

**A values-based approach for generating localized social indicators for use in sustainability  
assessment and decision-making: test case of brownfield soft reuse in Nigeria**

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## **Abstract**

Sustainable development is a global aim, aided in many ways by the use of indicators for assessment in its social, environmental and economic domains. However, there are significant weaknesses and needs for improvement in *social* indicators, and we show here that the bolt-on use of a values-based approach can meet those reported needs for the specific case of a widely used decision support framework used in sustainable land remediation to rank candidate development options. The decision-support framework developed by Sustainable Remediation Forum UK (SuRF-UK) is widely used internationally, incorporating considerable scope for local stakeholder input into its basic framework of indicators, with five categories provided in each of the three domains as a default ‘check-list’. However, as in sustainability tools in other fields, the indicators emphasizing social issues have problems of being difficult to localize; difficult to measure; difficult to connect to intangible local needs; thus, being less commonly used, and thus leading to assessments unbalanced across the three domains. Here we trial an unrelated approach named WeValue InSitu which has developed reliability in ‘crystallizing’ local shared values into tangible proto-indicators, as a bolt-on approach to produce localized social indicators for insertion into the SuRF-UK process. We use a hypothetical scenario analysis for a real community in villages near a derelict Salt Lake in Nigeria. Results show the approach resolves the challenges, does not introduce any new issues, and in addition provides a route for wider participation and auditability. The study shows that red flag boundaries may need to be introduced to allow veto of unacceptable breaches of social issues by scenarios.

**Keywords:** SuRF-UK; WeValue InSitu; Localization; Mmahi Salt Lake; Okposi Okwu; Sustainability assessment

## 1.1 Introduction

Sustainable development now forms a cornerstone of many government and corporate policies (CL: AIRE, 2010), and in alignment with those, policies concerning the remediation and regeneration of so-called brownfield sites increasingly involve sustainability assessments for ranking candidate options for their development. This paper focuses on current challenges with sustainability assessments for land remediation scenarios, which have direct parallels with sustainability assessments used more widely and generally. Stemming from the general UN practice of describing sustainability in terms of three main pillars of social, economic and environmental domains (UN, 2015), sustainability assessments whether specialized to land remediation or broader, tend to categorize and make use of indicators corresponding to each of the three domains. An example is shown in Table 1 where each domain contains five sub-categories, which are usually equally weighted.

Table 1 Overarching categories of indicators from the widely used SuRF-UK decision-support framework for sustainability assessment of remediation/regeneration projects (CL:AIRE, 2011). SuRF-UK was developed by the UK national Sustainable Remediation Forum.

Social	Economy	Environment
Human health and safety	Direct economic costs and benefits	Emissions to air
Ethics and equality	Indirect economic costs & benefits	Soil and ground conditions
Neighbourhoods and locality	Employment & employment capita	Groundwater and surface water
Communities & community involvement	Induced economic costs & benefits	Ecology
Uncertainty and evidence	Project lifespan and flexibility	Natural resources and waste

A number of indicator-based decision support frameworks for sustainable land remediation (SLR) evolved via different national fora and standards, and they all emphasize the importance of the balanced use of indicators from all three domains, and the need for site-specific decision making, which requires indicators which can both provide neutral ground for facilitating stakeholder interactions, and localize these sustainability concepts (Wass et al., 2014; UN, 2015).

Notwithstanding the firm guidelines of most assessment frameworks that decision makers first localize and then consider in balancing all three sustainability domains, there are continued and indeed increasing reports of stubborn challenges to achieving this in practice. In particular, problems are widely reported of developing indicators which capture social issues yet are measurable and workable alongside the more quantitative and well-defined financial and physical science indicators of the other two domains. While these indicator-based decision support frameworks generally are expanding the global usage and standardization of sustainability as a clear and underpinning foundation for decision making about land use, the lack of progress on useful and appropriate social indicators is threatening to undermine this advance (Bardos et al., 2018).

In this work, we review and summarize challenges for the use of social indicators in sustainable land remediation assessment frameworks. We then turn to a successful practice from social design which shows promise towards resolving some of these. It uses values-based approaches in producing indicators representing the shared values of groups of people - of what is 'valuable, meaningful and worthwhile' to them. Here we explore its use as a bolt-on process to produce social indicators which can then be directly inserted into a SuRF-UK assessment framework, via a test case study in a Nigerian rural area. We then discuss our findings in light of each of the challenges which had been identified.

## **1.2 Background**

### **1.2.1 Current challenges for social indicators**

Our readings of current challenges of social indicators in sustainability assessments revealed five broad themes which we discuss below, and summarize in Table2: intangibility, difficulty of measurement, limited use, incompleteness of lists, localization.

The site-specific nature of sustainable land remediation (henceforth: SLR) is such that all the 'default' indicators provided in any framework list require localization before they are valid (CL: AIRE, 2011; ISO, 2017), which can also be viewed as a way to channel input of local data into those assessment frameworks (UN, 2016). This is as true for the social indicators as the economic and environmental

ones, and most SLR decision-support frameworks and standards make provision for this localization, and that the weighting of the (localized) social domain be kept equal to the environmental and economic. The concept is that indicators that best capture the specific contexts and needs of the local people should be prioritized (UN, 2016), and this can be achieved by using the externally-provided list of indicators but only using those deemed locally relevant and suitably modified. Once the indicators have been adapted or 'localized' for a specific site, they can be used within decision support frameworks such as SuRF-UK in a simple and mechanistic manner to score or rank development options.

Another area of concern is that, in spite of the provisions made by SLR guidance frameworks about "comprehensively /simultaneously/ equally considering the relevant/ full range" of sustainability indicators from all three dimensions of sustainability (Hacking and Guthrie, 2008), a lopsided representation has persisted in favor of the environmental and economic dimensions at the expense of the social dimension, not only in SLR but also in diverse fields (Gathorne-Hardy et al., 2016; Wang and Shaw, 2018). This long-standing lack of a balanced use of social indicators has raised concerns that "they exist more in theory than practice" (Dixson, 2006), and there have been calls for "reinforcement of areas of concern that are considered to be or actually are omitted, given insufficient attention, or treated as 'poor neighbors'" in sustainability assessments (Hacking and Guthrie, 2008). The lack of a balanced use of social indicators is thus well noted in the literature.

Such 'poor neighbor' treatment of the social dimension of sustainability has also been reported by Cappuyns (2016) after reviewing twelve decision support tools used in sustainable land remediation (SLR), concluding that "the consideration of social aspects in the investigated decision support tools...is limited." A subsequent in-depth, critical review by Huysegoms and Cappuyns (2017) confirmed an "imbalance of used indicators, still expressing a strong preference for the environmental aspect at the expense of the economic and social aspects of sustainability". They stated that the observed "imbalance may indicate a lack of information on how to include these categories in a quantitative or qualitative manner, making it difficult for users to assess ..." Such difficult aspects include "how less-visible indicators and categories can be addressed..." (Huysegoms and Cappuyns, 2017). These reports

resonate with the more widely acknowledged problem of incorporating intangible, value-based dimensions into assessments (Dahl, 2012; Burford et al., 2013; Hak et al., 2015). The perceived intangibility and non-quantitative nature of social indicators is thus a current problem, in SLR and more widely.

The challenges found in the above studies can be related to the site-specific nature of sustainability assessments (Gibson, 2006), which necessitates localization of any indicators to make them relevant, and to enhance stakeholder understanding and acceptance of outcomes (UN, 2016). This is consistent with the assertion that assessments should be understood and communicated based on “localization of different stakeholders’ social practices” as well as economic and environmental peculiarities (Sardinha et al., 2013). Localization of indicators for each specific SLR site or project is intended to be achieved through stakeholder engagement (Bleicher and Gross, 2010) but difficulty in achieving this is widely reported. Even the most-cited, i.e. SuRF- UK framework, has been flagged in that it “so far does not yet include widespread stakeholder engagement” (Bardos et al., 2018). A lack of stakeholder engagement, especially for social indicators, is thus a current SLR problem.

A key function of the SuRF-style indicator guidance is to “provide an approach that is “failsafe” in that the range of issues covered by its fifteen indicator sub-categories should prevent any key considerations from being left out “(CL: AIRE, 2011). It does this by providing a list of generalized proto-indicators in each dimension which are intended as a ‘checklist’ to remind stakeholders of all possible areas needing localized indicators. However, SuRF-UK authors stated “it is already evident that there are some significant “missing” items in the social element of the SuRF-UK indicator guidance” (Bardos et al., 2018). This is further amplified by a critique which stated that it [SuRF-UK indicator guidance] may not be suitable “for the purposes of community engagement in sustainability assessment [because it] may not be fully representative of the “values” that impacted communities may wish to convey, or, not be formulated in a way that community participants can readily engage with” (Bardos et al.,2018). This implies poor default coverage of social indicators in the ‘checklist’ and calls for a methodological solution. This incomplete coverage of the social indicators has generated real impacts on real

stakeholders whose valid concerns have been historically excluded (Burger, 2008) in considerations of decisions that affect their lives. This impacts negatively on project outcomes since winning the trust of stakeholders is important and usually relates to the extent to which their interests are covered (Li et al., 2018). These studies suggest that ‘missing’ social indicators on the failsafe default lists is an issue in SLR.

Table 2: Summary of documented research needs for social indicators of decision support frameworks, derived from our literature review

Ref. #	Problem with social indicators	Referenced statement	Reference
1	Intangibility of social indicators	Such difficult aspects include “how less visible indicators and categories can be addressed...” Widely acknowledged intangibility of social aspects of sustainability	Huysegoms and Cappuyns, 2017 Dahl, 2012; Burford et al., 2013
2	Difficulty in measurement of social indicators	“lack of information on how to include these categories in a quantitative or qualitative manner...”	Huysegoms and Cappuyns, 2017
3	Limited consideration of social indicators	“the consideration of social aspects in the investigated decision support tools... is limited.”	Cappuyns, 2016
4	Incompleteness of indicator sets, and thus imbalanced decision making	“it is already evident that there are some significant “missing” items in the social element of the SuRF-UK indicator guidance”	Bardos et al., 2018; Huysegoms and Cappuyns, 2017
5	Poor localization of (social) indicators	“sustainability assessment work carried out so far does not yet include widespread stakeholder engagement”	Bardos et al., 2018

The review above shows clear and very significant challenges in sustainability assessments in five areas: in tangibility of social indicators; in the difficulties of measuring them; in the resulting imbalanced use compared to other domains; in engaging sufficient local stakeholders to cover potentially ‘missing’ areas and in the poor localization of indicators. In this work we will focus on developing a method for generating localized social indicators which can then be easily used, including on an equal basis with environmental and economic indicators, thereby potentially facilitating a step-wise improvement in the balance of input from the three domains into decisions made in SLR. We will do this by bringing in a specialized values-based approach from social design which reports being able

to crystallize the shared values of local groups (Podger et al., 2013) thereby “making the invisible visible” (Burford et al., 2015) and consequently developing them into local indicators (Burford et al., 2013b). The general approach, known colloquially as ‘WeValue’, was originally designed to amplify the voice of civil society groups (Podger et al., 2010), and has since been used to assist environmental groups to evaluate their goals on their own terms (Harder et al., 2014) and has been used across scales and scaled up (Podger et al., 2016) showing its potential for transferability. Ongoing studies have confirmed the validity to local groups of representative proto-indicators of their crystallized ‘in-situ’ shared values, produced with a specialized process, named WeValue InSitu (Sethamo et al., 2019). In this work we will investigate WeValue InSitu’s potential as a bolt-on pre-process to provide localized social indicators for direct integration into SuRF-UK (and thus in principle into other frameworks and decision support tools). We will do this in the context of a case-study of sustainable regeneration decision-making in the vicinity of a disused Salt Lake in the rural area of Okposi Okwu, Nigeria, considering three development scenarios alongside business as usual. We will then evaluate the usefulness of this approach to resolve the existing challenges identified above, in the hope of illustrating a new step-wise advance in localized social indicators for sustainable remediation and sustainability assessments more widely.

## **2. Methodology and methods**

The standard SuRF-UK framework was used (CL: AIRE, 2010; 2011), which provides decision-makers with guidance and ‘check lists’ of fifteen categories of default indicators to be assessed (Table 1) across all of the future scenarios being considered. Although scenarios could be scored, they are more commonly ranked, and the rankings are aggregated, with equal weighting applied across those themed as environment, economic and social (Smith and Kerrison, 2013). The entire SuRF-UK process includes: stages of preparation (site description, scenario definition), objective setting, identifying stakeholders, setting assessment boundaries, selection of assessment indicators and using assessment techniques in execution, and sensitivity analysis (Figure 1). At the stage of ‘selection of indicators’, we executed the WeValue InSitu approach with three local governance groups in the neighboring villages in order to produce values-based indicators for consideration for adding to or replacing the SuRF-UK

default social indicators. This required the involvement of a specialist WeValue facilitator for the three sessions of 3-4 hours each. Although localized revision of SuRF-UK indicators is encouraged in the SuRF-UK guidance, it is rarely reported to occur and certainly not to this extent: we thus take some care to set out our methods for this revision. With the final chosen indicators in place we continue with the remaining SuRF-UK stage, i.e. the mechanistic assessment itself of the scenarios against the final agreed indicators. We then evaluate the overall approach against each of the significant current challenges identified in the introduction.

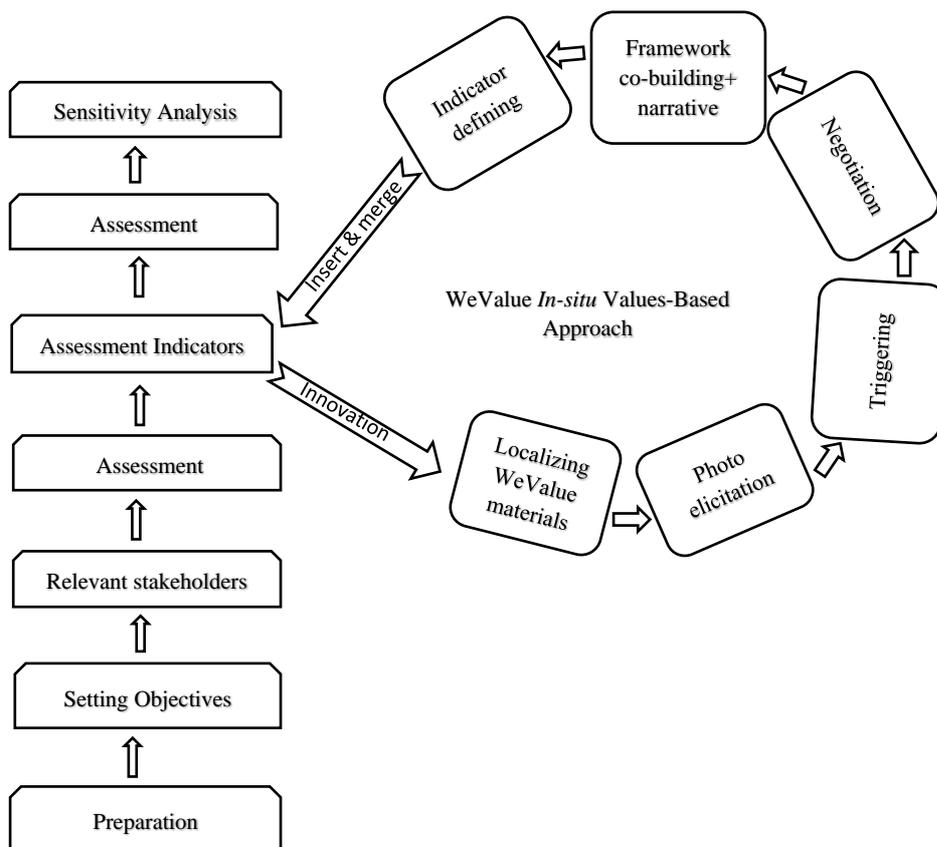


Figure 1: SuRF-UK framework guidance process flow showing ESDInds innovation loop

## 2.1 SuRF-UK Processes

### 2.1.1 SuRF-UK: Preparation

#### 2.1.1.1 Case site description

The selected site is a derelict salt ‘mine’ associated with Okposi Salt Lake, Mmahi, Nigeria (Figure 2). This site was selected because it has a land reclamation issue with several potential future scenarios to consider, but the considerations were very long term-term and non-urgent, with no set deadline or

appointed Assessment Team, which provided a conveniently relaxed situation that we could explore. The researchers played the role of the Assessment Team, bringing in representation from the community stakeholders via the WeValue InSitu process (see below). Our assessment results were of general interest to the local community but not to be used for a real decision, since the scenario proposals were only being considered for the distant future. In addition, the site was rural, and in a developing country, which provided a realistically challenging site for our research question, including of having less-educated local people who were not typically deeply engaged in such decision-making. Finally, the local governance system and culture was well known to the first author, who also spoke the local dialect, which facilitated the arrangements for informed consent, logistics, and obtaining background information on the potential scenarios.

According to the traditions of Okposi people, only local women are allowed to engage in the traditional salt mining, and it is their sole occupation and source of income. The lake is considered as a deity and a site of worship. The community bloc closest to the Salt Lake organizes itself into eleven village areas, each with a chief, men’s group, women’s group, and unmarried persons group for governance. Each group was intergenerational, strongly transmitting community values from one generation to another.

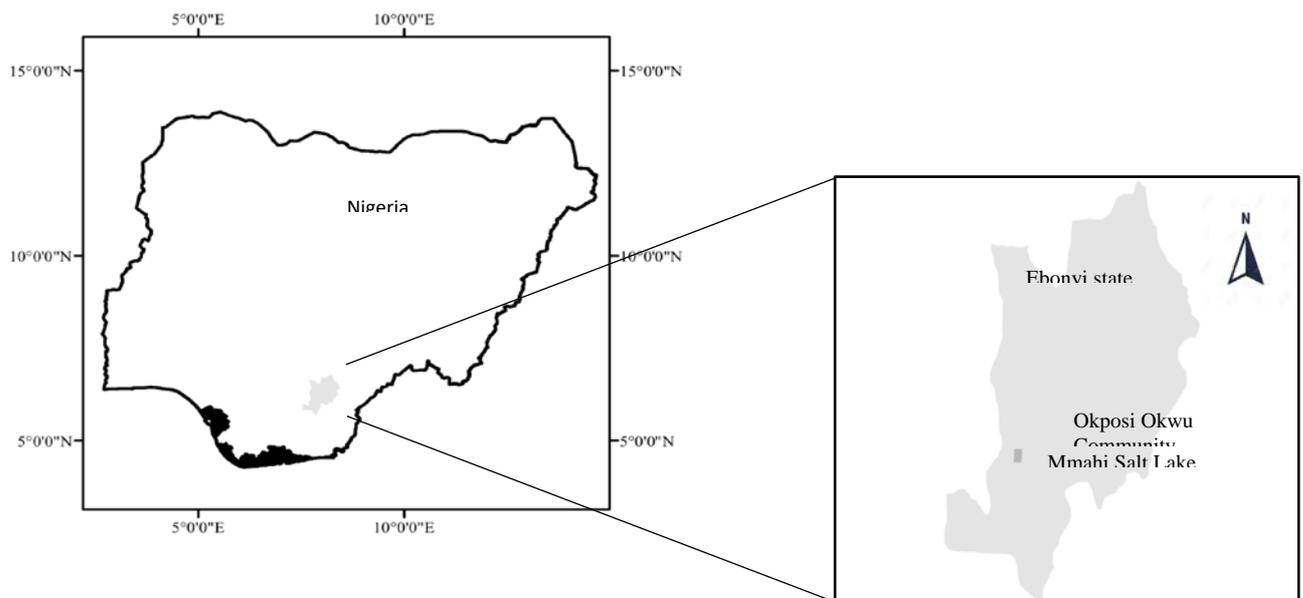


Figure 2: The site of the case study, Okposi Okwu located 06° 02.23 N', 007° 48.337' E Nigeria and is one of the Salt Lake communities of Ebonyi state, sometimes known as ‘salt of the nation’.

### 2.1.1.2 SuRF-UK: Description of reuse scenarios

We have four proposed reuse scenarios in this illustrative study, for the restoration of the derelict salt ‘mine’ to social, economic and environmental beneficial use, set out in Table 3. Scenario A is baseline - business as usual (BAU). Scenario B – Tourism Management Option (TMO) - is an illustrative proposal by a nominal tourism company with a basic focus on making profit but centered around the convenient local theme of historical salt-production activities and lake deity culture. It would build a lakeside small hotel and improve the immediate landscape to provide an area for recreation of outsiders, including demonstrations and information of local culture. Scenario C – Mechanized Salt Production (MSP) – is an actual, slowly developing scenario of a project entitled “Betterment of the Livelihoods of Women through Adoption of Improved Salt Processing Technology Program”, jointly funded by the Japanese Government under their Grant Assistance to Grassroots Human Security Project (GGP) in line with the One Village One Product (OVOP) program and the United Nations Industrial Development Organization (UNIDO) in collaboration with Ebonyi State, Nigeria (UNIDO, 2011). Scenario D – Lithium Extraction from Brine (LEB) - is another illustrative scenario inspired by the globally increasing need for cleaner energy sources which require lithium for batteries (O'Brien and Nickel, 2016), as well as several industrial processes (Shi et al., 2018). Lithium is mostly sourced from lithium-rich brines in salt lakes (Expedition One, 2018; Shi et al., 2018; Yu et al., 2015).

Table 3: Definition of four scenarios associated with the derelict salt mine at Okposi Okwu, Ebonyi State Nigeria highlighting the sustainability effect drivers associated with each scenario

Scenario	Description
Scenario A: (BAU) Business as Usual	Neglect and underutilization of the lake for example as a site of worship, as source of salt Women keep fetching the brine and transporting it to varying distances in clay pots Cutting and using wood as source of fuel for evaporating and availing salt crystals Sale of salt in local markets The traditional hut ‘ewe’ is retained as a means of removing impurities from the brine before evaporation Use of alum for sedimentation % of Salt Lake used varies, but less than 5%

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Scenario B: (TMO) Tourism Management Option	Landscaping the lake premises including flower, shrub and tree planting to provide natural shade Provision of relaxation spots with locally made shade Provision of permanent concrete slabs or wooden seats for visitors sit out Tourism centered on local traditions, legacies and spirituality of the Salt Lake Local women provide services that involve direct contact with the lake Employment of local tour guides and site maintenance personnel (50 employees such as administrative, tour guides, operations, sales, hotel staff). Building of a hotel near the lake (300 m2 land space). Conversion of path to access road Creation of a parking lot Creation of open-air dining and bar facilities 0% of Salt Lake used
Scenario C: (MSP) Mechanized Salt Production	Building concrete slabs as platforms for overhead storage tanks Installation of pipes Fuel powered pumping machine Offsite Design and Fabrication of Evaporation Machine Installation of solar heating technology Installation of distillation unit for production of distilled water Employment of local personnel (20 Employees (Administrative/Operations/Sales) Construction of factory building 200m2 of land Typical factory access restriction around the area of the lake for business operations Production target of 20 tonnes/day 20% of Salt Lake used
Scenario D: (LEB) Lithium Extraction from Brine	Building of a recovery plant 200 m2 Digging of 6 evaporation ponds for solar concentration (300m2 of land) Installation of pumping machines Running of pipes for pumping brine into evaporation ponds for concentration of lithium Typical factory access restriction around the area of the lake for business operations Recovery of lithium by filtration and extraction to remove unwanted salts Treatment with sodium carbonate (soda ash) to precipitate lithium carbonate Filtration of lithium carbonate, air drying and packaging for delivery Conversion to various lithium intermediary salts or lithium metal 200 tonnes/year capacity Employment of some local personnel (11 persons) 50 % of Salt Lake used

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### 2.1.2 SuRF-UK Objective Setting

The nominal objective of this SuRF-UK sustainability assessment was provided evidence to decision makers on the sustainability characteristics of each scenario for this site.

### 2.1.3 SuRF-UK: Relevant stakeholder groups

Standard SuRF-UK guidance is to involve representatives of as many of the relevant stakeholders as possible: representatives then become the Assessment Team who decides which indicators to use, and

the criteria for scoring/ranking them against scenarios, and carries out intersubjective negotiations of any difficulties arising (CL: AIRE, 2010). Although there are typically many relevant stakeholders, in practice, as seen in a number of published case studies, only a few stakeholder groups are typically involved, such as government or consultancy agents, and others with economic or environmental specialisms (CL:AIRE, 2013; Bardos et al., 2018; Song et al., 2018). A list of stakeholders we believe are relevant is given in Supplementary Information Table SI1. These included the often-voiceless local groups of the community, which were involved through the WeValue InSitu process to generate social indicators. As this was a hypothetical study, we took on the role of ALL the Assessment Team, and took into consideration the multiple likely perspectives of the stakeholders when formalizing the techniques to be used (2.1.6 below) and executing the assessment (2.1.7 below), both of which have to be fully justified and documented, as in Supplementary Information Tables SI2 and SI3 respectively).

#### 2.1.4 SuRF-UK Assessment boundaries

Setting assessment boundaries is necessary to ensure that various stakeholders and assessors involved in a particular project think and act with same contextual assumptions in mind (CL:AIRE, 2010). The spatial boundary here includes effects on Salt Lake, neighborhood and community as a whole. Thematically it included the fifteen default environmental, economic and social sub-category areas (Table 1), but to fold in any additional areas revealed as relevant by the WeValue InSitu process to cover the crystallized shared values of several groups in the community. The time boundary was chosen to span inter-generationally into the future, as this is the perspective these residents have.

#### 2.1.5 Assessment indicators and our innovation: the generation of novel values-based social indicators

##### 2.1.5.1 Assessment indicators

The Assessment Team will normally agree which indicators will be used. Typically, the default SuRF-UK ones are used, sometimes with exclusion of surplus or irrelevant indicators based on site-specificity and peculiarity of stakeholder concerns, with the rationale for exclusion recorded. In this case study some indicators were excluded in this manner, given in Supplementary Information SI4.

### 2.1.5.2 Our innovation with localized WeValue InSitu process

The WeValue InSitu shared values elicitation process is a values-based approach originating from an EU Framework7 Research project for civil society named ESDinds (European Commission, 2007): it facilitates group members to arrive at collectively negotiated, concise values statements that represent what they consider is ‘important’ to their work. It is currently delivered as a workshop with three stages (Brigstocke et al., 2017; Sethamo et al., 2019). In the First Stage participants are asked to introduce themselves in order to mentally contextualize themselves, and then to choose 1-3 photos (from a large selection of 50+) which ‘resonate’ with them about something they think is ‘worthwhile, valuable and/or meaningful to them’ about the group’s work or interaction. They individually present their ideas, with photo props, to the rest of the group, usually by naturally referring to illustrative experiences. In the Second Stage, participants are asked to read through a ‘Trigger List’ of 60-125 statements (that previous miscellaneous groups have provided about what *they* ‘valued’ about their work together), and again to select those which resonate. The trained WeValue InSitu facilitator then leads a very interactive and inter-subjective discussion where group members share, compare, contrast experiences for naturally related topics, and then create, negotiate, and reconstruct values statements on each sub-topic, writing them out on cards and placing them on a central table. In the Third Stage participants arrange the cards, linking clusters of related concepts according to their negotiations of meaning and relationship. The steps are shown in Fig. 1.

The photos and Trigger List used in the InSitu process must be easily related to by the participants, and since the version previously in use had been constructed in globalized societies (Podger et al., 2016), it was decided to derive them locally for this study. Many photos were thus replaced with images more typically locally encountered. A new Trigger List of values statements was pre-constructed: it was created through thematic analysis and clustering of similar statements taken from specially designed interviews of local individuals, in the local language, and the number reduced from 63 to only 40 as the participants were not fully literate. The full details of these processes will be presented in a future study which compares the localizations used in several different countries. Since the WeValue InSitu process

requires an experienced facilitator to prepare and run it (as does SuRF-UK, separately); the finer details are thus not presented here.

The standard outputs from the WeValue InSitu process are the *values statements* (linked in a visual framework), the accompanying narrative summary (Box 1), and anonymized transcripts of an audio recording of the process which captures conversations around the statement creation which can be referred to if needed. The values statements produced in this process are already in a format appropriate for immediate use in indicator frameworks such as SuRF-UK – although some very minor changes in sentence structure or grammar might be needed, or specific information might need adding as to how/ when/ where measures for them might be obtained (which is usually implied in the conversation of the group at the time the statements are created). However, in this study not one but *three* sets of values statements/ indicators were obtained, since three separate local groups went through the WeValue InSitu process. In general, the method does not call for representative sampling from groups, but rather theoretical saturation of values concepts. In this exploratory study, three groups were sufficient to check how difficult the process of aggregating them was, and to check for any surprise variations across groups. The method of aggregation of values statements/concepts is similar to thematic analysis with open coding: the statements are ‘clustered’ with any uncertainties clarified through reference back to the full transcripts. In this manner, a list of statements of shared values indicators can be produced which all three group’s members find valid to them (face validity).

Finally, the aggregated values-based indicators from the villagers need to be added and merged with the pre-existing default ones already provided in the SuRF-UK guidance. The objective here is to ensure that the same concept is not being counted twice: where they overlapped, the locally derived ones could replace the SuRF-UK ones as they would be more localized. Where entirely new concepts were presented, these could be added in to the SuRF-UK indicators (CL:AIRE, 2011) as per 2.1.5.1 above. The Assessment Team could then decide whether or not to maintain the equal weighting of the three categories environment, social, economic, as per suggested guidance: in this study equal weighting was maintained.

### 2.1.6 SuRF-UK: Assessment techniques for execution

Once the indicators to be used are chosen by the Assessment Team, SuRF-UK requires that the techniques and rules for their localized assessment be agreed and documented (as in Supplementary Information Table SI2) by the Assessment Team so that they can compare and justify their scores (as in Supplementary Information Table SI3), and offer them for scrutiny. Following SuRF-UK guidance (CLAIRE, 2010) and the principle of simplicity (Bardos et al, 2016), this study will rank the scenarios in an ascending rank order with 1 = best sustainability effect, and 4 = worst.

### 2.1.7 SuRF-UK: Sensitivity analysis

Sensitivity analysis becomes necessary when there are significant conflicting stakeholder interests leading to variation in final scenario ranking. This tempers the necessarily subjective aspects of the assessment process (CL: AIRE, 2010). Since three researchers played the part of the Assessment Team in this hypothetical assessment, they were asked to independently rank the sub-categories. This revealed an issue due to lack of clarity of the wording used in the scenario descriptions, but once that was resolved it was found that all three researchers had very similar rankings and justifications.

## 3.0 Results

### 3.1 Community group values frameworks and accompanying narratives

The framework of values statements produced by one of the village groups from the WeValue process is shown for illustration in Figure 3. The Narrative Summary of its meaning, as given by the villagers, is given in Box 1. The values-based indicators aggregated from the three groups in the community are listed in Table 4, shown inserted into the appropriate SuRF-UK categories.

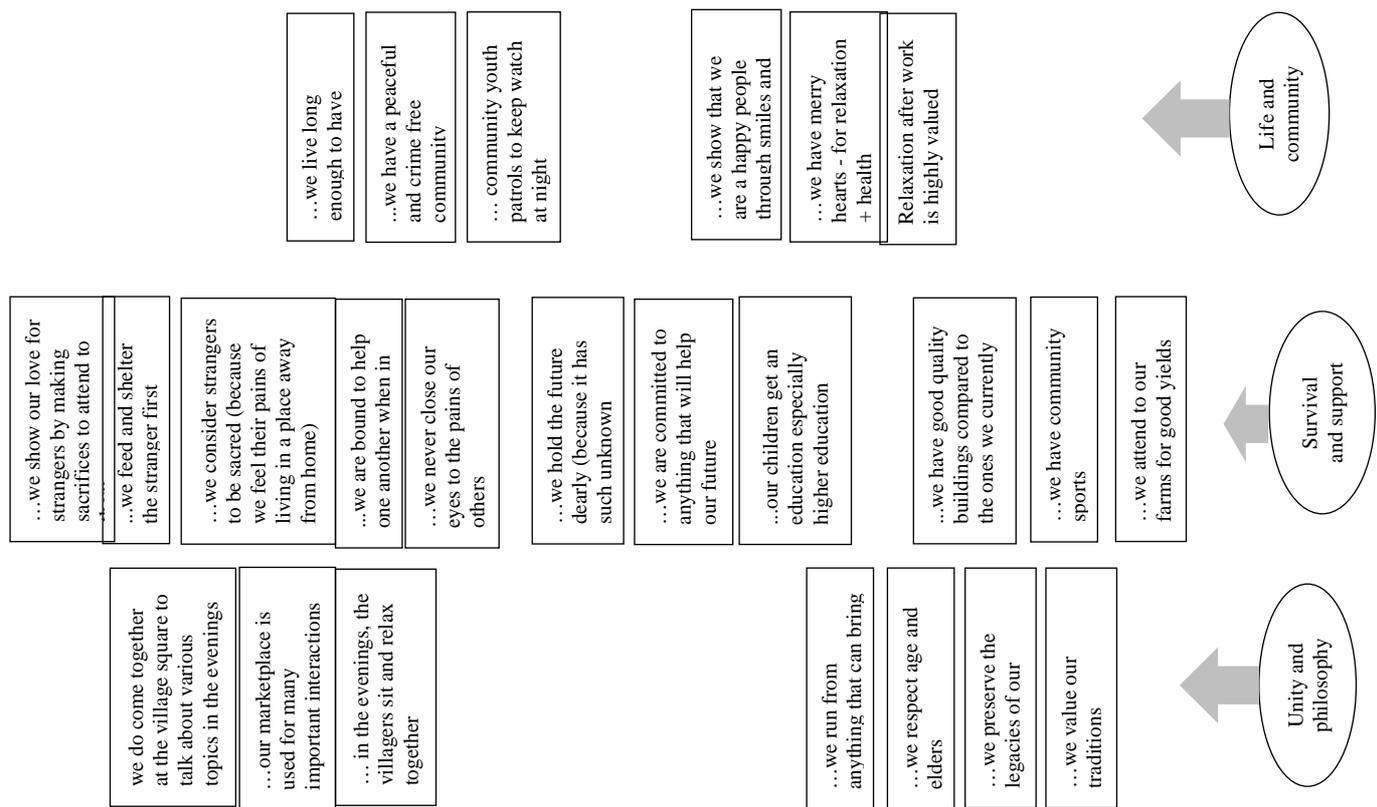


Figure 3: The framework of the shared values statements produced by one of the village groups in this study as an illustration. (Note the accompanying Narrative Summary in Box 1). The text of the statements aggregated from this and two other village groups can be read in Table 4, where the format is modified slightly so they can be read as indicators.

**Box 1**

**Narrative of the Villagers to accompany the Framework of Values Statements (Figure 3)**

Our values statements are arranged in three levels - top, middle and bottom - and are connected in coherent sets of naturally forming themes giving rise to the values framework. The top segment presents concepts that refer to life and community continuity, the middle segment points to personal survival and support to others while the bottom conveys values that reflect unity and community philosophical foundations. The first item on top talks about life and longevity and “just as we captured it, we value that we are able to live long enough to have grandchildren. It is arguably a universal human experience and is no different in our community that life is the most valued possession. Living to experience one’s children become adults, get married and have their own children is a great blessing. It is also a source of respect to old people in the community. The second item refers to the value of external peace in the community while the third communicates the role of young people in making that happen. Beyond external peace, internal peace which gives rise to happiness and relaxation is a great source of assurance and is highly valued in our community.

The middle piece communicates our commitment to surviving as individuals and supporting others. Love and care for strangers as well as for one another is prominent within the community. It is considered an abomination for anyone to close their eyes to the pains of others whether they are locals or not. The second cluster refers to the value placed on the future and what contribution education can

make in securing the future of the community. Finally, the place of shelter, food and opportunity for further development in specific areas such as sports is amplified. The bottom part of the framework communicates the value placed on unity and every means that affords opportunity for the community to interact is highly valued. This united community is built on strong philosophical foundations such as avoidance of shame, respect for elders, preservation of traditions and age-long legacies.

### 3.2 Incorporation of new indicators into SuRF-UK framework

The final aggregated list of the local indicators generated are given below in Table 4, where they are classified according to the appropriate SuRF-UK category. Although over 80% of elicited indicators fell into the Social Categories (SOC) 1 to 4, none was found for SOC 5. Interestingly, a small number belonged in other categories: one each went to ENV 2 and ENV 5, with four fitting into ECON 3.

This demonstrates that socially-derived issues may not be limited to specifically social issues (discussed in 4.1 below).

Table 4: The placement of the values-based indicators into the 15 SuRF-UK sub-categories.

SuRF Overarching Category	Situating Village Indicators in the SuRF UK Framework
SOC 1: Human Health & Safety	<i>V1a. (Any increase in) community sporting activities for the health benefits</i> <i>V21. Are there potential increased risks to eye sight</i> <i>V26. Is our chance of living long enough to have grandchildren affected</i>
SOC 2: Ethics & Equality	<i>V11. Effect on availability of simple/accessible fora for consensus building</i> <i>V12. Extent to which community's sense of 'truth' (honesty and transparency) is protected</i> <i>V13. Chance of continuity of trust-governed interactions in the community</i> <i>V28. The following principle is upheld: People/entities responsible for (any given) consequences are held responsible for them.</i>
SOC 3: Neighbourhood & Locality	<i>V2. Chance to have better quality buildings compared to the ones currently used</i> <i>V4. Influence of project on the marketplace, that is/ could be used for many important interactions</i> <i>V6. Level of opportunity to situate facilities that could improve the future of residents within the locality</i> <i>V34. Chance to have a place to relax together and talk in the evenings</i>

<p>SOC 4: Communities &amp; Community Involvement</p>	<p><i>Effect of the project on local culture and the ways of life in the community (local culture and vitality):</i></p> <p>V3. <i>Individual's ability to help in assuaging the pains of others</i></p> <p>V5. <i>Potential to show love to strangers and make sacrifices to attend to them</i></p> <p>V8. <i>Potential changes in culture of respect for age and elders</i></p> <p>V10. <i>Influence of project on maintaining a morality and shame culture</i></p> <p>V14. <i>Impact on the norm that, contentment is shown in smiles and laughter (comparable based on overall acceptability of project).</i></p> <p>V15. <i>Influence of project on culture of smiling as a sign of love, welcoming + acceptance (comparable based on overall acceptability of project).</i></p> <p>V16. <i>Impact on happiness of heart, smiling face and their perceived therapeutic benefits (comparable based on overall acceptability of project).</i></p> <p>V17. <i>Influence of project on community disposition towards God and spirituality</i></p> <p>V19. <i>Potential impact of project on community peace.</i></p> <p>V30. <i>Influence of scenario on preservation of agelong traditions, practices of forefathers such as observing annual festivals e.g. 'iri ji' (new yam festival).</i></p> <p>V31. <i>Does scenario enhance communal responsibility for training children and each other.</i></p> <p>V32. <i>Effect on the norm of experiencing togetherness in pain and joy</i></p> <p>V33. <i>Effect on the norm of doing things in unity in the community</i></p> <p>V25. <i>Potential of scenario to attract government's attention to community's ongoing needs</i></p> <p>V35 <i>Enhancement of community security e.g. as ensured by youth patrols keeping watch at night</i></p>
<p>SOC 5: Compliance, Uncertainty &amp; Evidence</p>	<p>-</p>
<p>ENV 1: Air</p>	<p>-</p>
<p>ENV2: Soil &amp; Ground Conditions</p>	<p>V36. <i>Scenarios (do not adversely) affect the management of farms (thus, soils) to ensure good yields</i></p>
<p>ENV3: Groundwater &amp; Surface Water</p>	<p>-</p>
<p>ENV4: Ecology</p>	<p>-</p>
<p>ENV5: Natural Resources &amp; Waste</p>	<p>V37. <i>Usage of local resources compared to external resources</i></p>
<p>ECON 1: Direct Economic Costs &amp; Benefits</p>	<p>-</p>
<p>ECON 2: Indirect Economic Costs &amp; Benefits</p>	<p>-</p>
<p>ECON 3: Employment &amp; Employment Capital</p>	<p>1b. <i>Chance to have community sports for training talents</i></p> <p>V18. <i>Chance of employment of one's energies in hard work</i></p> <p>V23. <i>Increased potential of educational access especially for the children</i></p> <p>V24. <i>Ability of young people to earn enough to provide for family dependents and less established villagers</i></p>
<p>ECON 4: Induced Economic Costs &amp; Benefits</p>	<p>-</p>

### 3.4 SuRF-UK: Final interpretations of assessment techniques

As SuRF-UK site assessments are unique and site-specific, it is standard practice that the final list of agreed indicators and interpretations of how they should be assessed (by the Assessment Team), which are taken forward for the final (more mechanistic) assessment (scoring or ranking), must be properly documented for later reference and scrutiny. These agreed interpretations are given in full in Supplementary Information Table SI2.

### 3.5 SuRF-UK: Final indicators and assessment

The full details of the final assessments of the four scenarios against each of the 15 sub-categories, including the resulting rankings and a simple explanation of the judgements, are given in Supplementary Information Table SI3. An extract including results for SOC3 and SOC4 are included below for reference in Table 5.

The process at this stage should be relatively mechanistic in the sense that revised interpretations should not be needed for the indicators or scenario definitions. In general, this was indeed the case, notwithstanding that the new, highly localized social indicators were now incorporated: they did not cause the difficulties that our literature review threw up, e.g. of being unmanageably subjective or difficult to make measures from (Table 2). At one point it was thought there would be an area of concern with the indicators SOC 4 (*Changes in the way the community functions*) which are related to ways of working and relationships, because the Assessment Team felt that the scenario definitions did not provide enough detailed information of how the main stakeholders (companies) in the scenarios might interact with the village, and had to estimate this from broad generalizations (e.g. the Tourism company will interact a lot with the village: the LEB will only have a business relationship). However, on reflection, it was realized that this is likely a common problem for all types of indicators, and thus not unique to the social character of the indicators.

Two other difficulties arose which are not related to published concerns for social indicators: the category SOC 5 (Compliance, Uncertainty & Evidence) seemed inappropriately allocated to the SOC domain, and there was a case of scenarios violating boundaries of acceptability against some indicators which brings up issues of weighting and deselection. Both of these are discussed in the Discussion sections 4.3, 4.2.

Table 5: The complete agreed set of localized indicators (including the newly generated WeValue InSitu ones in italics), and the rankings made by the Assessment Team of the four scenarios for each of the 15 SuRF-UK indicator sub-categories, with the justifications.

Overarching SuRF-UK Categories	The final indicators decided to be used (which includes the original SuRF UK ones, with irrelevant ones removed, plus the new ones adopted from the local WeValue framework ( <i>in italics</i> ))	B A U	T M O	M S P	L E B	Justification for ranks
SOC 3 Neighbourhood & Locality	<ul style="list-style-type: none"> <li><i>Impacts/benefits to local areas (tangible amenity changes), including effects from dust, light, noise, odor and vibrations during initial regeneration works as well as long term operation of the reuse options (some sources of such impact include traffic, working-day and night-time/weekend operations).</i></li> <li><i>Wider effects of changes in site usage by local communities (e.g. increased rate of visits by admirers of site, increased social activities)</i></li> </ul> <p><i>V2. Chance to have better quality buildings compared to the ones currently used</i></p> <p><i>V4. Influence of project on the marketplace, that is/ could be used for many important interactions</i></p> <p><i>V6. Level of opportunity to situate facilities that could improve the future of residents within the locality</i></p> <p><i>V34. Chance to have a place to relax together and talk in the evenings</i></p>	4	1	3	2	BAU is worst in this scenario because it maintains the unacceptable neighborhood and locality situations with respect to the used indicators such as no increased noise, odor, light, traffic, vibrations etc, neither are there any amenity improvements and definitely the future is a bit uncertain. It is followed by MSP, there is less potential of increased benefits. LEB is worse than TMO which is best in this category because LEB has less potential of increasing the benefits than TMO which obviously brings more amenities with it including lodgings, restaurants and relaxation spaces. This implies an enhancement of the facilities that could bring future benefits.
SOC 4 Communities & Community Involvement	<p><i>Changes in the way the community functions and the services they can access (all sectors commercial, residential, educational, leisure, amenity)</i></p> <p><i>Effect of the project on local culture and the ways of life in the community (local culture and vitality):</i></p> <p><i>V3. Individual's ability to help in assuaging the pains of others</i></p> <p><i>V5. Potential to show love to strangers and make sacrifices to attend to them</i></p> <p><i>V8. Potential changes in culture of respect for age and elders</i></p>	4 * d	1	2 * <sup>d</sup>	3 * <sup>d</sup>	TMO is best in this category because it enriches community ways of life and enhances community involvement with the lake in a most personal way providing both commercial, educational and leisure amenities. With respect to other indicators, it also performs best. MSP ranks second in this category because it has less technicalities than LEB, community members are able to interact better with the components of the option than LEB. For example, community members could serve as major distributors of the products of MSP unlike LEB that has professional market

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*V10. Influence of project on maintaining a morality and shame culture*

*V14. Impact on the norm that, contentment is shown in smiles and laughter (comparable based on overall acceptability of project).*

*V15. Influence of project on culture of smiling as a sign of love, welcoming + acceptance (comparable based on overall acceptability of project).*

*V16. Impact on happiness of heart, smiling face and their perceived therapeutic benefits (comparable based on overall acceptability of project).*

*V17. Influence of project on community disposition towards God and spirituality*

*V19. Potential impact of project on community peace.*

*V30. Influence of scenario on preservation of age-long traditions, practices of forefathers such as observing annual festivals e.g. 'iri ji' (new yam festival).*

*V31. Does scenario enhance communal responsibility for training children and each other.*

*V32. Effect on the norm of experiencing togetherness in pain and joy*

*V33. Effect on the norm of doing things in unity in the community*

*V25. Potential of scenario to attract government's attention to community's ongoing needs*

*V35. Enhancement of community security e.g. as ensured by youth patrols keeping watch at night*

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system (not a direct consumer good). The foregoing stands make LEB to be ranked third but the worst in this category is BAU since status quo is maintained, no improvement but there could be deterioration as usage of the lake is currently dwindling.

### 3.6 Final and overall scenario rankings

The final summative SuRF-UK sustainability assessment of the four reuse scenarios for Okposi Salt Lake, Mmahi (two hypothetical and two real), are shown in Table 6, with rankings for the 15 sub-categories of the SuRF UK sustainability assessment framework, using the final agreed indicators and assessment technique interpretations of them as given in the left side of Table 6.

The aggregates show that the SOC and ECON categories clearly favour the TMO option, by a large margin. The ENV category rates both the TMO and BAU options identically. Overall, the assessment indicates TMO is the best option in terms of sustainability.

For comparison, the scenarios were also ranked against the *default* SuRF-UK criteria, i.e. without the insertion of the locally derived indicators obtained from the WeValue InSitu process. The results are shown in the right side of Table 6. There is no *a priori* reason to expect the SOC rankings to be different or similar, and the result is indeed that there are no significant differences in any scores for sub-categories or categories, with the exception of SOC 4 rating for BAU, and the SOC 2 Ethics & Equality rankings, which are discussed in the Discussion.

Table 6: Sustainability assessment of four alternative reuse scenarios (BAU, TMO, MSP and LEB) considered for Mmahi, Okposi Okwu Salt Lake, Nigeria. The better the sustainability effect of a scenario, the higher its rank. Overall the TMO option is ranked highest, by a large margin.

Assessment Criteria		WEVALUE VERSION				DEFAULT SURF-UK VERSION			
		BA U	TM O	MS P	LE B	BA U	TM O	MS P	LE B
SOC 1	Human Health & Safety	2	1	3	4	2	1	4	3
SOC 2	Ethics & Equality	1	2	3	3	2	1	3	4
SOC 3	Neighbourhood & Locality	4	1	3	2	4	1	2	3
SOC 4	Communities & Community Involvement	4	1	2	3	2	1	3	4
SOC 5	Compliance, Uncertainty & Evidence	1	2	4	3	1	2	4	3

<b>Aggre gate</b>		<b>12</b>	<b>7</b>	<b>15</b>	<b>15</b>	<b>11</b>	<b>6</b>	<b>16</b>	<b>17</b>
ENV 1	Air Emission	2	1	3	4	2	1	3	4
ENV2	Soil & Ground Conditions	1	2	4	3	1	2	3	4
ENV3	Groundwater & Surface Water	1	2	3	4	1	2	3	4
ENV4	Ecology	1	2	4	3	1	2	4	3
ENV 5	Natural Resources & Waste	2	1	3	4	2	1	3	4
<b>Aggre gate</b>		<b>7</b>	<b>8</b>	<b>17</b>	<b>18</b>	<b>7</b>	<b>8</b>	<b>16</b>	<b>19</b>
ECON 1	Direct Economic Costs & Benefits	4	2	3	1	4	2	3	1
ECON 2	Indirect Economic Costs & Benefits	3	1	4	2	3	1	4	2
ECON 3	Employment & Employment Capital	4	1	3	2	4	1	3	2
ECON 4	Induced Economic Costs & Benefits	4	2	3	1	4	2	3	1
ECON 5	Project Lifespan & Flexibility	2	1	3	4	2	1	3	4
<b>Aggre gate</b>		<b>17</b>	<b>7</b>	<b>16</b>	<b>10</b>	<b>17</b>	<b>7</b>	<b>16</b>	<b>10</b>

#### 4. Discussion

The investigation did not reveal any difficulties or disadvantages in the use of the localized social indicators derived using the WeValue InSitu process. On the contrary, the issues raised in the literature and concerning the five specific needs for improved social indicators, as summarized in Table 2, appear to have been met, and those are each discussed in detail below. We also discuss the ability of the WeValue InSitu process to provide an audit trail for the SOC indicators; the possible need to move the SOC 5 sub-category elsewhere; and the possible need for a ‘red flag’ mechanism for any category.

##### 4.1 How the WeValue innovation addresses reported needs

In the Introduction we summarized five specific challenges for improved SuRF-UK social indicators (Table 2): intangibility; difficulty in measurement; limited consideration; incompleteness or missing;

poor localization. The results obtained in this study show there is evidence that the WeValue InSitu values-based approach helped significantly with all of these challenges, discussed in full below.

The first two challenges - intangibility of social indicators and their difficulty in having useful measures - were in fact the main topics of research in the original research which produced WeValue, and were thus already resolved (Burford et al. 2013; 2015) by its inter-subjective negotiated discourse method. The same method was used here with the Okposi Okwu community groups: they have no standard written form of their dialect, yet they were able to produce a values framework of concise statements. The early WeValue work laid out a clear pathway to measures from the values statements, i.e. indicators from proto-indicators, and several examples of evaluation applications were published (Burford et al.; 2013a; Harder et al.; 2014; Podger et al.; 2016). The current study shows that SLR researchers specify the challenge (Table 2) as that social indicators need to be “measurable or comparable in some way that is sufficient to allow [for] evaluation” of sustainability effects (CL: AIRE 2011) across several remediation options. The results showed that specific indicators could indeed be produced, and that they were suited for the relative ranking or scoring measures needed by SuRF-UK (Table 3), thus meeting the first two challenges.

These first two challenges, intangibility and difficulty in measurability of social indicators, have been blamed as reasons for the third challenge in Table 2: their limited consideration in sustainability assessments and decision making (Cappuyns, 2016), and “a strong preference for the environmental aspect at the expense of the economic and social aspects of sustainability”. (Huyssegoms and Cappuyns, 2017). Resolving them with the WeValue approach should thus lead to social indicators being more widely considered. The Assessment Team reported that they were no more difficult to consider in the four scenarios than the other, non-social indicators. This shifts the problem towards the remaining potential barrier in obtaining the WeValue indicators: it requires a trained WeValue InSitu facilitator. However, that is not necessarily any more difficult than obtaining specialized SuRF-UK assessors, as training programs for WeValue are now available. This means there should no longer be any reason

remaining for not considering social indicators regularly, and with equal applicability, in SuRF-UK assessments.

The last two challenges - localization of social indicators, and the possibility of producing a 'complete set' - are both intertwined from the perspective of WeValue. This is because that approach makes use of 'trigger lists' which ensure participants consider a wide range of topics that they might wish to develop values statements for, and the facilitator will explore even more widely if needed. After scores of studies, there are rarely any new topics added to the lists. Thus, when the villagers had completed the WeValue process, they were likely to not have 'missed' any topics that were equally valuable to them. SuRF-UK requires that any sustainability indicators used must necessarily be localized through allowing stakeholders to decide which are used - usually through prioritization and modification of the default ones provided (CL: AIRE, 2011). Since every statement produced with WeValue would have been the product of not only local discussions, but negotiations across the group participants with respect to local illustrations and examples – it would be fully localized. This aligns with the recommendation of SuRF-UK (CL: AIRE, 2011) that the process of indicator selection be “sufficiently flexible to allow the stakeholders associated with particular situations to agree the most appropriate indicators themselves”. The fact that a few of the WeValue-derived indicators were relevant to non-SOC categories (ENV 2, ENV 5 and ECON 3) is consistent with the idea that WeValue processes return an 'envelope' of equally importantly valued topics from groups, and also that groups can have core concerns about environmental and economic aspects – not only social ones.

The characteristic of WeValue process to return an 'envelope' of things which are valued by a group is particularly useful to mitigate the SuRF-UK concerns for 'missing' indicators (Bardos et al., 2018). Since indicators are the medium of communication as well as the used for understanding the effects of sustainability drivers (Rinne et al., 2013), it follows that if any necessary indicators are absent, it affects the whole process from beginning to end. Therefore, the extent to which indicators are included in decision support tools currently in use in SLR is an indication of how those indicators are included - or not - in decision making (Huysegoms and Cappuyns, 2017). Our study has thrown up a strong example

of how this can be a major problem, discussed in 4.2 below, where a strong social boundary concerning the acceptability of anyone other than local women being allowed into contact with the lake waters could not be accommodated in the existing ranking method.

With all of these five challenges shown to be greatly mitigated with the approach used in this study, there is no remaining major challenge for social indicators to be used more widely, and where they are available, they should be easy to use, allowing for a future balanced use of social indicators alongside the more commonly currently used environmental and economic ones. The WeValue approach seems to be very complimentary to SuRF-UK, making up for the “valid concerns” (Bardos et al., 2018) expressed about its lack of effectiveness for community engagement, due to its development to date being led top-down and by physical scientists (CL: AIRE, 2009). Together, a balanced sustainability decision- support system seems to be created.

#### **4.2 A possible need for ‘red flag’ boundaries to indicators**

The ranking system did not permit sufficient strength of concern about the indicator V30 to be indicated, and rating might not do so either. V30 concerns, “*Influence of scenario on preservation of age-long traditions, practices of forefathers*”. There is a very strong local tradition that only certain village women are allowed contact with the lake waters, yet none of the scenarios guaranteed, or even considered this topic (although TMO was judged to be sympathetic to it, as the tourism would be centered on local traditions of the lake). The local feeling on this issue is sufficiently strong that any scenario likely to lead to a violation would be categorically rejected. However, the ranking system only allowed a single point difference on the matter.

It is possible for a rating rather than scoring system to be used in any SuRF-UK assessment, but this would still not communicate the strength of local feeling, and thus the decision-support tool or framework would not be doing its declared job. The fact that this issue has arisen while considering locally sourced social indicators emphasizes their importance: it could not have arisen without that

localization. On the other hand, the possibility of an indicator needing a red flag could in principle arise with any indicator in any category. For example, if one scenario created deadly emissions. It might be assumed that such boundaries would not be breached because they would be so well known in the ENV and ECON categories, but in principle they could still happen.

We thus suggest that a Red Flag system would be useful, not only for the social but also the other categories, to indicate when any scenario is deemed to be close or to have reached an unacceptable boundary which would result in automatic deselection.

#### **4.3 A possible need to reconsider SOC 5 in the context of weighting**

SOC 5 focuses on quality of information used in the sustainability assessment and SuRF guidelines state: "...it is important to consider in the sustainability appraisal the quality of the evidence presented in support of claims for the proposed options being considered". A related issue is uncertainty. The lower the level of uncertainty over possible outcomes for an option being considered, the more likely that option would be successful if implemented in practice. Another important consideration is how assertions of sustainability can be verified once a project development is underway or has been implemented, and operations have begun. (CL: AIRE, 2009).

It was felt by the Assessment Team that SOC 5 (Compliance, Uncertainty & Evidence) may be inappropriately inserted into the SOC category, and thus 'stealing' some of the SuRF-UK weighting, effectively reducing it to 4/5ths. It is suggested that the default criteria be reconsidered, and/or the sub-category considered elsewhere.

#### **4.4 WeValue-derived narratives could provide indicative weightings for social indicators**

Concerning weighting within a category, it should be noted that for simplicity we have maintained the default equal weighting, e.g. SOC1 = SOC2, but SuRF-UK permits any modifications to the weighting that an Assessment Team might decide. In fact, the WeValue InSitu process produces a Summary Narrative for each stakeholder session, and weightings can be deduced from these if desired: the trained

facilitator could report recommendations alongside the proposed social indicators derived. If familiar with SuRF-UK, they could even recommend modifications to the default weightings within the SOC category.

#### **4.5 Auditability of the new SOC indicators via WeValue InSitu**

A distinct advantage of the use of the WeValue InSitu process to provide SOC indicators for SuRF-UK has not yet been noted: its auditability. The process directly produces values statements, their framework showing how they are linked, and a Summary Narrative, and these outputs can be directly related to the final SOC indicators produced and the recommended weightings. In cases where multiple groups have been engaged and their values statements clustered, the clustering process can be followed for verification. In brief, the SuRF-UK consultants, and the commissioning agents for it, can be assured of an audit trail showing the validity of the SOC indicators obtained locally.

#### **Conclusion**

This study demonstrates a useful, innovative and transferable way to generate localized social indicators which are shown here to be useful in meeting the five widely reported needs of: being difficult to localize; difficult to measure; difficult to connect to intangible local needs; thus, being less commonly used, and thus leading to assessments unbalanced across the three domains. The WeValue InSitu approach was used as a bolt-on process to provide locally adapted social indicators desired in a particular decision-support framework for sustainable land remediation (SuRF-UK), but is transferable to any similar one which accommodates qualitative measures or assessments for their criteria. The WeValue InSitu approach fulfills the ambitious original design features of SuRF-UK for in-depth input from local community, and fully makes use of the SuRF-UK scope for incorporating local priorities and identifying 'missing' aspects not covered by its own 'check-list' of indicators. WeValue InSitu produced articulated statements of an 'envelope' of all the high-priority shared values for three village groups, which were then developed into local indicators. These social indicators were used in the mechanistic processing of the SuRF-UK tool alongside the economic and environmental ones with no difficulties or new issues arising.

In addition, this work shows that red flag boundaries may need to be introduced to allow veto of unacceptable breaches of social issues by some candidate scenarios (in this case that of non-local female persons having access to the sacred lake). Although SuRF-UK allows local Assessment Teams to choose the scoring methods, even the most accommodating version would only allow unacceptable options to be scored low instead of high, rather than to rule them out completely.

Finally, the WeValue InSitu processes naturally provides documentation of its process from local inter-subjective involvement to the final social indicators for use, which could be very valuable to practitioners as an audit trail. All decision-makers prefer to have clear audit trails to both resolve and pre-empt conflicts, and WeValue provides this.

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