



RESEARCH ARTICLE

REVISED **Enhancing urban regeneration at the neighbourhood level: the role of sustainability assessment frameworks [version 2; peer review: 3 approved with reservations]**

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Abstract

Purpose: Urban centres have been argued to be crucial in the battle for sustainability. With more than half of the global population presently living in cities, the sustainability challenges of global warming, environmental degradation, social inequality, and economic recessions have continued to thrive. To this end, there have been efforts to revive and improve the existing physical and social structure of cities in a process known as urban regeneration. The aim of this paper is to explore the role of sustainability assessment frameworks in urban regeneration.

Approach: Aligning with the positivism philosophical position, and using document analysis as a data collection method, the study discusses the state of the art of urban regeneration and its application in recent times. The study also reviewed selected neighbourhood sustainability assessment frameworks as a tool for decision-making towards sustainability to know the extent in which they capture the goals of urban regeneration.

Findings: Findings showed that the uptake of the sustainability assessment frameworks could play a role in enhancing integration of local context, social wellbeing and economic prosperity, environmental quality, and stakeholder engagement at the neighbourhood level which are the main aspects of urban regeneration.

Theoretical and practical implications: In theory, this paper establishes the assumption that with some revisions, sustainability assessment frameworks could serve as a tool for decision-making in urban regeneration process. Practise-wise, urban regeneration at the neighbourhood level can now be measured against sustainability benchmarks and indicators.

Keywords

Cities, Global warming, Indicators, Neighbourhood, Sustainability, Sustainability assessment frameworks, Urban regeneration

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Any reports and responses or comments on the article can be found at the end of the article.



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REVISED Amendments from Version 1

This version demonstrates the implementation of the suggestions of the reviewers as explained under the various section of the article. Introduction: clarity on the link between urban regeneration, sustainability, and NSAFs; recognition of existing studies in this regard (Boyle *et al.*, 2018; Peng *et al.*, 2015; Sharifi & Murayama, 2014; Zheng *et al.*, 2017). Literature review: a balanced discussion on NSAFs from the perspective of the challenges and limitations. Methods; expansion of the selected NSAFs from three to four with the inclusion of DGNB Urban Districts used in Germany; justification for the selection of the NSAFs. Results: expanded to include consideration for the four main components of urban regeneration in DGNB Urban Districts with a revision to Table 1, Table 2, Table 3, and Table 4. Discussion and conclusions: a more critical approach has been adopted with references to some case studies such as the MediaCityUK as suggested by the reviewers; the limitations of NSAFs were also identified and areas for improvements were highlighted. This revised article contains some new references as the implementation of the comments from the reviewers suggests.

Any further responses from the reviewers can be found at the end of the article

Introduction

The idea that the battle for sustainability will be won or lost in urban areas has been established by various scholars (Glaser, 2011; Komeily & Srinivasan, 2015; Owen 2010). This is because in the last 100 years, urbanisation has resulted in key environmental, social, and economic challenges. For example, it has been noted that whilst cities occupy just 3 per cent of the earth's landmass, they disproportionately account for 60–80 per cent of energy consumption and 75 per cent of carbon emissions (Robinson & Cole, 2015; UN, 2016). Urban population has increased in recent years, from only 2 per cent of the world's population in 1800 to more than 50 per cent in 2008 (Wu *et al.*, 2014), and presently at 55 per cent. According to UN-Habitat (2016), it is projected to reach 68 per cent by 2050.

As a result, several approaches to enhance urban sustainability have been devised in various contexts, in addition to the various international agenda (e.g. sustainable development goals, and the new urban agenda). One of such approaches is the Building Environmental Assessment (BEA) tools developed to assess the sustainability credentials of buildings. This evolved when it was discovered that the construction industry accounts for about 60 per cent of total energy consumption (Curwell *et al.*, 2005; Deakin & Curwell, 2004; Lehmann, 2015:5). However, sustainability studies and lessons from practice have indicated that a conglomerate of green buildings does not guarantee urban sustainability, without a focus on the neighbourhood scale which has been regarded as the planning unit and building blocks of cities (Berardi, 2013; USGBC, 2018; Wangel *et al.*, 2016). The main argument is that if sustainability considerations, principles, and targets are integrated at the decision-making process of a new neighbourhood, then this can in the long-term and wider picture create a sustainable urban area (Bahadure & Kotharkar, 2018; Cole, 1999; Komeily & Srinivasan, 2015). This concept and approach of planning at the neighbourhood level are traceable to the 1898 Garden city

of Ebenezer Howard and pioneers like Clarence Perry, among others (Farr, 2008). This idea has been operationalised with the emergence of the Neighbourhood Sustainability Assessment Frameworks (NSAFs) through which a proposed development can be assessed against an array of sustainability indicators. Examples include BREEAM Communities, LEED-ND, CASBEE-UD, etc.

While NSAFs have been useful for new developments, urban regeneration scheme as a deliberate process to change an urban environment by a large-scale adjustment to standard requirements for urban living and working (Dimuna & Omatsone, 2010) has continued to thrive globally. This has been conceived as the most practical way to change the economic, social, and environmental status of a degenerated location. With these potentials, Zheng *et al.* (2014) argued that urban regeneration could contribute to sustainability. This raises a question of how it can be assessed taking into consideration the complexities involved in urban regeneration. As a result, the link between sustainability assessment and urban regeneration project has been emphasised by La Rosa *et al.* (2014) resulting in several studies that have attempted to explore this relationship. This has come in several approaches. One, current NSAF to assess urban regeneration project as in the MediaCityUK which was awarded BREEAM Communities Excellent ranking (Sharifi & Murayama, 2014). Two, an assessment of one dimension of sustainability. For example, Glasson & Wood (2009) and Sairinen & Kumpulainen (2006) focused on the social sustainability of urban regeneration projects. Three, a multidimensional approach (e.g. indicator-based) which assesses various aspects of sustainability as demonstrated by Hemphill *et al.* (2004) and Peng *et al.* (2015)

Amongst the several approaches, this paper would focus on the use of NSAFs for urban generations where some key findings have emerged from existing literature. For example, Boyle *et al.* (2018) emphasised the shortcomings of NSAFs in terms of their inability to address the sustainability of existing communities in deprived areas, because they are more tailored to deliver “green-rated” master-planned neighbourhoods, which are only affordable by a selected few. In addition to the fact that some of the frameworks are expert-driven, they are also prescriptive with an environmental bias and little consideration for socio-economic assessment which is crucial in urban regeneration.

Although while a new framework in its entirety is proposed by Zheng *et al.* (2017) to assess neighbourhood sustainability to support urban renewal decision-making in high-density cities, a revision of the existing frameworks where necessary will perhaps be beneficial for the following reasons. One, NSAFs are already gradually becoming the definition of a sustainable neighbourhood in various contexts where they are been applied because they address to some extent the local needs, values, and aspiration. For example, the indicator set of DGNB used in Germany is different LEED-ND used in the USA. Two, some NSAFs have helped implement some existing statutory regulations in development proposals. For example, in the UK, the EIA is compulsory for all development before it can be considered by BREEAM Communities assessment. Three,

although some of the NSAFs have been in existence since the closing decades of the twentieth century, they are constantly being evolved to reflect and address current needs. As a result, they can be expanded to address regeneration issues in their various contexts.

To this end, this paper aims to explore the role of selected NSAFs in urban regeneration at the neighbourhood scale of spatial development. The 2 main questions guiding this paper are: (i) can the uptake of NSAFs in urban regeneration projects enhance the delivery and benchmarking of sustainable neighbourhoods in the context where they are being applied? (ii) what key revisions do the NSAFs need to enhance their suitability for urban regeneration?

A related study to this paper in literature is [Sharifi & Murayama \(2014\)](#) which examined three case studies using selected NSAFs from the lens of their compliance with sustainable development. However, this paper attempts to explore the NSAF from the perspective of the principles of urban regeneration in terms of their substantive (structure and content) and procedural aspects. Also, newer versions of the NSAFs used for the study have since been released.

The paper is divided into the following headings: the literature review provides an overview of NSAFs and urban regeneration; the methodology which presents strategies and the methods applied in the study; the results section presents the level of consideration of the four goals of urban regeneration in the selected NSAFs; the discussion and conclusions which highlights the key inferences from the results.

Literature review

Urban regeneration

Urban regeneration emerged after the Second World War in Europe and Britain as a result of the post-war decline of industries ([McDonald et al., 2009](#)). It is also traceable to the public housing slum clearance movement launched in 1949 as captured in the 1949 Act with the main aim of providing a better and quality housing through the removal of residential slums. To date, urban regeneration has evolved in terms of its substantive and procedural characteristics ([McDonald et al., 2009](#)). It has been a process to address poverty in an urban context by a change in the physical landscape, having the potential to yield social and economic benefits. Urban regeneration programmes have been driven by both government institutions and residents, with strong advocacy for a joined-up approach ([Couch et al., 2003](#)). However, the first decade of the 21st century heralded an understanding that urban regeneration could be helpful to deliver sustainable places. That is, places where people can live and work, now and in the future, as characterised by consideration for equity, provision of necessary services, transport and connectivity, environmental integrity, economic prosperity, affordable housing and built environment, social and cultural integration, and governance ([Office of the Deputy Prime Minister, 2003](#)).

These characteristics have shaped the understanding of the concept by various scholars, which according to [La Rosa et al. \(2017\)](#)

is a multidisciplinary field of research. As a problem-solving strategy, it involves a comprehensive and integrated vision, which will resolve urban issues and enhance development in urban neighbourhoods ([Roberts, 2009](#)). This is because, it brings transformation to an environment that has experienced a decline in its physical, economic, and environmental status ([Egan et al., 2015](#); [Egan et al., 2015](#); [Peng et al., 2015](#)). Also, urban regeneration helps to eliminate sub-standard housing while stimulating housing production that is affordable, decent and enhances quality living ([Dimuna & Omatsone, 2010](#)).

As a result, it is considered as one of the most effective instruments in evolving long-term solutions for economic, cultural, environmental, physical and social concerns ([Alpopi & Manhole, 2013](#); [Newman & Jennings, 2008](#)). Urban regeneration could, therefore, serve as a useful platform to enhance urban sustainability as noted by several scholars ([La Rosa et al., 2017](#); [Peng et al., 2015](#); [Vojnovic, 2014](#); [Zheng et al., 2017](#)) while also decreasing the demand for new developments in peri-urban centres and making cities more attractive and appealing ([Turcu, 2012](#)). This assertion can be established by its definition as a “comprehensive and integrated vision and action which seeks to resolve urban problems and bring about a lasting improvement in the economic, physical, social, and environmental condition of an area that has been subject to change or offers opportunities for improvement” ([Roberts, 2017:18](#)). For example, urban regeneration helps to deliver socio-economic function which is central to urban sustainability because such process brings a facelift to urban fabrics which are dominantly occupied by the vulnerable sects of urban population ([Boyle et al., 2018](#)). In addition to addressing the key aspects of sustainability, urban regeneration aligns with and upholds the context-specificity principle of sustainability. That is, its desired success depends on consideration for contextual indices such as institutional framework, economic and market processes, government policies, physical and social fabric, and environmental aspects ([Doak & Karadimitriou, 2007](#); [Paddison, 2012](#)). This is however executed under the ambit and in tandem with the global principles of urban regeneration.

The above submission suggests that urban regeneration aims to deliver four key goals, as illustrated in [Figure 1](#).

Neighbourhood Sustainability Assessment Frameworks

Evolution. Sustainability assessment (SA) as a concept, process, and method was developed as a decision-making strategy that directs decisions towards sustainability ([Hacking & Guthrie, 2008](#)). It is a “formal process of identifying, predicting, and evaluating the potential impacts of a wide range of relevant initiatives (such as legislation, regulations, policies, plans, programmes and specific projects) and their alternatives on sustainable development of society” ([Devuyst, 2000](#); [Hacking & Guthrie, 2008](#)). SA is a distinctive form of integrated assessment (IA) which considers the social, economic, and environmental impacts of a proposed development, plans, policies, programmes, and other initiatives ([Bond & Morrison-Saunders, 2013](#); [Gibson et al., 2005](#); [Scrase & Sheate, 2002](#)). It is a type of ex-ante assessment because it is conducted at the preliminary stage of a project to predict future outcomes. This helps to choose between

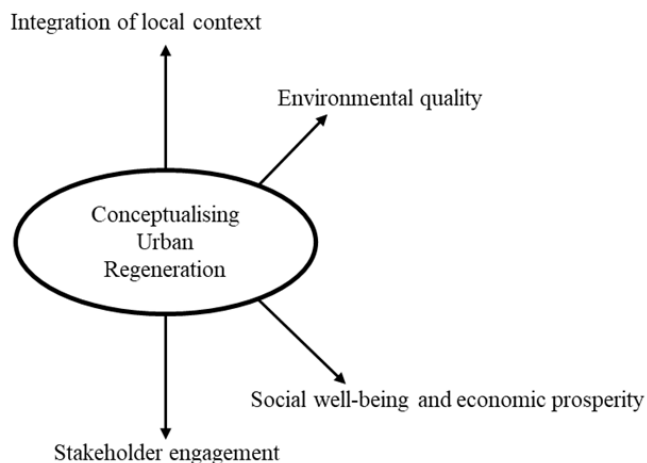


Figure 1. Components of urban regeneration.

various options. With this, it helps to avoid taking decisions that would not lead to the delivery of sustainable places.

In recent times, SA frameworks have been useful tools and mechanisms to support the decision-making process in planning for urban sustainability, even recently at the neighbourhood scale (BRE, 2017; GBCA, 2014; Wang et al., 2016). This it does in three stages. Firstly, by clarifying the definition of sustainability based on the needs, values, and aspiration of the people. The second is by transferring the definition and interpretation of sustainability into an operational information unit in a properly communicated approach using indicators. Thirdly, by implementing the assessment framework to trigger action and solutions based on the simplified and well-communicated information that would enhance urban sustainability (Waas et al., 2014). Executing the first stage which involves exploring the meaning of sustainability to the people implies the appreciation and recognition that the concept of sustainability is context-specific.

NSAFs emerged around a decade ago (Joss et al., 2015); this was triggered by Agenda 21 (a non-binding action plan of the United Nations about sustainable development), which had earlier called for local stakeholders' participation to implement local plans. This was also coupled with the need to enlarge the scale of SA from the building to the neighbourhood level (Berardi, 2011; Berardi, 2011; Cole, 1999; Komeily & Srinivasan, 2015) due to the perceived ineffectiveness of the pioneer Building Environmental Assessment (BEA) tools in assessing the impact of a proposed development holistically. The neighbourhood defined as a "geographically delineated sub-area within a city where residents share services, facilities and common interest" (Zheng et al., 2017:905). A neighbourhood is not in isolation because they are connected to a broader system of neighbourhoods under the umbrella of a city. This scale, therefore, serves as a suitable scale to evaluate the social, economic, and institutional dimensions of sustainability (Berardi, 2013; Sharifi & Murayama, 2014). NSAFs have evolved as

tools to aid decision-making for a better and holistic assessment in monitoring progress toward sustainability. NSAFs have been at the front banner in the campaign for urban sustainability (Berardi, 2013; Cashmore & Kornov, 2013). Scholars agree that it has both helped to integrate the various dimensions of sustainability in the decision-making process by setting out clearly the indicators that must be met in order of priority when conceptualising a new neighbourhood. Pioneering the NSAF movement was the development of HQE 2R between 2001 and 2004 and Earthcraft communities in 2003. Subsequently, between 2006 and 2009, the CASBEE-UD, the U.S. Star community Rating System (STAR-CRS), LEED Neighbourhood Development (LEED-ND), and the UK BREEAM communities were launched. The German system DGNB New Urban Districts and the Australian system Green Star Communities were released in 2011 and 2012, respectively (Wang et al., 2016).

Classifications of NSAFs. There are complexities in classifying NSAFs. Scholars have therefore attempted to classify NSAFs based on their mode of development and their functions. A NSAF can either be third-party or plan-embedded in terms of development (Sharifi & Murayama, 2013). It is third-party if it was developed as an extension of a BEA tool with an enlargement in the scope of its assessment. That is, from the building to the neighbourhood scale. Most of the well-known NSAFs (e.g. BREEAM Communities, CASBEE-UD, and LEED-ND among others) are in this category. It is plan-embedded if it was specifically developed to evaluate proposed plans with respect to their sustainability performance, e.g. Ecocity, HQE 2R.

Classifying by function, a NSAF can be in one the following three categories: (i) performance; ii) certification, and (iii) planning tool kit (Joss et al., 2015). Performance NSAFs measure the sustainability of a neighbourhood development against some criteria in order to make a comparison with another development. Urban areas use performance assessment frameworks to set targets in measuring progress over time which is also useful for policymaking. Examples include: CASBEE for Urban Development/Cities; City Biodiversity Index (Singapore Index); City Grid; Eco-City Development Index System; European Common Indicators; Global City Indicators Facility; Global Urban Indicators; Green City Index; REAP for Local Authorities; Slim City; Sustainable Cities Index.

Certification NSAFs assess a proposed neighbourhood development for certification or endorsement, which mostly involves an accreditation process with some fee payment (Joss et al., 2015). In most certification frameworks, the results are classified to make it understandable. The certification helps to benchmark new developments and market a proposed development in terms of its sustainability potential (Wang et al., 2016). Examples include: BREEAM Communities; Climate Positive; Enterprise Green Communities; Green Star Communities; IGBC Green Townships Rating System; LEED ND; Living Building Challenge; Star Community Rating System; DGNB NSQ; One Planet Communities; Sustainable Communities; EcoQuartier; Estidama Pearl Community Rating System; National Eco-County, Eco-City

and Eco-Province; National Eco-Garden City; Selo Casa Azul Caisa.

Lastly, the planning toolkit NSAFs serve the purpose of guiding the processes of planning for sustainability geared towards enhancing a collaborative decision-making process within stakeholders (Joss *et al.*, 2015). They advocate for community engagement and participation in the planning process. Examples include: ASEAN ESC Model Cities; Biosphere Eco-City; Community Capital Tool; Eco Districts; Eco2 Cities; Green Communities; Urban Sustainability Indicators; Charter of Eco Mayors (Les Eco Maires); Eco-Model Cities; Green Climate Cities; and RFSC.

While some NSAFs can perform more than one function, some frameworks can perform one function. Others can perform all the three functions in the design process. For instance, BREEAM Communities, which is categorised under ‘certification assessment frameworks’, is also used a planning tool-kit encouraging and facilitating community engagement through consultation plan. Furthermore, it can also be used for performance assessment of a regeneration project.

Structure of a NSAF. A NSAF framework comprises of (i) indicators (ii) weighing system; (iii) certification level; (iv) rating stages.

Indicators: Sustainability indicators are measurable variables which are used to evaluate a proposed development. There are three significances of indicators in a NSAF. One, since they are locally developed in consultation with stakeholders, they have the potential to stress the context-specificity of sustainability in an assessment framework. Two, they simplify communication which helps to guide decision-making towards sustainability (Valentin & Spangenberg, 2000). Therefore, this process helps to extend sustainability from abstract formulation to explicit discussions on its concepts and operational meaning which is essential in meeting sustainability targets (Rennings & Wiggering, 1997; Rigby *et al.*, 2001). Three, they serve to actualise the call for greater involvement of the grassroots and local stakeholders as it helps to establish the view of sustainability in a context in a simplified way accommodating its social and political ideologies (O’Riordan & Viosey, 1998).

Weighing system: The weighing system gives information about the weight assigned to each indicator, which demonstrates its significance in contributing to a decision during the decision-making stages. For instance, the greater the weighting, the higher such indicator is perceived to contribute to a sustainable neighbourhood in that context. How then do we determine the weighting of an indicator in a way that will not be controversial and highly subjective? This can be addressed using any of the multi-criteria decision analysis (MCDA) methods such as the Analytic Hierarchy Process (AHP); Analytic Network Process (ANP); Preference Ranking Organisation Method for Enrichment of Evaluations (PROMETHEE), involving stakeholders which perhaps offers a less subjective scoring and weighing

process as the consistency of the result can be determined (Lee *et al.*, 2009; Sharifi & Murayama, 2015).

Certification level: The certification level is obtained after the assessment of the proposed neighbourhood against the indicators. The final score obtained determines the level of certification. This varies from one assessment framework to another. For example, the certification levels in the BREEAM Communities are outstanding, excellent, very good, good, pass, and unclassified, with each level of certification indicating how well a proposed neighbourhood meets BREEAM sustainability credential. The certification level is conducted in various stages of the proposed development. For instance, the LEED-ND V4 has three stages which are: (i) conditional approval; (ii) pre-certification; (iii) full certification.

Challenges of current NSAFs

It is noteworthy that NSAFs have continued to receive attention by practitioners on the following basis. One, they are structured to have a clear methodology and are easy to understand (Hiremath *et al.*, 2013). For examples, the certification stages of the NSAFs (e.g. outstanding, excellent, and pass etc.) gives a clear summary of the sustainability credential of a proposed development. Two, a platform to demonstrate the stakeholders’ interest to assess the sustainability of cities at an appreciable scale (Dawodu *et al.*, 2017). Three, facilitation of engagement and dialogue amongst various stakeholders including consumers of the proposed neighbourhood thereby enhancing social learning (Shriberg, 2002).

They are however not without the following challenges and weaknesses as identified by various scholars. One, there are several complexities associated with the urban development process which perhaps may be unaddressed by NSAFs which are objective and based on metrics (Boyle *et al.*, 2018) therefore being inadequate to capture the structure and processes that define urban morphology (Boyle *et al.*, 2018; Elgert, 2018). Two is the expensive nature of data collection before and during the assessment process as noted by Garde (2009). Three, they are most times expert-led in their development without a holistic consideration of the views and perceptions of other stakeholders (Komeily & Srinivasan, 2015). Four, most NSAFs are market-driven because the certification of a proposed neighbourhood (as either gold, platinum, etc) promotes the market recognition of the neighbourhoods (Ameen *et al.*, 2015; Sharifi & Murayama, 2013) which has resulted to criteria hunting in the assessment process.

Methods

This study aligns with the positivism philosophical stance, which postulates that knowledge can be obtained through observation and measurement. As a result, this study is objectively limited to data. This is appropriate in this context because data was obtained primarily from the technical manuals of selected NSAFs using document analysis. The assessment frameworks selected are: BREEAM Communities (UK), LEED-ND V4 (USA), Green Star Communities (Australia), and DGNB Urban District

(Germany). The following documents: (i) [BREEAM communities technical manual SD202 \(v1.2:2012\)](#), (ii) [LEED v4 for Neighbourhood Development](#), and (iii) [Green Star Communities 2012](#) and (iv) [DGNB Urban district \(criteria overview\)](#) were obtained from the website of Building Research Establishment; US Green Building Council; Green Building Council of Australia; and DGNB (German Sustainable Building Council) respectively, which are the institutions responsible for the development of the assessment frameworks. These manuals are the established and recognised documents for each of the NSAFs which are to serve as a guide for developers and other built environment professionals before the submission of their proposals for assessment. They have also been used by various scholars ([Adewumi *et al.*, 2019](#); [Sharifi & Murayama, 2013](#); [Wangel *et al.*, 2016](#)) in a similar study. The choice of these frameworks is based on these considerations: One, to enhance the geographical spread of this study in terms of assessing context-based issues. Two, their technical manuals are readily available for different categories of stakeholders (researchers, policymakers, developers, and other built environment professionals). Three, they are also widely used hence dominating NSAF literature.

Document analysis as a method is useful for obtaining data from existing documents such as official gazettes, policy documents, newspapers and journal publications among others majorly through a process of reviewing and evaluation ([Bowen, 2009](#)). One of the advantages of this method is that it allows the readily available data to be well examined and interpreted to give it meaning. It is also cost-effective, and there is also no obstruction to the research process ([Yin, 2009](#)). The process involved a

review of the selected NSAFs in terms of their content and how they address the following: integration of local context; social wellbeing and economic prosperity; environmental quality; and stakeholder engagement which are the four components of urban regeneration as presented in the literature review. The reliability of the data sourced was strengthened using the technical manuals of the selected assessment frameworks, which are available and readily accessible to the public, ensuring its repeatability and consistency with similar studies ([Sharifi & Murayama, 2013](#); [Wangel *et al.*, 2016](#)). The validity of the study was ensured in two ways. First, that document analysis seemed to be the appropriate data collection method as it allowed the gathering of detailed information of each assessment framework. Second, that the geographical spread of the frameworks ensures the capturing of what may appear as context-related issues across the various countries where NSAFs are being applied.

Results

This section presents the extent to which the selected assessment frameworks addresses the four main components of urban regeneration.

Integration of local context

The LEED-ND, DGNB Urban Districts, and the BREEAM Communities have targeted categories and indicators that address local context (see [Table 1](#)). To address the current challenge of urban sprawl in most parts of the United States, targeted indicators were used in LEED-ND with the ‘neighbourhood pattern and design’ category, with criteria such as ‘walkable streets’, ‘compact development’, ‘mixed-use neighbourhoods’, and ‘connected and open community’ amongst others. The LEED-ND

Table 1. Targeted indicators in selected neighbourhood sustainability assessment frameworks.

Country	Core/local urban challenges	NSAFs	Selected targeted indicators
UK	Inadequate social wellbeing; non-engagement of citizens in planning	BREEAM Communities	SE02- Demographic needs and priorities; SE05- Housing provision; SE06- Delivery of services, facilities, and amenities; SE07- Public realm; SE09- Utilities; SE11- Green infrastructure; SE12- Local parking; SE14- Local vernacular; SE15- Inclusive design
USA	Urban sprawl; high dependence on automobile; urban heat island	LEED-ND	NPD C1- Walkable streets; NPD C2- Compact development; NPD C3- Mixed-use neighbourhood centres; NPD C4- Mixed-Income diverse communities
Australia	None	Green Star Communities	None
Germany	Social wellbeing and need for more user-friendly spaces	DGNB (Urban District)	SOC 1.1- Thermal comfort in open spaces; SOC 1.6- Open space; SOC 2.1- Barrier-free design; SOC 3.2- Social and functional mix; TEC 3.2- Mobility infrastructure- pedestrians and cyclists

also has the ‘Regional Priority Credit’, which is targeted to address geographically specific environmental issues (USGBC, 2018). BREEAM communities also attempt to address the concern for social wellbeing which perhaps has not been properly addressed in the UK introduces key social wellbeing indicators to the BREEAM communities 2012 which was an improvement to the 2008 version of the assessment framework.

Social wellbeing and economic prosperity

BREEAM Communities considers social wellbeing which is aimed at delivering a socially inclusive community. For example, a proposed development is expected to show evidence of the provision of services, facilities, and amenities. The SE01-Economic impact according to BRE (2017) is aimed at increasing economic wellbeing by attracting inward investment, create local jobs while also enhancing the economic activity in the local area. LEED-ND addresses social wellbeing with the ‘smart location and linkage’ category. Although the framework does not have a category that addresses economic prosperity, this consideration of this can be seen in some categories. For example, the ‘neighbourhood pattern and design’ category has indicators such as ‘local food production’, ‘transit facilities’, and ‘transportation demand management’ that could contribute to economic growth. Also, indicators such as ‘smart location’, ‘access to quality transit’ under the ‘smart location and linkage’ category can help to achieve economic prosperity. The Green Star Communities attempts to deliver social wellbeing by permitting and recognising developments that are “diverse, safe, inclusive, and improve the wellbeing of those that live, work and play within them” (GBCA, 2014). Examples of indicators in the ‘liveability’ category which addresses this include: access to amenities, community development, and safe places amongst others. The

framework also aims to ensure that new development enhances business diversity, education, and development of skills. Indicators in the category of ‘economic prosperity’ include: ‘affordability’, ‘employment and economic resilience’, and ‘return on investment’ amongst others. DGNB also captures both social wellbeing and economic prosperity by advocating that new development should have social and commercial infrastructure with an efficient transport system. Table 2 presents a summary of the consideration for social wellbeing and economic prosperity in the selected assessment frameworks.

Environmental quality

BREEAM Communities attempts to promote environmental quality by ensuring minimum impacts of environmental conditions on the health and wellbeing of residents using six indicators. Examples are flood risk assessment, adapting to climate change etc. SE-03 which captures flood risk assessment is to ensure that development takes due account of flood risk where it present and as a result take necessary measures to reduce the risk of flooding to the development and surrounding sites (BRE, 2017). LEED-ND V4 envisages promoting environmental quality with the ‘green infrastructure and buildings’ category, having indicators like ‘construction activity pollution control’, ‘renewable energy production’, and ‘wastewater management’ amongst others. In addition to this, is the ‘smart location and linkage’ category with such indicators as ‘brownfield remediation’, ‘floodplain avoidance’, and ‘wetland and water body conservation’. The intent of the ‘brownfield remediation’ according to USGBC (2018) is to encourage the cleaning up of contaminated lands while ‘wetland and water body conservation’ is to preserve water quality, natural hydrology, and biodiversity through conservation of wetlands and water bodies. The Green Star Communities also has

Table 2. Indicators in selected neighbourhood sustainability assessment frameworks addressing social wellbeing and economic prosperity.

NSAF	Social wellbeing	Economic prosperity
BREEAM Communities	SE02- Demographic needs and priorities; SE05- Housing provisions; SE06- Delivery of services, facilities and amenities; SE07- Public realm SE09- Utilities; SE11- Green Infrastructure; SE12- Local parking; SE14- Local vernacular; SE15- Inclusive design	SE01- Economic impact; SE17- Labour and skills
LEED-ND	Housing and jobs proximity; Access to civic and public spaces; Neighbourhood schools; Access to recreation facilities; Visitability and universal design; Access to quality transit	Local food production; Transport demand management; Infrastructure energy efficiency; Housing types and affordability
Green Star Communities	Healthy and active living; Community development; Sustainable buildings; Culture, heritage, and Identity; Walkable access to amenities; Access to fresh food; Safe places	Community investment; Affordability; Employment and economic resilience; Education and skills development; return on investment; Incentive programs; Digital Infrastructure; Peak electricity demand
DGNB (Urban Districts)	SOC 1.1- Thermal comfort in open spaces; SOC 1.6- Open spaces; SOC 3.2- Social and functional mix; SOC 3.3- Social and commercial infrastructure; TEC 3.2- Mobility infrastructure- pedestrians and cyclists	ECO 1.1- Life cycle costs; ECO 1.2- Local economic impact; ECO 2.3- Land use efficiency

the ‘environment’ category which aims to ensure that developments are less resource-intensive while giving priority to practices that reduce a community’s impact on land, water and the atmosphere” (GBCA, 2014). The life cycle assessment in the DGNB is aimed at reducing emissions-related impacts on the environment and consumption of non-renewable resources to a minimum (DGNB, 2020). Table 3 presents a summary of the consideration of environmental quality in the selected assessment frameworks.

Stakeholder engagement

BREEAM Communities has the ‘governance’ category which aims at ensuring community involvement in the decision-making process at the various stages of new development. This category has such indicators as ‘consultation plan’, ‘demographic needs and priority’, and ‘design review’ amongst others. The ‘consultation plan’ is to ensure that the needs and knowledge of the community are captured to improve the quality and acceptability of the development (BRE, 2017). Members of the local community and appropriate stakeholders must have been identified for necessary consultation. LEED-ND has the ‘LEED accredited professional’ indicator under the ‘innovations’ category for stakeholder engagement. Although there was no clarity on the role of the local community, one of its objectives is to encourage team integration required by new development (USGBC, 2018). Green Star communities encourages engagement with stakeholders with the ‘governance’ category with such indicators as ‘sustainability awareness’, ‘engagement’, and ‘operational governance’ amongst others. According to GBCA (2014), development proposals are to provide evidence that a stakeholder engagement strategy has been demonstrated according to best practice standards while ensuring that sustainability information will be shared with the various stakeholders at the community level so that local stakeholders can maximise the social, economic, and environmental initiatives implemented. Table 4 presents a summary of the consideration of stakeholder engagement in the selected assessment frameworks.

Discussion and conclusions

The review of the selected NSAFs showed that their uptake in an urban regeneration project at the neighbourhood could be helpful to some extent to address the four main goals of integration of local context, social wellbeing and economic prosperity, environmental quality, stakeholder engagement. However, there is still a further need to establish contextual meanings of the four goals, so that the aspirations and values of all stakeholders are captured. For example, the findings from this paper show the differences in the meaning of social wellbeing and economic prosperity in the selected NSAFs, based on the indicators assigned to each one supporting the findings of Boyle *et al.* (2018); Joss *et al.* (2015) and Adewumi *et al.* (2019) that NSAFs are context-specific. Therefore, as the NSAFs continue to evolve, their revisions is expected to reflect these contextual understandings so that their uptake and use at the various decision windows in urban regeneration could set the sustainability benchmarks in different contexts. This would be in addition to the ‘mandatory criteria’ in each NSAFs which are to ensure the attainment of some acceptable level of sustainability. The mandatory criteria or indicators which are not tradeable are compulsory before new development can be certified. The BREEAM communities’ certificate, for example, will not be issued to development without addressing all mandatory criteria (BRE, 2017).

Also, the potentiality of NSAF for urban regeneration in enhancing the consideration for social wellbeing as demonstrated by the selected NSAFs should serve as enough impetus for the revision of its cost in terms of payment for assessment. For example, Black (2008) noted that not all the developers who applied for LEED-ND certification in 2009 could afford the cost of accreditation. The consideration for social wellbeing (with such indicators as housing provision; delivery of services, facilities, and amenities; inclusive design; safe and appealing streets; and access to public transport amongst other) in the current version of BREEAM Communities has addressed the criticism of its focus on environmental aspects. However, this does not suggest that there

Table 3. Indicators in selected neighbourhood sustainability assessment frameworks (NSAFs) addressing environmental quality.

NSAFs	Environmental quality
BREEAM Communities	SE03- Flood risks assessment; SE04- noise pollution; SE08- Microclimate; SE10- Adapting to climate change; SE13- Flood risk assessment; SE16- Light pollution
LEED-ND	Wetland and Water-body conservation; Agricultural land conservation; Brownfield remediation; Certified green buildings; Heat island reduction; Solid waste management
Green Star Communities	Integrated water cycle; Greenhouse gas strategy; Materials; Sustainable transport and movement; Sustainable sites; Ecological value; Waste management; Heat island effect; Light pollution
DGNB (Urban Districts)	ENV 1.1- Life cycle impact assessment; ENV 1.4- Biodiversity; ENV 1.5- Urban Climate; ENV 1.6- Environmental risks; ENV 1.7- Ground water and soil protection; ENV 2.1- Life cycle assessment (resource consumption); ENV 2.2- Water cycle; ENV 2.3- Land use

Table 4. Indicators in selected neighbourhood sustainability assessment frameworks (NSAFs) addressing environmental quality.

NSAFs	Stakeholder engagement
BREEAM Communities	GO 01- Consultation plan; GO 02- Consultation and engagement; GO 03- Design review; GO 04- Community management of facilities
LEED-ND	LEED accredited professional
Green Star Communities	Accredited professional; Corporate responsibility; Sustainability awareness; Engagement; Operational governance; Adaptation and resilience; Environmental management
DGNB (Urban Districts)	PRO 1.7- Consultation

is no room for improvement because the success of the integration of these criteria needs to be measured to make the necessary amendments where necessary. For instance, some of the projects on completion either as new development or as regeneration are only affordable to the high-income earners raising the question of home affordability which is a key component of urban regeneration. Some of those projects include Hoyt Yards in Portland, Oregon which received a LEED-ND platinum certification. This was also noticeable in the MediaCityUK where no affordable or social housing has been provided (Sharifi & Murayama, 2014).

Findings from this study also show that a NSAF could be helpful to deliver a regeneration project that does not adversely affect the environmental, social, and economic characteristics of existing (surrounding) neighbourhoods. SE-03 in BREEAM Communities which focuses on flood risk assessment as presented in the results is an example of this. This is what Komeily & Srinivasan (2016) noted as 'relational balance'. That is, indicators that address spatial and social relationships within the neighbourhood and between existing neighbourhood in terms of infrastructure and amenities. This consideration also aligns with Roberts (2017) that urban regeneration task can best be addressed from an integrative and comprehensive perspective. For example, using the MediaCityUK project as a case study, Mould (2015) noted that the NSAF adopted did not ensure adequate linkage between the project and the surrounding environment.

While recent versions of NSAF have continued to show the appreciation of stakeholders' engagement in urban development as presented in this study, more could still be done if the use of these frameworks is to be well suited for urban regeneration. This can be achieved by giving clarity on the roles and responsibilities of all relevant stakeholders at each of the development phases (Roberts, 2017). LEED-ND, for example, needs to make it mandatory for developments to engage with residents to ensure that they are carried along in the whole process. This has the

potential to enhance social learning while promoting effective collaboration.

Conclusively, this paper has examined the potentiality of NSAFs in urban regeneration. It argued that to some extent, they could serve as a mechanism to support decision-making during an urban regeneration exercise at the neighbourhood level while also suggesting areas for improvement. Such revisions could position the NSAFs as a tool to measure the performance of an urban regeneration project in terms of how they address sustainability targets. Urban regeneration schemes can thus be conceptualised with NSAF at the early phase taking into consideration the existing reality and urban context. As urban regeneration will continue to shape the fabric of the 21st century's neighbourhoods, such initiatives should be executed in hand with sustainability targets which can be worked with using such mechanisms like NSAFs.

Data availability

Source data

LEED v4 for Neighborhood Development is available at: <https://www.usgbc.org/resources/leed-v4-neighborhood-development-current-version>.

The LEED v4 for Neighborhood Development document is used for the planning and design of new neighbourhood developments by presenting the various sustainability categories and criteria including their respective scores

The Green Star Communities scorecard is available at: <https://new.gbca.org.au/green-star/rating-system/communities/>.

The Green Star Communities scorecard explains the sustainability criteria and the score attached to each criterion in the assessment of a proposed development.

The BREEAM Communities Technical Manual is available at: <https://www.breeam.com/communitiesmanual/>.

The BREEAM Communities Technical Manual presents the structure of BREEAM communities (which is a Neighbourhood Sustainability Assessment Framework), explaining its categories and credits for assessing a new neighbourhood development.

DGNB Urban Districts Technical Manual is available at: https://www.dgnb-system.de/en/schemes/scheme-overview/urban_districts.php

The urban districts scheme reflects the guiding principle of the DGNB and considers the well-proven quality sections: ecologic, economic, sociocultural, functional, technical and process quality. The scheme includes all areas relevant to a sustainable building: from the location and energy supply of the district to public space amenities and mixed-use, sustainable mobility and reducing costs throughout the entire life cycle.

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Version 2

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Maria Balouktsi 

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The paper is well structured and its purpose is clear, i.e. to investigate whether neighbourhood sustainability assessment frameworks can be useful tools not only for guiding the development of new neighbourhoods, but also for supporting urban regeneration projects. However, it does not provide sufficient details to support its main conclusion.

Thus, I recommend a major revision where the author expands and rewrites his results to guarantee a more in-depth analysis. In my comments below, I recommend specific changes that could enhance the author's narrative and presentation of results.

Introduction

§3

Please note that whenever you use expressions such as "several studies", you should always provide (at the minimum) examples, i.e. references to these studies. Ideally, the most important conclusions of these studies should be summarised.

"This has come in several approaches" – it is not clear what the difference is between approach "one" and approach "three"; most of neighbourhood sustainability assessment systems nowadays are multi-dimensional, i.e. they cover environmental and socio-economic aspects, just sometimes in an unbalanced way.

Please also explain what you mean by "indicator-based". Neighbourhood sustainability assessment systems are also typically indicator-based. Why is this referred to as a special feature of approach "three"?

§5

The three reasons why the review of existing NSAFs is beneficial are not clear. E.g. "some NSAFs have helped implement some existing statutory regulations..." it is no surprise that all these

systems comply with national regulatory requirements and of course go beyond that. If not, no developer/client would choose to use them to certify their developments. These are market-driven tools. Why is this important in the context of the paper?

“Three, although some of the NSAFs have been in existence since the closing decades of the twentieth century, they are constantly being evolved to reflect and address current needs.” Is the author trying to highlight that by reviewing selected systems, recently developed or updated, one can get a hint about what are the currently pressing global and national problems that need to be taken into account in urban regeneration processes, irrespective of whether these are considered important from the neighbourhood/city stakeholders? For example, an evolutionary trend towards including GHG emission calculations, sometimes from a life cycle perspective, can be seen in the most recent systems. However, if this is the author’s intention – i.e. to identify such trends – it is surprising that he reviewed the previous version of Green Star Communities (the latest is of 2016, v1.1) as well as that he chose to review LEED ND instead of the very recent LEED for Existing Communities (launched in 2018, if I am not mistaken). The latter is especially designed for this paper’s purpose and perhaps reflects better the “current needs”.

Methods

§1

Justification of the choice of these frameworks: “One, to enhance the geographical spread of this study in terms of assessing context-based issues.” I would suggest that the author adds a framework from Asia to his review to be more consistent with this argument, e.g. BEAM Plus Neighbourhood, CASBEE UD, etc.

“Three, they are widely used hence dominating NSAF literature”. It would be interesting to know the numbers, if possible – how many neighbourhoods have been assessed/certified using these tools up to date? What types of neighbourhoods have been assessed? Such information could be presented in a table. The fact that they dominate literature is not a proof that they are widely used in practice. Maybe they constitute the better marketed ones.

Results

All tables: it would be better to organise the tables in such a way that they can directly reveal the commonalities, differences and gaps of the reviewed frameworks with respect to the topics covered. A better arrangement could be: the rows list all the important aspects that should be addressed in sustainable urban regeneration projects based on literature, the columns lists the frameworks, the cells are filled with the related indicators where applicable. In this way, one will be able to readily see where the gaps are. In the current state, it is hard to tell what important aspects are not addressed at all by any of these systems (if any).

Integration of local context: an analysis of how DGNB integrates local context is missing. For example, the indicator of “barrier-free design” reflects the current interest in Germany, and Europe as a whole, in this thematic area, due to the changing demographics toward an ageing population. E.g. in Germany there are also standards (DIN 18040) for barrier-free construction. In general, the author should provide a more in-depth discussion of which aspects are considered universally important, i.e. are global concerns, and which ones are only of regional/national

interest. The author should also note that existing neighbourhoods can be very diverse even within the same country: historic city centres, villa suburbs, low-income suburbs, etc. Local context is therefore not only the context of the country. Can existing frameworks satisfy the needs of different types of neighbourhoods through their indicators?

Table 4, typo: Please replace “environmental quality” with “process quality”.

Stakeholder engagement: this term can mean anything. Please first present the main building blocks/principles of a sustainable stakeholder engagement and sustainable governance based on literature. Then, it can be shown whether these are suitably covered in the reviewed frameworks (i.e. their indicators). My recommendation on how to rearrange the tables also applies here. Some questions that should be asked: do the frameworks promote the inclusion of vulnerable and marginalised social groups (like women, minorities and the disabled) in the decision-making process to foster social equity? Do they promote the clear and transparent communication of the content and results of the process to a wider audience than the few stakeholder representatives? How conflicting interests can be avoided? Examples of sources that can provide inspiration: (1) UN-Habitat. (2007). *Inclusive and Sustainable Urban Planning: A Guide for municipalities*, Vol. 1. Nairobi, Kenya: Un-Habitat¹; (2) Oliver, A., & Pearl, D. S. (2018). Rethinking sustainability frameworks in neighbourhood projects: a process-based approach. *Building Research & Information*, 46(5), 513-527².

Discussion and conclusions

This section is relatively well written, but I feel that, in parts, it introduces new arguments (e.g. the ‘relational balance’), which arguments could be moved to the results.

Perhaps for this specific paper, dividing the last sections into “results and discussion” and “conclusions” could improve the narrative.

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Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Not applicable

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Is the argument information presented in such a way that it can be understood by a non-academic audience?

Partly

Does the piece present solutions to actual real world challenges?

Partly

Is real-world evidence provided to support any conclusions made?

Partly

Could any solutions being offered be effectively implemented in practice?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: 1) sustainability assessment at all urban scales, 2) life cycle assessment of buildings and construction products

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 28 May 2020

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Helen Wei Zheng 

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While this version has some improvement, there are still issues that need to be addressed.

1. Introduction:

Even new literature has been added, some arguments are still not convincing. To my knowledge, there are more research articles regarding how urban regeneration is assessed, and how this can be linked to sustainability assessment.

The three reasons for conducting this study are still not clearly explained. For example, you say 'some NSAFs have helped implement some existing statutory regulations in development proposals'. But why is this important? Also, the three reasons are disjoint. Still, it is difficult to understand research gaps from the arguments.

'This has come in several approaches....'

The classification of these approaches is not clearly explained.

There are quite a few typos that need to be tidied up.

2. Literature review:

While urban regeneration has some potential to contribute to sustainability, there are some potential problems. However, the literature review does not critically address that and link it back to the introduction.

The title of figure 1 needs to be adjusted. Should not be 'component'.

Different types of NSAFs are mentioned. It could be useful to use a table to summarise them critically rather than just listing the names.

Not all NSAFs have the structure you mentioned. Need to dig into the details.

3. Results:

Though the four dimensions used are good, the details in the results are very descriptive. More efforts could be made to analyse their characteristics, similarities, and differences.

4. The case study you mentioned is very general and brief. The case studies suggested last time should include details and comprehensive analysis. It could be useful to conduct a comprehensive case study in a separate session.

5. Discussion and conclusions

More analytical depth is required. Some contents are more like results.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Partly

Are the conclusions drawn adequately supported by the results?

Partly

Is the argument information presented in such a way that it can be understood by a non-academic audience?

Partly

Does the piece present solutions to actual real world challenges?

Partly

Is real-world evidence provided to support any conclusions made?

Partly

Could any solutions being offered be effectively implemented in practice?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: The first strand of my research is decision-making support for sustainable urban regeneration by developing different indicator frameworks and simulation models. The second strand of my research focuses on sustainable urbanisation from a spatial planning perspective.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Version 1

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Luke Boyle

Urban Real Estate Research Unit, University of Cape Town, Cape Town, South Africa

The introduction does not outline how the study is going to be carried out.

I think the link between urban regeneration and sustainability could be made a little clearer. I suggest a little more depth in articulating why urban regeneration is necessary for urban sustainability. This aspect of the argument is a little thin.

I would have liked to see a more balanced discussion about NSAFs. There is a lot of literature that is critical of these tools (i.e. top-down, market-driven, prescriptive, reductionist, inadequate consideration for context and socio-economic aspects of sustainability etc.)

The paper makes the point regarding how an assessment at the building scale inform us of the sustainability credentials of the neighbourhood. By this logic, how can neighbourhood assessment tools inform us of the sustainability credentials of the city when they are seen in isolation to the economic, political and social forces that influence urban regeneration and sustainability? Are we just now drawing an arbitrary circle around a bigger target? Thus, explain how NSAFs are different to green building assessment tools and how they promote sustainable urban regeneration and development in a broader sense.

The paper does not discuss the link between NSAFs and urban regeneration. This is an important link as the tools tend to be aligned more with new developments and urban regeneration typically involves uplifting inner city districts or areas in decline.

I feel that more clarity is required in demonstrating how the research objective will be achieved through the methodological approach. It is my understanding that three NSAF manuals were used as the primary data for the research based on their geographical spread (which seems arbitrary). I question how reliable inferences regarding NSAF tools more generally can be made by examining three manuals. Further, how can it be applied to urban regeneration without drawing upon any evidence of their use for urban regeneration projects? There is plenty of literature that looks at the application of these tools and looks at their role in urban regeneration. It is suggested that these are used to build the case for the argument, since the research objective is to explore the role of NSAFs in urban regeneration.

The findings offer very little detail and depth. There needs to be a deeper discussion about each aspect and how it relates to urban regeneration. For example, the author asserts that: "*BREEAM Communities gives adequate consideration for social wellbeing which is aimed at delivering a socially-inclusive community*" without providing any depth to support this statement or to describe what 'adequate consideration' means. As a result, the findings read more like a summary/review of the NSAF categories rather than an evaluation pertaining to their application for driving sustainable urban regeneration.

Unfortunately, I do not feel that there is a strong enough case made by the author that the NSAFs uphold the imperatives of sustainable urban regeneration. This is partly due to the lack of depth provided by the literature review, findings. The outcome is that there is little reflection and interrogation whether NSAFs can drive sustainable urban regeneration. The author starts to do this to a limited extent in the discussion and conclusion. Should the author address the comments and apply more depth to their analysis, perhaps supported by examples, I believe the paper could make a valued contribution. For the most part the paper is well-written but could do with another proofread as some grammatical errors may have slipped through the cracks.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Not applicable

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

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Author Response 22 Apr 2020

Ayomikun Solomon Adewumi, University of Dundee, Dundee, United Kingdom

Dear Reviewer,

I want to sincerely appreciate your gesture in accepting to review this article. Also, your thoughtful comments on how its quality can be enhanced. I agree with your suggestion on the need for more clarity on the link between urban regeneration and sustainability because that is the only this basis by which we can discuss urban regeneration from the lens of a sustainability assessment framework. Also, a more balanced discussion on NSAFs will be considered in the revised article from the perspective of the challenges and limitations as established in the literature. I have gathered some new literature (Peng et al., 2015; Boyle et al., 2017; Sharifi & Murayama, 2014; Zheng et al., 2017) which will be helpful in this regard.

Yes, I agree on the need to discuss the link between NSAFs and urban regeneration knowing well that these tools are tailored for new development, unlike urban regeneration which involves the renewal of existing development. Document analysis as explained in the methods section was adopted in this study. On the selection of the NSAF used for this study, while the geographical spread was a factor, the primary criteria was the availability and accessibility of the technical manuals. Also, these are the most dominant in existing literature allowing this study to make a comparison with the existing study. The revised article will expand the selection to DGNB used in Germany. Yes, I hold a similar view on the need to draw evidence from case studies. References will be made to the MediaCityUK and Hoyt Yards regeneration projects in the UK and US respectively in the revised articles in the discussion of results. A detailed review of each sustainability aspect in the light of urban regeneration is presented in the revised article.

Thank you also for your comment that most of the article is well-written. The revised article will address some already identified grammatical errors. I plan to submit the revised article soon. I will be most grateful if you could please give a review based on your comments.

Thank you and kind regards
Ayomikun

Competing Interests: There are no competing interests.

Reviewer Report 26 February 2020

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Helen Wei Zheng 

Department of Planning and Environmental Management, Manchester Urban Institute, University of Manchester, Manchester, United Kingdom

This paper provides a review of sustainability assessment frameworks, which is interesting. However, it is still not ready for indexing in terms of contribution to knowledge.

First of all, sustainability assessment at the neighbourhood scale for urban regeneration is not a new topic. This paper does not well address the research gaps. What are the research gaps in literature? Why is the review important?

'There exists a gap in terms of a benchmark in ensuring that urban regeneration delivers sustainable outcomes, most especially at the neighbourhood level.'
Why did the author claim this gap? It is suggested to add more detailed analyses on existing

frameworks rather than proposing a gap out of blue.

Second, literature review on NSAFs is very descriptive. It is OK to include evolution and structure. But it would be better to provide a critical analysis. For example, what are the current challenges of NSAFs? Again, with this analysis, the gap can be better clarified.

Third, the review of the frameworks mainly draws upon three tools. How can the three frameworks shed light on the proposed research aim? There is a need to explore more frameworks. Another suggestion is to include case studies at the neighbourhood level that address practical issues to strengthen the critical power of the paper.

The framework in Figure 1 is a good start to further strengthen the paper. It is suggested to include more in-depth analyses for further development of the paper.

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Author Response 27 Feb 2020

Ayomikun Solomon Adewumi, University of Dundee, Dundee, United Kingdom

Dear Dr Helen,

Thank you very much for accepting to review the article and I must admit that your comments will enhance the quality of the article. I have been able to access more articles (e.g. Boyle et al., 2018 and Zheng et al., 2017) that focus on sustainability assessment frameworks and decision support for urban regeneration which I will review to identify more gaps in literature agreeing to your comments. The current challenges of NSAFs will also be looked in to. The choice of three frameworks was justified based on their dominance in existing literature coupled with the accessibility of their technical manuals for review. In this regard, I will explore further if I could access more manuals of existing NSAFs such as CASEE-UD and DGNB.

Once again, thank you very much for your time in reading through the article and providing your comments.

Competing Interests: No competing interest