A Roadmap for Sustainable Development Through Responsible Sourcing in Construction

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A road-map for achieving sustainable development goals through responsible sourcing in the AEC sector

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**Date:** 06.06.21

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Responsible sourcing and green supply chains are becoming dominant tools towards procuring materials in a sustainable manner across the architecture, engineering and construction (AEC) sectors to achieve the Sustainable Development Goals (SDGs). The aim of this study is to provide a structured review of responsible sourcing literature to identify the potential opportunities and obstacles towards the accomplishment of a roadmap for the sectors to support the delivery of the SDGs (n = 38 articles). The main opportunities included competitive advantage, stakeholder value and improved supply chain management. The main obstacles included cost, deficiencies in structured frameworks and an array of industry specific constraints. These were aligned with the SDGs to produce a roadmap, validated by AEC industry experts. For fruition, it is surmised that the refocussing of the industry in recent years combined with the achievement of the SDGs will stimulate innovative technical solutions to produce truly sustainable development.

**Keywords:** Sustainable Development, Procurement, Construction.
1. INTRODUCTION

The architecture, engineering and construction (AEC) sectors can instrumentally support the delivery of the United Nations (UN) 2030 Agenda for Sustainable Development, with its concomitant Sustainable Development Goals (SDGs) (United Nations, 2015). However, this requires a fundamental shift away from a silo-based approach of the sector towards a multi-dimensional, transversal approach (Tremblay et al., 2020; Ament et al., 2020). The UN delivery plan is based on five intertwining elements, each of crucial importance, known as the five pillars (the SPs), namely People, Planet, Prosperity, Peace and Partnership (United Nations, 2015).

With the SPs in mind, it is imperative to recognise the AEC sectors have become a prominent force when considering resource exploitation and environmental degradation, derived from manufacturing/production processes (DEFRA, 2008, 2011; IPCC, 2014). For instance, in the United Kingdom (UK), the AEC industries contribute over 30% of landfill waste and produce almost 50% of carbon emissions (Czarnecki et al., 2010; Dixit et al., 2010). There are also stakeholder concerns over welfare, bribery and corruption (Murray and Dainty, 2009). As environmental awareness grows, traditional practices have become incompatible with modern demand, indicating improvements must be made within production and waste management (Finster and Hernke, 2014).

Corporate Social Responsibility (CSR) has emerged as a driving force for sustainable procurement decisions across the AEC sectors. The most successful strategies integrate smart decisions within their respective industries (Porter and Kramer, 2011). By analysing stakeholder needs and innovating solutions, organisations instil behaviour shifts, producing benefits including competitive advantage, customer loyalty, staff retention and increased brand value (Cohen and Robbins, 2011; Falck and Heblich, 2007; Zairi and Peters, 2002). The evolution of supply chain management displays a paradigm shift in that competition is no longer between individual companies (Lambert and Cooper, 2000). Hence, organisations are shifting towards accountable, transparent and responsible ways of working. However, barriers are widespread and include lack of awareness (Glass et al., 2012), outsourcing, risk, time (Khoo et al., 2001), quality management, (Upstill–Goddard et al., 2012), cost (Agrawal and Lee, 2016), and lack of established platforms and collaboration (Rohracher, 2001). Russell et al. (2018) noted contrasting methods to enable sustainable supply chains (e.g. ethical approaches (bottom up) pioneered by organisations such as the Forest
Stewardship Council (FSC) and policy drivers (top down) through regulations such as the UK Modern Slavery Act). This effectively supports the promotion of shared values aligned with transparent performance indicators.

A solution to rising demand for sustainable construction management is responsible sourcing. This involves manufacturers providing accurate information on materials, which can be utilised by designers and contractors (Mustow, 2006). Generally, this is utilised through a certification or procurement standard. BES6001 is a UK framework standard for responsible sourcing materials. Certified through a point–based system, the BRE (2018) examines products and organisations through an ethos of supply chain management and product stewardship, encompassed by social, economic and environmental dimensions of sustainability. BES6001 provides a reference point and certification which allows access to valuable credits in schemes (such as BREEAM or LEED). However, Upstill–Goddard et al. (2012) found there remains a lack of investigation into the practical application of the framework.

Global concerns over environmental limits, social inequality and an influx of erratic initiatives, necessitated the creation of a historic global political agreement (in 2015). The 17 SDGs (signed by 193 countries) provide 169 targets, backed up by specific indicators, creating a theoretical instruction manual for AEC sectors to contribute towards sustainable development (Pedersen, 2018). Previous studies relating to responsible sourcing have mainly evaluated supply chains and responsible procurement drivers and obstacles. Additionally, various researchers have reviewed literature against one goal: SDG-12 - Silva and de Figueiredo (2020) and Russell et al. (2018), SDG-8 - Rai et al. (2019) and SDG-11 - Koch and Krellenberg (2018), though this is the first study known to analyse literature against multiple SDGs. This study aims to provide a structured review of responsible sourcing literature across the AEC sectors to identify the array of potential opportunities and obstacles towards the accomplishment of a roadmap for the sectors to support the delivery of the SDGs. The structure of this article commences with background information derived from literature surrounding the research topic and an outline of the research methods utilised in the study. Subsequently, the findings, discussion and roadmap are presented before concluding remarks are drawn.
2. BACKGROUND

Stakeholder pressures on organisations to act more responsibly is derived from growing concerns for the planet’s limits, plus human needs and rights disparities (Park–Poaps and Rees, 2010). Within the AEC sectors, rapid urbanisation and high resource use requires the streamlining of manufacturing and operational processes to design sustainable working practices (Jabareen, 2006). Strategies include responsible supply chains, resource and waste management, and improved labour practices (Upstill–Goddard et al., 2015).

Epstein (2008) highlights that organisations that are pro–active rather than reactive have a higher chance of survival. Thus, AEC companies must strive to make smart(er) choices to ensure resilience (Howley, Scott & Redmond 2009); whereby, the environmental impacts of developments are assessed throughout its life, from concept design through to operation and maintenance. Perhaps unsurprisingly, a building’s maintenance and operation are the largest portion of its lifetime carbon footprint (Paulsen 2003). Consequently, Murray and Dainty (2009) argue this is where improvements should be made, through sustainable design and construction. Clearly, one of the starting points for the transition towards sustainable businesses and sustainable buildings/infrastructure is to enhance and enrich organisational supply chains so they consider environmental and social issues alongside economic ones.

One approach for improving the AEC supply chains is responsible sourcing. This involves the management of individual products, whilst maintaining balance between quality, delivery, environmental and ethical impacts (Glass, 2011"). For instance, Mustow (2006) identified a demand for detailed and accurate information on supply chain materials. Therefore, by investing in supply chains, organisations can align with ethically and environmentally sympathetic materials and processes (Glass 2012). Responsible sourcing has been linked with many opportunities, including the reduction of waste (Jiao et al., 2013), positive brand image (Chen et al., 2010), cost savings (Revell and Blackburn, 2007), quality delivery (Christopher and Peck, 2004) and better risk management (Guo et al., 2016). Organisations detail responsible sourcing through purchasing processes and within their procurement policies (Glass et al., 2012), which are portrayed in the ‘Responsible Sourcing Supply Chain Temple’ (Figure 1) based on the UNs 5P’s (United Nations, 2015).
Over the last decade, the delivery mechanisms for AEC organisations have transformed into a complex and dynamic system of unique solutions whereby, maintaining quality management, can be problematic (Upstill–Goddard et al. 2012). Seuring and Muller (2008) noted legislation has driven pressure for the utilisation of sustainable supply chains; however, misconceptions over responsibly sourced materials may be repressing uptake (Dodds et al. 2017). Various entities have tackled negative connotations associated with the AEC sectors, particularly construction, with processes focusing on silos within the industries (Ojo et al., 2014). To address this disjointed approach, green supply chain management has emerged as an overarching solution (Balasubramanian et al., 2017). Green supply chain management is the integration of environmental thinking throughout supply chains to create closed loops throughout life cycles (Stivastasta, 2007). Ageron et al. (2012) identified motivations for investing in sustainability including management vision, competitive advantage and stakeholder opinion. Barriers to this remain lack of awareness, fake views, costs and perceived slower production (Glass et al., 2012; Bowen et al., 2001; Hick, 2000). Khoo et al. (2001) also noted that the industry still demands a “just in time” approach to construction.

If AEC organisations are to accomplish genuine sustainability, the complexities of sustainable development require balancing. The SDGs signpost responses to social, economic and environmental challenges and their interlinkages
indicate deliberate attempts at integrated sustainable thinking (Elder et al., 2016). Out of the 243 indicators for the 17 SDGs, extensive translation is required to contextualise specific responses from industry (Koch and Krellenburg, 2018). Janouskova et al. (2018) acknowledged whilst the SDGs are not legally binding, governments are expected to take ownership, but without a procedural framework, results of assessments may be ambiguous. To support the construction sector, the SDG Industry Matrix was developed (Goubran, 2019). Focussing on shared value, the matrix provides industry specific examples and signposts actions for each of the SDGs (Figure 2). The World Green Building Council (2014) ascertained that “green” buildings can directly contribute to SDG–3 (improvements to health and well-being), SDG–7 (renewable energy), SDG–8 (green buildings create new jobs), SDG–9 (innovation and resilient infrastructure), SDG–11 (sustainable communities), SDG–12 (minimising waste in construction and responsible sourcing), SDG–13 (reduced carbon emissions), and SDG–15 (commitments to biodiversity). To support the construction sector, the SDG Industry Matrix was developed (Goubran, 2019). Focussing on shared value, the matrix provides industry specific examples and signposts actions for each of the SDGs.

Figure 2: The Industry SDG Matrix underpinned by the 17 goals (Source: KPMG, www.undp.org)
3. METHODOLOGY

This research was conducted using a two–phased methodological approach (Figure 3): (i) phase one includes a structured literature review, document analysis and (ii) phase two includes the creation of the roadmap that was then validated by industry experts.

![Diagram of research phases and stages](image)

Figure 3: The phases and stages used in the research design of this study (Author original).

3.1 Literature Review

An interpretivist epistemology (i.e. using different points of view or aspects of reality), applying an abductive reasoning approach (i.e. many possibilities with best explanation proffered) with elements of positivism, was used to achieve the purpose of this study. A comprehensive review of existing responsible sourcing literature followed the PRISMA evidence–based transparent and complete reporting process; whereby, extant articles are identified, screened and checked for eligibility before inclusion in systematic or structured reviews (Moher et al., 2009). For the purpose of this
study, two categories of literature were considered: peer-reviewed publications and professional reports (Abanda et al., 2015). A host of databases (including Scopus, and Web of Science, amongst others) were chosen to cover a variety of different discipline areas (listed below). The search was limited to common phrases or keywords (listed below) within fields (such as architecture, engineering, construction) and the literature search was constrained to articles from 2000 to 2020 (years inclusive), restricted to peer-review journal papers, reviews, conference papers and book chapters, and works published in the English language; BRE reports, documents and website articles were excluded.

The typical code used to search the databases was: TITLE–ABS–KEY (‘responsible AND sourcing’ OR ‘sustainable AND supply AND chain’ OR ‘green AND supply AND chain’ OR ‘BES6001’) AND (‘architecture’ OR ‘engineering’ OR ‘construction’) AND (PUBYEAR AFT 2000) AND (LIMIT–TO (DOCTYPE , "ar") OR LIMIT–TO (DOCTYPE, "re") OR LIMIT TO (DOCTYPE, "cp") OR LIMIT–TO (DOCTYPE, "ch")( ) AND (LIMIT–TO (SUBJAREA, "busi") ) OR LIMIT–TO (SUBJAREA, "engi") OR LIMIT–TO (SUBJAREA, "soci") ) AND (LIMIT–TO (LANGUAGE, "English"). As this study seeks to compile lists of the opportunities and obstacles previous authors have already identified, once all publications and reports were screened and checked, content analysis was used to scrutinise the publications selected for inclusion in the review, based on: (i) the country of research focus; (ii) methods employed; and (iii) relevant findings extracted.

3.2 Validation and Expert Opinion

Without rigor, validated research becomes irrelevant (Scandura and Williams, 2000). Methodological deficiencies have debilitating effects on research conclusions (Bergh et al., 2006). Logical validity is demonstrated through a clear research framework within the literature review, pattern matching throughout articles and triangulation through seeking the approval of experts (Cook and Campbell, 1979; Yin, 1994).

Information extracted from the literature review was presented to a group of AEC experts for content validation. Each participant was asked to confirm their sector of expertise, years of service in the sector, years working on sustainability-related projects, highest educational achievement (minimum Bachelor degree) and current professional body membership (minimum of one). Assured that each participant met the eligibility requirements to be considered an expert, participants were asked to confirm whether the items listed as opportunities and obstacles signified a comprehensive inventory of those representing the AEC sectors (Mack, 2005). Expert approval allowed the authors to
create a roadmap linking the items to the SDGs. This was again presented to a group of AEC experts, meeting the same eligibility requirements as previous. The experts were invited to examine the roadmap, completing a quantitative survey of close-ended questions and make comments, where considered necessary.

Ethics and moral standards are integral to research studies (Guillemin and Gillam, 2004; Singhapakdi et al., 2001). All experts involved in this study were informed that their involvement was voluntary and their decision to return their answers and comments would be deemed as their consent to take part. As responses were anonymous, participants were also informed that no opportunity would be given to withdraw once responses had been returned.

The profiles of the experts are surmised in Table 1. This shows the experts came from each of the AEC sectors (Architecture: n = 4; Engineering: n = 1; Construction: n = 11). Most have at least 6–10 years of professional experience working in the AEC industries, with some having >20 years’ experience, as well as having at least 6–10 years of experience working on sustainability-related projects. Every expert is qualified with a minimum Bachelor degree and 34% (n = 6) of them qualified at postgraduate level. Further, every expert is a current member of an AEC recognised professional body.

Table 1: Professional profiles of the AEC experts used in the validation exercises.

<table>
<thead>
<tr>
<th>No.</th>
<th>Job Role</th>
<th>Time in industry</th>
<th>Time on sustainability projects</th>
<th>Qualification Level</th>
<th>Professional Body Membership</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design Manager</td>
<td>6-10 years</td>
<td>1-5 years</td>
<td>Masters</td>
<td>RIBA</td>
</tr>
<tr>
<td>2</td>
<td>Design Manager</td>
<td>6-10 years</td>
<td>6-10 years</td>
<td>Masters</td>
<td>C Abe</td>
</tr>
<tr>
<td>3</td>
<td>Project Manager</td>
<td>&gt;20 years</td>
<td>11-15 years</td>
<td>Bachelors</td>
<td>CIBSE</td>
</tr>
<tr>
<td>4</td>
<td>Planner</td>
<td>6-10 years</td>
<td>1-5 years</td>
<td>Bachelors</td>
<td>ICE</td>
</tr>
<tr>
<td>5</td>
<td>Site Manager</td>
<td>6-10 years</td>
<td>6-10 years</td>
<td>Masters</td>
<td>RICS</td>
</tr>
<tr>
<td>6</td>
<td>Site Manager</td>
<td>1-5 years</td>
<td>&lt; 1 year</td>
<td>Masters</td>
<td>CIOB</td>
</tr>
<tr>
<td>7</td>
<td>Design Manager</td>
<td>6-10 years</td>
<td>1-5 years</td>
<td>Masters</td>
<td>CIOB</td>
</tr>
<tr>
<td>8</td>
<td>Design Manager</td>
<td>1-5 years</td>
<td>&lt; 1 year</td>
<td>Masters</td>
<td>CIOB</td>
</tr>
<tr>
<td>9</td>
<td>Quantity Surveyor</td>
<td>1-5 years</td>
<td>&lt; 1 year</td>
<td>Bachelors</td>
<td>RICS</td>
</tr>
<tr>
<td>10</td>
<td>Quantity Surveyor</td>
<td>11-15 years</td>
<td>6-10 years</td>
<td>Bachelors</td>
<td>RICS</td>
</tr>
<tr>
<td>11</td>
<td>Environmental Manager</td>
<td>11-15 years</td>
<td>6-10 years</td>
<td>Masters</td>
<td>IEMA</td>
</tr>
<tr>
<td>12</td>
<td>Sustainability Manager</td>
<td>&gt;20 years</td>
<td>16-20 years</td>
<td>Bachelors</td>
<td>CIOB</td>
</tr>
<tr>
<td>13</td>
<td>Procurement Manager</td>
<td>16-20 years</td>
<td>6-10 years</td>
<td>Bachelors</td>
<td>CIPS</td>
</tr>
<tr>
<td>14</td>
<td>Planner</td>
<td>1-5 years</td>
<td>1-5 years</td>
<td>Bachelors</td>
<td>CIOB</td>
</tr>
<tr>
<td>15</td>
<td>CSR Manager</td>
<td>16-20 years</td>
<td>6-10 years</td>
<td>Bachelors</td>
<td>CIOB</td>
</tr>
<tr>
<td>16</td>
<td>Quantity Surveyor</td>
<td>1-5 years</td>
<td>1-5 years</td>
<td>Bachelors</td>
<td>CIOB</td>
</tr>
</tbody>
</table>
4. FINDINGS

The initial literature search generated 1,043 articles. Screening was completed, removing irrelevant articles, duplicates and grey literature (Figure 4). Following this, relevance and area of research was considered, leading to the final 38 articles chosen for inclusion in the review (Table 2). The articles are predominantly UK industry research (n = 28), and others include the USA, Brazil, Hong Kong, India, Singapore, Slovenia and Sweden (n = 10). All articles published post–2000, with 14 of the 38 being published after 2015 – after the point of agreement for the SDGs. Most articles (n = 17) within the study align with entire organisational supply chain management, rather than a focus on one aspect of supply chains (i.e. procurement). The remaining articles relate to sustainability and responsible sourcing within the AEC industry. These articles were reviewed taking cognisance of the SDGs and key themes were aligned with particular indicators within the framework to produce a roadmap.

Figure 4: PRISMA Flow Diagram of Literature Search and Selection Process (Adapted from: http://prisma-statement.org/prismastatement/flowdiagram.aspx)
Table 2: Classification of the responsible sourcing publications used in this study.

<table>
<thead>
<tr>
<th>No</th>
<th>Year</th>
<th>Country/District</th>
<th>Evaluation Methods</th>
<th>Article Type</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2020</td>
<td>Brazil</td>
<td>Survey and Literature Review</td>
<td>Journal Paper</td>
<td>Silva and de Figueiredo</td>
</tr>
<tr>
<td>2</td>
<td>2019</td>
<td>USA</td>
<td>Survey</td>
<td>Journal Paper</td>
<td>Chen et al.</td>
</tr>
<tr>
<td>3</td>
<td>2019</td>
<td>UK</td>
<td>Survey</td>
<td>Journal Paper</td>
<td>Krueger et al.</td>
</tr>
<tr>
<td>4</td>
<td>2018</td>
<td>UK</td>
<td>Systematic Literature Review</td>
<td>Journal Paper</td>
<td>Bastas and Liyanage</td>
</tr>
<tr>
<td>5</td>
<td>2017</td>
<td>UK</td>
<td>Case Study</td>
<td>Journal Paper</td>
<td>Nasi et al.</td>
</tr>
<tr>
<td>6</td>
<td>2017</td>
<td>India</td>
<td>Systematic Literature Review</td>
<td>Journal Paper</td>
<td>Sivrapakasam et al.</td>
</tr>
<tr>
<td>7</td>
<td>2017</td>
<td>UK</td>
<td>Survey and Literature Review</td>
<td>Journal Paper</td>
<td>Dunant et al.</td>
</tr>
<tr>
<td>8</td>
<td>2016</td>
<td>UK</td>
<td>General Assumptions</td>
<td>Journal Paper</td>
<td>Agrawal and Lee</td>
</tr>
<tr>
<td>11</td>
<td>2019</td>
<td>UK</td>
<td>Semi-structured interviews</td>
<td>Conference Paper</td>
<td>Iles and Ryall</td>
</tr>
<tr>
<td>13</td>
<td>2015</td>
<td>UK</td>
<td>Case Study</td>
<td>Journal Paper</td>
<td>Dadhich et al.</td>
</tr>
<tr>
<td>15</td>
<td>2014</td>
<td>Slovenia</td>
<td>Case Study</td>
<td>Journal Paper</td>
<td>Ćuš-Babić et al.</td>
</tr>
<tr>
<td>16</td>
<td>2013</td>
<td>UK</td>
<td>Survey</td>
<td>Journal Paper</td>
<td>Williams and Schaefer</td>
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<tr>
<td>17</td>
<td>2013</td>
<td>UK</td>
<td>Cross-sectional Study</td>
<td>Journal Paper</td>
<td>Hoejmoose et al.</td>
</tr>
<tr>
<td>18</td>
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<td>Survey</td>
<td>Journal Paper</td>
<td>Glass et al.</td>
</tr>
<tr>
<td>20</td>
<td>2012</td>
<td>UK</td>
<td>Systematic Literature Review</td>
<td>Journal Paper</td>
<td>Glass</td>
</tr>
<tr>
<td>21</td>
<td>2012</td>
<td>UK</td>
<td>Survey and Literature Review</td>
<td>Journal Paper</td>
<td>Ageron et al.</td>
</tr>
<tr>
<td>22</td>
<td>2012</td>
<td>UK</td>
<td>Survey</td>
<td>Journal Paper</td>
<td>Glass et al. (1)</td>
</tr>
<tr>
<td>24</td>
<td>2011</td>
<td>UK</td>
<td>Case Study</td>
<td>Conference Paper</td>
<td>Glass (1)</td>
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<tr>
<td>25</td>
<td>2011</td>
<td>UK</td>
<td>Survey</td>
<td>Book Chapter</td>
<td>Harwood, Humby and Harwood</td>
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<tr>
<td>26</td>
<td>2011</td>
<td>Hong Kong</td>
<td>Model or process</td>
<td>Journal Paper</td>
<td>Xue et al.</td>
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<td>2011</td>
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<td>Conference Paper</td>
<td>Glass et al. (2)</td>
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<td>2010</td>
<td>USA</td>
<td>Survey</td>
<td>Journal Paper</td>
<td>Becerik-Gerber and Rice</td>
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<td>Sweden</td>
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<td>Journal Paper</td>
<td>Gluch et al.</td>
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<tr>
<td>31</td>
<td>2007</td>
<td>UK</td>
<td>Survey and Interviews</td>
<td>Journal Paper</td>
<td>Revell and Blackburn</td>
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<td>33</td>
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<td>UK</td>
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<td>Journal Paper</td>
<td>Azapagic</td>
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<tr>
<td>34</td>
<td>2002</td>
<td>UK</td>
<td>Survey and Literature Review</td>
<td>Journal Paper</td>
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</tr>
<tr>
<td>35</td>
<td>2001</td>
<td>UK</td>
<td>Survey</td>
<td>Book Chapter</td>
<td>Bowen et al.</td>
</tr>
<tr>
<td>37</td>
<td>2000</td>
<td>Europe</td>
<td>Case Study</td>
<td>Journal Paper</td>
<td>Vrijhoef and Koskela</td>
</tr>
<tr>
<td>38</td>
<td>2000</td>
<td>Singapore</td>
<td>Case Study</td>
<td>Journal Paper</td>
<td>Ofori</td>
</tr>
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</table>
Table 3: Classification of opportunities and obstacles highlighted within literature.

<table>
<thead>
<tr>
<th>No.</th>
<th>Competitive Advantage</th>
<th>Stakeholder Value</th>
<th>Transparency</th>
<th>Lower Environmental Impacts</th>
<th>Improved Supply Chain Performance</th>
<th>Improved Collaboration</th>
<th>Compliance</th>
<th>Cost</th>
<th>Lack of Frameworks/Information</th>
<th>Lack of Awareness</th>
<th>Quantifiable Impacts</th>
<th>Risk</th>
<th>Client Reluctancy</th>
<th>Industry Time/Pressures</th>
</tr>
</thead>
<tbody>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
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Barriers:

1. Client Reluctancy
2. Industry Time/Pressures
3. Lack of Awareness
4. Quantifiable Impacts
5. Risk
6. Cost
7. Lack of Frameworks/Information
8. Compliance
9. Improved Supply Chain Performance
10. Transparency
11. Lower Environmental Impacts
12. Improved Collaboration
13. Stakeholder Value
14. Competitive Advantage
15. Transparency
16. Lower Environmental Impacts
17. Improved Supply Chain Performance
18. Improved Collaboration
19. Compliance
20. Cost
21. Lack of Frameworks/Information
22. Lack of Awareness
23. Quantifiable Impacts
24. Risk
25. Client Reluctancy
26. Industry Time/Pressures
4.1 Literature Review

Acknowledging the rising importance of sustainability, this study investigates the opportunities and obstacles of utilising responsible sourcing, and how this enables the achievement of the SDGs. Previous studies surrounding responsible sourcing have mainly evaluated supply chains, and procurement drivers and barriers. Additionally, various researchers have reviewed literature against one SDG (Silva and Figueiredo, 2020; Rai et al., 2019; Koch and Krellenberg, 2018; Russell et al., 2018), though this is the first study known to analyse literature against multiple SDGs.

Articles were categorised (Table 3) to determine the opportunities and obstacles of responsible sourcing. Figure 5 shows the main opportunities identified by previous research; competitive advantage, stakeholder value and improved supply chain performance. The most frequently reported obstacles include cost, lack of awareness, lack of frameworks/information and industry pressures (Figure 6). Confirmation on the comprehensiveness of the items extracted from the literature (Figures 5 and 6) has been concurred by a group of industry experts (n = 16). The survey shared with the experts revealed 88% (n = 14) of them agreed the literature review has successfully identified all relevant opportunities and obstacles of adopting responsible sourcing in the AEC sectors. Those who disagreed, 12% (n = 2), indicated missing opportunities as “social impacts” and “governance strategy” along with obstacles including “lack of buy-in” and “business priorities”.

![Figure 5: This shows the known opportunities (n = 7) provided by responsible sourcing and the frequency of their reporting in the AEC publications (n = 38) used in the literature review.](image-url)
4.2 Opportunities for Responsible Sourcing

Despite noted improvements in perceptions of responsible sourcing, the majority of current construction remains steadfast that short–term solutions outweigh long–term gains (Demaid and Quintas, 2006). The literature review notes the most frequently reported opportunities as competitive advantage, stakeholder value and improved supply chain performance which this section will now examine in further detail.

As the AEC sector strives towards sustainable development, an assumed opportunity of responsible sourcing is competitive advantage and increased access to clients (Upstill–Goddard et al., 2016). Within the construction industry, the adage “time is money” remains appropriate; thus, effective risk management, efficient delivery and conflict reduction between social responsibility and traditional methods of procurement, also produces retained profitability and competitive advantage (Bubicz et al., 2019; Harwood et al., 2011). Responsible sourcing and supply chain management are transparent tools for demonstrating wholly sustainable thinking. Hoejmose et al. (2013) and Cohen and Robbins (2011) also documented organisations responsible sourcing decisions yield competitive advantage. Competitive advantage as a benefit of pro–environmental behaviours was identified by Bansal and Roth (2000) and mirrored by Revell and Blackburn.
(2007). By addressing innovation both internally and externally, organisations deliver sustainable procurement and gain competitive advantage. These arguments of competitiveness underpin current policy-making approach with governments driving the response to climate change and other environmental concerns (Gluch et al., 2009; Williams & Schaefer 2013).

According to Epstein (2008), pro-active management produces robust client–organisation relationships (Gluch et al., 2009). Lee and Kim (2009) also emphasised that firms’ reputations are improved through tangible action rather than vague communication, thus evidencing responsibly sourced products demonstrates a reaction to stakeholder requirements. Chen et al. (2019) reinforces growing demands for sustainable behaviours are determinant forces in supply chain management. A traditional obstacle to responsible sourcing has been client reluctance due to intangible benefits, however, there seems to be changing values for stakeholders (Becerik–Gerber and Rice 2010). Ageron (2012) surmised that management and stakeholder opinions were strong influencers over sustainable supply chain management and self–regulation remains an opportunity (Finster & Hernke 2014). However, the perception of value for stakeholders remains problematic, with Dunant et al. (2017) finding lower value observations within designs where pro–environmental practices are not considered.

The construction industry is a complex and diverse market at the forefront of a shift to increase productivity, value, and quality. This influx of sustainable thinking means organisations must be resilient and collaborative in changing markets. Ofori (2000) labels supply chain performance as essential to the competitiveness of construction businesses, due to the spectrum of influencers throughout a project’s lifecycle. The multitude of stakeholders creates synergies between quality delivery and supply chain performance (Bastas and Liyanage, 2018). Through effective green supply chain management, due to increased environmental consciousness within the sector organisations re–evaluate more innovatively, which is considered vital when chasing responsible practice (Bowen et al., 2001; Upstill–Goddard et al., 2013).
Over the last decade, research into sustainable practices has been established in a bid to reduce negative environmental consequences of over-production. Nasi et al. (2017) noted potentially improved supply chain performance through analysis and management, with Carter and Jennings (2002) also eluding to positive impacts of socially responsible procurement and links to supply chain relationships. The integration of information flows was noted by Čuš–Babič et al. (2014) as a method to improve material management within AEC sectors. By undertaking rigorous analysis of materials production and utilisation of responsible sourcing, organisations can bridge gaps within the supply chain to improve performance. Through mapping and integrating responsible choices throughout the supply chain, it can be surmised that time, waste and costs can all be reduced.

4.3 Obstacles for Responsible Sourcing

As previously outlined, the most common obstacles were cost, lack of structured frameworks and industry constraints. These aspects will be explored in more detail throughout this section. The literature highlighted various studies noted cost as a key obstacle to responsible sourcing. Agrawal and Lee (2016) and Bowen et al. (2001) inferred this is in relation to higher capital costs, coupled with longer lead times (Carter and Jennings, 2002). Stakeholders also exhibit confusion in terms of investment, in respect of costs associated with achieving responsible supply chains and how these conflict with traditional practices (Zarei et al., 2020). The conversion to responsible sourcing is dependent on upstream and downstream aspects of the supply chain (Meckenstock et al., 2015). As budget often dictates viability for project, the value of responsible sourcing and green supply chain management can be difficult to envisage, as cost and economic uncertainty take priority (Guinipero et al., 2012). The capital cost of materials falls to the client, dissuading clients from proceeding with responsible sourcing, preferring to place value elsewhere (Becerik–Gerber and Rice, 2010). Sustainability initiatives, therefore, should be pursued as early as possible in order to avoid trade-offs (Guo et al., 2016).

Iles and Ryall (2019) recognised cost as an obstacle, however, this observation tends to be from organisations who do not operate sustainable procurement. With the correct application of responsible sourcing and
embedding of strategies, companies can actually experience a cost saving overall (Spence and Rutherfoord, 2000). This is in part, due to the integration of supply chains and minimisation of waste through responsible procurement (Bastas & Liyanage 2018). Dunant et al. (2017) highlighted the difference between perceived and actual costs and that with the correct approach overall costs can be reduced when adopting sustainable behaviours. Dadhich et al. (2015) mirrors this when considering green supply chain management, organisations which integrate smart decision-making results in cost reductions and an increase in economies of scale. Therefore, the perception of cost, rather than the actual costs may be the barrier to uptake, thus it can be concluded that inertia is perhaps the physical obstacle.

The clash between sustainable thinking and a lack of established platforms between stakeholders in project teams was highlighted by Rohracher (2001) who, also acknowledged a lack of collaboration as a roadblock. The root cause of this may be attributed to the multitude of stakeholders involved throughout projects (Vrijhoef and Koskela, 2000). Glass et al. (2012) reinforced the belief that despite growing concerns over resource use, responsible management of supply chains remains difficult. Zorzini et al. (2015) highlighted multiple conflicting aspirations, therefore, it can be difficult to implement responsible supply chain decisions (Klassen and Vereecke, 2012).

Organisations are striving to revamp current practices, to respond to the changing industry (Finster and Hernke, 2014). A technical obstacle of sustainable construction is a lack of common frameworks, which Häkkinen and Belloni (2011) acknowledge and propose BES6001 as tool to provide in-depth analysis and accurate product information, debunking fake views and produces measurable reductions in environmental impacts (Mustow, 2006). However, when considering the complexity of construction supply chains, the common use of outsourcing, and just–in–time delivery, the effective analysis of materials becomes problematic (Bowen et al., 2001; Boyd et al., 2007). Through increased awareness of protecting natural resources, responsible sourcing and green supply chain management have emerged as management tools (Iqbal et al., 2020). Whilst many industries are shifting towards a wholly sustainable approach, the
construction industry’s culture can be challenging. Akintoye et al. (2000) ascertained the state of supply chain collaboration and highlighted workplace culture as an obstacle. Russell et al. (2018) also suggested regulation, training and education as standard tools for shifting towards responsible consumption and production.

5. DELIVERY OF THE SUSTAINABLE DEVELOPMENT GOALS

It is important to note, that all SDG’s are underpinned by the practices of the AEC sector, and that for the purpose of this research, the focus remains on those closely linked to the uptake of responsible sourcing. Below, each of the SDGs focussed on in this research are contextualised in relation to the AEC sector. As identified by the pool of experts, those with the strongest links to responsible sourcing literature were SDG–8, SDG–9, SDG–11, SDG–12, SDG–13 and SDG–17. These will be explored within the context of this research in further detail below.

SDG–8: Decent Work and Economic Growth

Through to 2030, crucial targets within SDG-8 are to improve global resource efficiency in consumption and production chains to unlock economic growth and environmental degradation through innovative diversification and technological upgrading. Within the AEC sectors, this delinking lies within procurement. Due to the multiple interested parties within any project, it may be challenging to develop a sustainable procurement strategy sympathetic to individual agendas (Johnson et al., 2020). In order to promote decent work, protect labour rights and provide safe working environments, the eradication of forced labour, modern slavery and child labour is essential. The AEC sectors contribute significantly to GDP growth and sustainable construction stimulates new opportunities and improved working conditions through health and safety management (Goubran, 2019).
SDG–9: Build Resilient Infrastructure, Promote Inclusive and Sustainable Industrialization and Foster Innovation

SDG–9 focusses on innovative, affordable and equitable industrialisation, resilient infrastructure and adoption of clean technologies and processes by 2030. Traditional heavy resourced and intense construction methods are incapable of producing sustainable infrastructure (Folke et al., 2010). The AEC industry is at the forefront of the response to SDG–9, by using sustainable construction and green supply chains to contend with the impacts of rapid urbanisation and rising housing demand, through improving efficient and responsible project delivery (Jabareen, 2006). Tomaselli et al. (2019) surmised SDG–9 is vital for achieving economic growth and, therefore, linked to SDG–8. This growth must be environmentally sympathetic to create resilient infrastructure (SDG–11).

SDG–11: Make Cities and Human Settlements Inclusive, Safe, Resilient and Sustainable

SDG–11 entails access to safe, sustainable and affordable housing responding to growing inequality, whilst safeguarding the world’s cultural and natural heritage. Within the construction industry, innovation through financial and technical means, and the utilisation of local materials generates sustainable development (Palaneeswaran et al., 2001). Climate change also has various environmental impacts on the AEC sectors, this includes flooding, soil swelling, increased weathering, and higher demands on heating and ventilation systems (Zhou and Lowe, 2003). Due to this, resilient infrastructure is vital to protect cities, and the links between holistic development of green spaces in urban areas and improved mental health are well researched (Xiao et al., 2018; Lee and Maheswaran, 2011).

SDG–12: Responsible Consumption and Production

Sustainable management of supply chains and efficient use of natural resources enables the reduction of waste in manufacturing. By 2020, SDG–12 aims to achieve environmentally sound waste management throughout its life cycle to reduce pollution. Resilient supply chains are sought–after, and traditional linear views are no longer compatible with responsible consumption (Presutti Jr, 2003). Furthermore, targets include
sustainable waste generation through prevention, reduction, recycling, reuse and reporting to encourage sustainable strategies consistent with legislation and consumer priorities. To achieve this, sustainable development allows prioritising lifestyles in harmony with nature and rationalising inefficient fossil fuel use with wasteful consumption penalties (Silva and de Figueiredo, 2020). All of SDG–12’s targets involve creating conducive environments to transform business practices throughout supply chains. Hahn (2012) acknowledged the opportunities of legislation in producing stakeholder confidence, whilst Zhou and Lowe (2003) suggested legislation is effective in encouraging innovation. Wang et al. (2019) also recognised Europe’s position of leadership in sustainable consumption practices, concluding that AEC organisations, have a responsibility to continue this development (Dadhich et al., 2015).

SDG–13: Climate Action
SDG–13 targets include strengthening adaptable capacity to climate related hazards through continued policy and planning. Climate change response within the AEC sectors has gained traction. Key performance standards (such as BREEAM and BES6001) have increased in value, as have standards relating to the effects of climate change and use of fossil fuels (Zackrisson et al., 2008). The importance of building resilience is unopposed; organisations must make smart choices to protect the liveability of developments (Howley et al., 2009). Life cycle analysis (LCA) details carbon footprints of construction elements from cradle to grave (Karlsson et al., 2020). As 60-80% of global energy is consumed in urban areas, and costs within building materials makes up to 65% of a project, understanding the use and sourcing of materials is crucial in addressing climate change concerns. Thus, reinforcing the value of responsible sourcing and sustainable construction to achieve the SDG’s (Sharifi and Yamagata, 2016).

SDG–17: Partnership for the Goals
In order to achieve the other goals, SDG–17 outlines partnerships for technology, capacity building and trade to promote equitable systems and stabilise employment. Facilitating sustainable choices and promoting public–private partnerships creates capacity and innovation for change. Goubran (2019) reviewed the impact
of the AEC sectors on the SDGs and noted key synergies. Collaboration through the use of responsible sourcing will lead to transparent supply chains, which in turn produces direct results to achieve decent work and economic growth (SDG–8), innovation (SDG–9) resilient cities (SDG–11) responsible production (SDG–12) and responses to climate change (SDG–13).

6. DISCUSSION

The SDGs provide a measurable, strategic framework for the achievement of sustainable development. The potential contribution responsible sourcing has on this achievement is largely unmeasured. This section highlights the potential influence of responsible sourcing on the SDGs.

SDG–8 aims to promote sustained, inclusive economic growth producing employment and decent work (Rai et al., 2019). The integration of green supply chain management provides self–sustaining economic systems with reduced environmental impacts. Through the utilisation of responsible sourcing and associated analysis of supply chains the AEC sector can contribute to the achievement of SDG–8 and SDG–9 (Nasi et al., 2017). Whilst external pressures influence responsible practice, a notable motivation was personal values, as opposed to economic opportunities. Therefore, responsible sourcing aids SDG–8’s target to delink economic growth and environmental degradation (Williams and Schaefer, 2013). Whilst SMEs are apprehensive of client–led environmental requirements, most are motivated to engage (Baden et al., 2009). Stakeholders, therefore, directly influence the use of sustainable practices and the uptake to responsible sourcing. As this was highlighted as a key opportunity of responsible sourcing, it is clear the sector’s attitudes are changing to align with sustainable construction (Ageron et al., 2012).

The International Institute for Sustainable Development (2002) highlighted numerous opportunities through adopting sustainable behaviours, including healthier environments and competitive advantage. Consequently, shifting towards sustainable practice enables an integrated approach to develop deeper stakeholder relationships (Chen et al., 2019). Hence, it can be assumed responsible sourcing aids SDG–8, through achieving
economic development and improving resource efficiency within consumption and production (SDG–12). The importance of responsible sourcing products has increased rapidly over the last decade; thus, driving the attainment of multiple SDGs (Sivaprakasam et al., 2017). Combining all aspects of sustainability through responsible sourcing incorporates the social indicators of SDG–8 and SDG–9 as responsible sourcing encourages transparency, collaboration and socially sustainable industrialisation (Zorzini et al., 2015). SDG–11 intends to protect the world’s cultural and natural heritage whilst implementing integrated policies towards resource efficiency. Goubran (2019) noted construction directly impacts 80% of the targets within SDG–11. Through analysing products, quantities and requirements and choosing responsibly, the industry can reduce waste sent to landfill, cut carbon emissions and design truly sustainable developments (Glass, 2012). The use of responsible sourcing materials contributes indirectly to SDG–11 as it stimulates sustainable construction practices, which in turn meet targets within SDG–8, SDG–9, SDG–12 and SDG–13. Thus, by approaching the SDGs with an awareness of the synergies, multiple indicators can be achieved (Koch and Krellenberg, 2018).

The achievement of SDG–12 within the context of this research is of utmost significance as the literature review focusses on the use of responsible sourcing and green supply chain management. Lindgreen et al. (2009) notes sustainable procurement working within environmental limits is consistent with sustainable development,. Zarei et al. (2020) emphasised collaboration between all aspects of the supply chain contributes greatly to responsible sourcing. The opportunities and obstacles of responsible sourcing within the AEC industry are well–documented, however, as policymaking and client–demand shifts towards more sustainable practices, the industry has to respond to survive (Paramanathan et al., 2004). The use of responsible sourcing creates supply chains with efficient resource use, and green supply chain management enables the reduction of waste and control of harmful substances (Agrawal and Lee, 2016). Xue et al. (2011) ascertained regular supply chain reviews produce pro–active material management. Responsible sourcing requires regular supply chain assessments thus, it can be surmised that supply chains perform better and produces value throughout, thus contributing to the achievement of SDG–12.
The achievement of responsible consumption involves the efficient use of natural resources. To address the issue of overconsumption and overproduction, Taghikhah et al. (2019) identified the link between consumers and production as supply chains, hence, the most effective way to meet SDG–12 is through responsible sourcing and supply chain management. Paramanathan et al. (2014) analysed the contribution of corporate reputation and stakeholder value and identified particular challenges as product choice and supply chain management, both of which are positively influenced by responsible sourcing, thus producing tangible results to reach SDG–12. The uptake of responsible sourcing to yield financial opportunities is noted by researchers. Iles and Ryall (2016) concluded that companies embracing responsible sourcing maximise economic opportunities (Hoejmose et al., 2013). Responsible sourcing therefore is integral to the success of the construction sector as they shift towards modern methods of materials sourcing. In line with this the SDGs act as a structured framework for improvement towards sustainable construction (Bastas & Liyanage 2018).

The use of BES6001 provides thorough analysis of products, producing data to help combat climate change – SDG–13 (Dadhich et al., 2015). Iqbal et al. (2020) also surmised that green supply chain management acts as a tool to achieve net-zero waste. Li et al. (2017) suggested scheduling could achieve minimal energy consumption. It can therefore be evidenced that utilising responsible sourcing through supply chain management has positive links to reducing energy usage and tackling climate change (SDG–13).

SDG–17 acts as a reminder of the importance of communication and collaboration. The AEC sectors remain complicated and multi–faceted, therefore encouraging shared technical information is valuable (Glass et al., 2011a). Heightened demands for responsibility and transparency by policymakers and stakeholders leads the industry towards alternate working. Ofori (2000) indicated that collaboration between all parties produces improved purchasing behaviours. Therefore, improved information flows and partnerships allow misconceptions of responsible sourcing to be dispelled, and consequently progresses the sectors consumption and production of materials, subsequently reducing environmental impacts – relating to SDG–12, SDG–13 and SDG–17. BES6001 acts as a universal standard for implementing effective and targeted improvements to
consumption and production, mirroring the principles of ethical trading initiatives responding to issues such as child labour, efficient production and pollution contributing to SDG–8 and SDG–12 and SDG–13, respectively (Glass, 2011).

The impact of legislation to encourage collaboration is well-documented through development frameworks. However, it must be acknowledged that costs of environmental and social production falling to organisations has economic repercussions. Collaboration within industries is insufficient, and in order to achieve the SDGs, collaboration across sectors must be explored (Revell and Blackburn, 2007). Pedersen (2018) praises the SDGs as they deliver economic, social and environmental rewards to those which innovate practical solutions to meet the targets. The vital action is to reflect on the targets of the SDGs aligning with those connected to the core business model. This is emulated by CSR studies, that reflect the ethos of an organisation and integrate smart industry–specific decisions, yielding the maximum positive opportunities (Becker–Olsen et al., 2006; Cochran, 2007; Porter and Kramer, 2011). Thus, it can be concluded the success of responsible sourcing within the AEC sector is directly linked to the achievement of multiple SDGs.

6.2 Creation and Validation of the SDG Roadmap

Roadmap creation has developed over time; however, it can be defined as a reflection of the knowledge and vision of a group of experts (Wietz et al., 2017). The first steps are to characterise the baseline, in the case of this research - responsible consumption (SDG-12) – therefore it is shown in the centre. The achievement of all SDGs is the aim, and the opportunities of responsible sourcing “fill this gap”. The creation of the road map at goal level was selected due to the interlinkages in targets across the SDGs. The road map was shaped in several iterations, through consultation and refinement using feedback drawn from the pool of experts detailed earlier (Table 1). The SDGs were examined further and interlinkages between them discussed where appropriate in relation to the AEC sector. The road map illustrates the top opportunities highlighted by the literature review. It was agreed that all opportunities have direct impacts on targets within SDGs: 8, 9, 11, 12,
13 and 17. The roadmap is an illustration to show this, however, it is worth noting all SDGs are interlinked by responsible choices and sustainable construction, so this roadmap is a starting point.

The same group of experts (Table 1) were also invited to comment on the final roadmap (Figure 7). Their feedback was positive with 75% (n = 12) indicating they agreed that responsible sourcing impacts not only on SDG–12 but indirectly affect SDG–8, SDG–9, SDG–11, SDG–13 and SDG–17. This is further endorsed by 82% (n = 13) of the experts agreeing that the adoption of responsible sourcing within the AEC sectors can contribute to the achievement of the SDGs. 60% (n = 10) also agreed the road map is easily understandable – providing that “context of research is suitably defined”.

![Figure 7: A roadmap to the SDGs based on the opportunities provided by implementing responsible sourcing supply chains in the AEC sectors.](image-url)
7. CONCLUSIONS

The structured literature review presented is the first known study to acknowledge the direct impact of responsible sourcing supply chains on multiple SDGs. The main findings within this research were key opportunities of responsible sourcing in competitive advantage and stakeholder value. The core obstacles were cost and a lack of structured frameworks. Whilst the use of responsible sourcing has obvious advantages and contribute directly to various SDGs, there is still a requirement for entire industry uptake. This study has focussed upon key SDGs relating to the AEC sectors, highlighting the interactions and synergies between the targets, however, it should be noted that the AEC sector has strong links to achieving all of the 17 SDGs. Green supply chain management has been evidenced as important for sustainable procurement across the AEC sectors. This drive towards more sustainable thinking is due to rising awareness over the planet’s boundaries currently being exceeded. This research, amongst others, agrees responsible sourcing has emerged as a solution to wholly sustainable construction, and the industry has extensive influence over the accomplishment of the SDGs.

The roadmap presented and validated by experts, highlights the key links between the opportunities of responsible sourcing, and their contribution to the indicators within the SDGs. The recommendations of this research are therefore:

- Responsible Sourcing should be prioritised across public–funded framework contracts awarded to key AEC organisations;
- Increased access to be made available to SME’s for frameworks integrating sustainable procurement;
- Further research onto the measurable indicators of responsible sourcing and their performance against the indicators of the SDGs.

It is undisputable that the construction industry is a complex supply network, however findings within this study highlight in the long term, the promotion of the shared values of the SDGs and the implementation of responsible sourcing can create truly sustainable networks for building.
The potential implications of the value of responsible sourcing contributing to the delivery of the SDGs are tangible. Through selection of sustainable materials, organisations appear accountable, reinforcing the trust and collaboration of contractors, consultants and clients. The refocussing of the industry in recent years combined with the achievement of the SDGs will stimulate innovative technical solutions to produce truly sustainable development.

8. REFERENCES


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