations of the physical environment are one of the bases of symbolic interactionism. New meanings and approaches to responses within human societies are regularly achieved via stimuli interpretation leading to a sustainable society as a result of the procedure of meaning interpretation. Another assumption of symbolic interactionism is the fact that communication and interaction are possible between humans based on the agreed meaning associated with the objects in their culture and external world. Another premise of the theory of symbolic interactionism is the meaning attached to things changes over time based on individual context. This tenet of symbolic interaction supports the need for the spatio-temporal dimension of sustainability within HEIs campuses to allow for continuous monitoring and review of human perception and importance to the level of sustainability within these campuses. This is because the current state of things and situations can be fully understood via human interpretation of actuality within societies. It is imperative for scholars studying the spatio-temporal dimensions of sustainability of the HEIs campus to study the history and past experiences of the groups and or individuals within the scope of the study. The identification of individuals and their perceptions based on time and past views necessitate spatio-temporal dimension which is continuous monitoring of events over time.

With the incorporation of this theory into the existing CSA framework, the meaning that the participants of the study attached to sustainable campus could be revealed based

on the socio-economic, environmental, and cultural values key stakeholders of HEIs attached to campus sustainability and sustainability attributes within certain geographical regions or higher education. The campus sustainability attributes with higher awareness, comments, likes, etc. could be given more priorities and preferences. Figure 3 depicts the integration of symbolic interactionism into the identification and selection of HEIs sustainability indicators using social media UGC.

The next section presents the applicability of the adopted theoretical basis based on a study conducted by the authors in a West African nation (Nigeria) where that status of the sustainability performance of HEIs is presently unknown.

3.3 Case study: identifying spatial-based attributes preferences for campus sustainability in Lagos Mega City

Currently, a high percentage of studies relating to higher education and sustainability give more preference to hypothesis testing, utilisation of mathematical equations and software, etc. rather than the adoption, creation, expansion, incorporation, validation, and verification of theoretical approaches/frameworks. If this trend is not corrected, campus planning, appraisal, and design for sustainability studies will lack knowledge contributions and theoretical basis for guiding these endeavours. In campus planning for sustainability, the planning theory aspect relating to behavioural relationships and public welfare could be linked with the theoretical perspective of symbolic interactionism. In social sciences, the more a discipline becomes complex, the more it needs for theory creation, incorporation, and adoption. Theoretical perspectives assist in the process of decision making, policy issues deliberations, and evaluation of policy effectiveness. The identification of the preferences of campus sustainability attributes using social media UGC provides a real-life scenario to test the applicability of the tenets of symbolic interactionism in a university in Lagos megacity, Nigeria.

Currently, the estimated population of Lagos is 13.7 million and occupies the 17th position among the largest megacity of the world (United Nations, 2016). The status of Lagos as a megacity is one of the reasons for selecting a university for this study because only Cairo in Egypt and Kinshasa in DR Congo have the status of megacities in Africa. Also, unlike the two cities of Tokyo and Osaka in Japan that have been projected to experience a decline in growth rate; the city of Lagos has been continuously experiencing an annual growth rate of 2.5% and a 5% population increase from 1970 to 1990. The astonishing projection states that the city will become the largest city in the world by the year 2100 (Desjardins, 2017).

Investigation and comprehensive review of the literature reveal that the annual increase in the number of people residing in Lagos is due to the movement of people from the nearby countries and other parts of the country for studies in several HEIs. From amongst the HEIs, the University of Lagos, a top-ranked university in Nigeria that was established in 1962 in the coastal city of Lagos was selected for the application of the theoretical basis. The University was selected for the application of the proposed approach because it possesses some principles of sustainable campus which include but not limited to the:

- 1 allocation of a large area of land for the establishment of a botanical garden
- 2 presence of sustainable infrastructure

- 3 preservation of its wide green area, and historic buildings
- 4 presence of natural Lagoon waterfront.

4 Research findings

4.1 Environmental-dimension attributes with spatial-based campus sustainability indicators

In ensuring the identification of campus-wide sustainability attributes preferences based on the basis of symbolic interaction, 220 indicators with 266 sub-indicators across 55 categories from the 13 extracted CSA tools in Table 1 were extracted. Thereafter, they were filtered to ensure the selection of environmental-dimension attributes with campus-wide indicators. A large number of spatial data within the framework of HEIs campuses could be obtained without any dependence on official data that are either restricted or unavailable. Spatial decision support systems ensure that indicators with spatial dimension provide smart referenced based campus planning and decision making that could be monitored and reviewed based on one of the tenets of symbolic interactionism. This led to the limiting of the categories, indicators, and sub-indicators to 13, 50, and 65 respectively.

Afterward, repeated campus sustainability attributes or with similar technical meanings were merged and subjected to SMART Approach. This is to make certain that the attributes are:

- 1 *Specific*: A reliable attribute must be specific (i.e., discrete to avoid confusion during a CSA application). A specific attribute is clear to the HEIs stakeholders and defines the domain in which the whole campus-wide assessment will be carried out. It is also founded on available, accessible, and accurate information.
- 2 *Measurable*: A sound attribute must be measurable. A measurable attribute is bound to possess a certain discrete numerical value as well as a standardised unit of measurement that is acceptable all over the world. The measurable property of attribute also assists in the statistical analysis of the framework.
- 3 *Achievable*: One of the prime properties of good attributes is that they are achievable. If an attribute cannot be achieved, it is impossible to utilise the symbolic interactionism approach and come up with conclusions and results. The attribute will then be merely a hypothetical one. Attributes should also reflect the HEIs capability to effect change, linked to the precise and complete goals of the HEIs and based on the democratic inclusion of stakeholders in their selection process.
- 4 *Relevant*: Another quality of a good attribute is an ability to be robust and relevant to overall assessment objectives as well as local and global sustainability challenges. They should also be comparable to the local and contemporary context and meet the key needs of campus stakeholders. Also, in selecting attributes, consideration is given to their ability for data collection, documentation, and maintenance. Irrelevant attributes complicate the indicator framework and the whole assessment process.
- 5 *Time-specific*: Lastly, as attributes are measurable entities, notable change over a specific time is an important feature of indicators for CSA. Sound attributes have

longevity, which means attributes should allow for repeated measurement, and be adaptive to change based on one of the tenets of symbolic interactionism.

The outcome of the SMART Approach is presented in Table 3.

Table 3 Identified campus-wide sustainability attributes

<i>Categories</i>		<i>Indicators</i>
Energy and climate change	1	Air and climate
	2	Annual energy consumption rate
	3	Building energy efficiency
	4	Concentration of emissions, effluents, and waste
	5	Concentration of greenhouse gases
	6	Energy consumption
	7	Energy efficiency
	8	GHG emissions
	9	Number of renewable energy sources in campus
Environment	10	Production of emission, effluents, and waste
	1	Greenspace and forest land
	2	Land
	3	Landscape
	4	Public space
	5	Total area on campus covered in forest vegetation
	6	Total area on campus covered in planted vegetation
	7	Total area on campus for water absorption besides the forest and planted vegetation
Setting and infrastructure	8	The ratio of open space area to the total area
	1	Buildings
	2	Green buildings
	3	Physical structure
Transportation	4	Natural heritage
	1	Access for handicapped people
	2	Green transportation
	3	Campus fleet
	4	Flow planning
Waste	5	Pedestrians and cycling
	1	Construction and demolition waste diversion
	2	Sewage disposal
Water	3	Waste reduction
	1	Amount of water supplied and distributed/collected for purification
	2	Rate of water consumption and quality
	3	Treated water consumed
	4	Water consumption
	5	Water efficiency

4.2 Twitter social media user generated content mining based on symbolic interactionism premise

To demonstrate symbolic interactionism in campus appraisal for sustainability, the authors conducted a study via the use of:

- 1 elastic stack (i.e., data mining open-source product)
- 2 Python 3 Library: GetOldTweets3 to mine Twitter social media UGC from an account of a university in Nigeria (West Africa) to establish the preferences of the selected campus sustainability attributes.

For convenient data analysis, Python programming language was utilised in transforming the UGC in comma-separated value (CSV) to JavaScript Object Notation (JSON). The official Twitter handle of the university (@UnilagNigeria) has more than 10,000 followers since its creation in 2017. Unlike other HEIs' Twitter account, the Twitter account of the University of Lagos has UGC involving green campus and sustainable development that are frequently updated. In this study, 1,989 UGC generated by the social media users between May to July 2017 was extracted based on the first tenet of symbolic interactionism although the university Twitter account has UGC in thousands.

The second tenet of symbolic interactionism states that "meaning arises in the process of interaction among individuals" [Shalin, (1984), p.544]. The meaning individuals attached to the concept of campus sustainability will become evident on social media due to continuous interactions amongst social media users. This will become evident in the comments, likes, and retweets. The authors discovered the meaning behind every post on Twitter by also mining the comments underneath them. A questionnaire survey was later distributed to experts within the university to validate the applicability of Twitter likes, comments, and retweets. This was done to determine their weight and the formulation of the equation for defining preferences given to the campus sustainability attributes discussed during social media interactions. Twenty experts in four different academic departments of the university were visited. Five experts each from the Department of Computer Sciences; Urban and Regional Planning; Sociology; and Systems Engineering. The weights of replies, retweet, and favourites are 3, 2.85, and 3.1, respectively. The campus sustainability attributes preference equation is defined as follows:

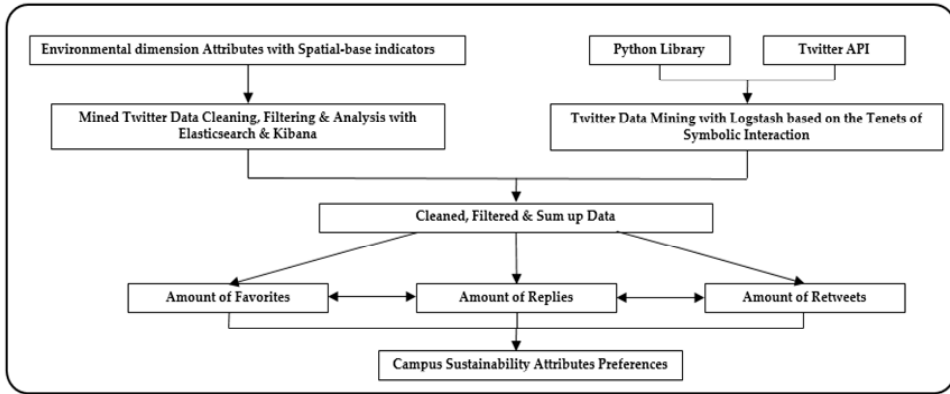
$$S_p = \frac{R_p(3.0) + R_t(2.85) + F_t(3.1)}{S_{p_{\max}}} \quad (1)$$

where S_p represents campus sustainability attributes preference, R_p , R_t , F_t representing replies, retweets, and favourites; and $S_{p_{\max}}$ represents the maximal campus sustainability attributes preference.

Still, with the use of social media tags, other users can react by making comments, likes, or retweeting because they agree on the meaning attached to the topic. The authors agreed that tweets with fewer likes, retweets, and comments have fewer individuals that have agreed with meanings attached to them. Better still, they are of less awareness or did not match the nature and the present challenges/needs of HEIs. They are therefore given less level of preference for sustainability appraisal. At the end of the data analysis stage, the energy and climate change category had the highest preference level. This is followed by waste; water; setting and infrastructure; environment; and lastly transportation. Unlike Figure 3 that depicts the general incorporation of a symbolic interactionism basis in CSA,

the framework for the determination of the campus sustainability attributes preference for the selected university is depicted in Figure 4.

Figure 4 A framework for identifying HEIs attributes preferences



5 Discussion and implication for sustainability in HEIs

The first tenet underpinning symbolic interactionism is that humans interpret the world via the utilisation of symbols when they are communicating with themselves. Also, Charles Cooley was reported to have mentioned that the human mind is the action that channels the utilisation of symbols toward self (Charon, 1995), based on the concept of ‘social self’ by Williams James. Therefore, when conducting a symbolic interactionism study of understanding others, the researcher is a role projected by an individual to identify language symbols being used. The UGC with Twitter tag symbols were identified and thereafter filtered and analysed to obtain sustainability attributes contained in the UGC with the highest likes, replies, and retweets. The results were analysed using the campus sustainability attributes preference equation adopted and modified from Sun et al. (2018) to identify the positive or negative orientation and behaviours towards the campus-wide sustainability within the university campus.

In symbolic interactionism, the understanding of the information humans have about their environment as well as the importance they attached to things within their surroundings is also relevant. As such, the authors focus on the preferences that social media stakeholders of the university have for campus-wide sustainability. For instance, individuals are likely to exhibit different behaviours and provide different responses when they are confronted with a questionnaire survey or face to face interview and when they are providing comments, opinions, or discussing campus sustainability topics on social media. As such obtaining data on campus sustainability from both the social media and face-to-face interviews with questionnaire surveys might ensure that the overall sustainability behaviour is obtained. In studies relating to campus appraisal for sustainability, the vital component of obtaining the importance humans attached to sustainability indicators is the interaction between the individuals and the campuses. Considerations for the perception of the concerned stakeholders and individuals require that they provide a valid basis for constructing and conducting a CSA. It is also

paramount for scholars using this philosophical perspective to inquire into the records and history of the individuals or groups being understudied. To ensure that this is considered in the study, the authors mined UGC containing:

- 1 Twitter username
- 2 Tweet date
- 3 Tweet text
- 4 number of favourites
- 5 number of retweets
- 6 number of replies.

One of the tenets of symbolic interactionism focuses on the process of interaction among humans rather than the structure of the interaction. When conducting CSA research based on the perspective of symbolic interactionism, understanding the views leading to the decisions, comments, replies, likes that an individual makes about campus sustainability indicators is not enough. The process that led to the comments made by the individuals also need to be ascertained. Besides, when it comes to understanding the behaviours of humans to campus sustainability it is important to understand the process that led to the action being taking by individuals rather than just focusing on individual behaviours. The adoption of symbolic interactionism based on the computer technology of artificial intelligence in judging the sentiment orientation of the UGC that are related to campus sustainability is also relevant. For instance, the appraisal of the preferences of experts on more than 30 important performance attributes in Andalas University was carried out via the use of AHP (Amrina and Imansuri, 2015). Also in the process of developing a framework of sustainability assessment for some selected buildings in a Canadian university and another one in Egypt, a fuzzy TOPSIS approach was used to derive the preferences of some selected experts (Mahmoud et al., 2019).

The authors would like to state here that the findings and conclusions of these previous studies based on their adopted methodologies to arrive at the HEIs stakeholders' preferences are not being undermined or condemned. Nonetheless, the number of stakeholders that participated in the process of reaching the preferred criteria, the objectivity of the methodology, and the advancement of the employed methods seem not impressive.

Society is made up of people that constantly engage in different types of interactions which makes it possible for the establishment of human society, and campus communities. As such, it makes humans different from other living creatures. Therefore, incorporating the philosophical approach of symbolic interactionism into sustainable campus appraisal would assist researchers in concentrating and comprehending in clearer perspectives the studies on societal-based, social media-based, and perspective of individuals. This is because there will be no HEIs campuses without the interactions of humans. It is important to understand the meanings attached to campus sustainability across different cultures and societies from the views of different societal groups and individuals. The adoption of a symbolic interactionism approach to sustainable CSA has the prospect of widening the knowledge on individual and collective behaviours to campus facilities and infrastructure without neglecting existing theories in the field. Lastly, considerations for the tenets of symbolic interactionism before, during, and after

undertaking any CSA projects could have a huge potential in significantly expanding the knowledge base and development within the field of urban and campus planning.

6 Conclusions and future direction

As a philosophical approach that derived its foundation from the field of sociology, the incorporation of symbolic interactionism in the area of CSA is still missing. Despite several research outcomes of both CSA and the symbolic interactionist perspective, the study of symbolic interactionism as a rational, logical, and analytical concept that incorporates or adopts both sustainable campus and symbolic interactionism is rare. The theory guides in developing efficient, significant, and innovative methods of conducting, discussing, and interpreting campus planning and design for sustainability. On the other hand, it proffers a philosophical as well as a conceptual approach that will ensure that the assessment of the level of environmental sustainability in HEIs is conducted efficiently with the integration of artificial intelligence, social media UGC, machine learning, and sentiment analysis. The theory also ensures that several other technology-driven resources and tools for planning of HEIs campuses are incorporated in the campus sustainability studies. For planners, administrators, researchers, and environmental impact assessment experts that utilised several techniques like AHP, environmental impact assessment, and other multi-criteria approaches to appraising sustainable campus, symbolic interactionism offers a theoretical approach to conduct well-structured research that contributes to knowledge in the field of urban planning and CSA. The utilisation of symbolic interactionism as a theoretical basis for conducting CSA brings into the research area of campus planning and design for sustainability a better understanding of human sustainability behaviours' towards HEIs campuses.

There are some general criticisms of symbolic interactionism in the extant literature. Some scholars maintained that the theory:

- 1 does not apply the scientific method in its approach and cannot comprehensively address the challenges of macro sociology
- 2 is mostly limited to the field of sociology and social psychology
- 3 the majority of the scholars that are concerned with this theoretical approach only engage in agentic choices that have received a lot of condemnations.

The criticism of the theory from the perspective of the post-modernism and some other theorists is that its data and collection strategies are perceived as a second-order reality, discursive and should be dissolved and questioned continuously. Blumer (1969) responded to some of the critics of this theoretical approach that symbolic interactionism is not a method but rather a philosophical approach. Also, the philosophical approach of symbolic interactionism is not limited to the field of sociology and social psychology but rather it has been expanded into several other theories like the theories of the development of civilisation, critical theory, chaos theory, Parsonian theory. Symbolic interactionism has also been incorporated with cultural studies and several adoptions of the theories have been identified in extant literature. The authors perceived the criticisms of the theory as strengths and justification for incorporating this approach in campus appraisal for sustainability because there is a need for modification and continuous review of the HEIs appraisal process.

Future research should utilise sentiment analysis based on the latest machine learning technology to ascertain the orientation (i.e., positive, neutral, or negative) of the identified attributes. The machine learning technology could also be utilised in understanding the behaviours within HEIs based on the identified campus sustainability attributes. Future studies utilising the study's framework and the proposed theoretical basis should be extended to all HEIs in Nigeria and the global south.

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