

EXPLORING THE POTENTIAL OF SUSTAINABILITY ACTION PLANS WITHIN CONSTRUCTION PROJECTS

Craig S. Thomson¹ and Mohamed El-Haram²

1 School of the Built and Natural Environment, Glasgow Caledonian University, G4 0BA, UK.

2 Division of Civil Engineering, University of Dundee, DD1 4HN, UK.

The construction industry has been identified as a key enabler in the delivery of UK national carbon emission targets and the wider principles of sustainable development. Increasingly, the industry is being challenged by evolving policy and building standards to change its product and practices to align with sustainable construction. However, delivering sustainability in practice remains a challenge partly due to a range of traditional cultural/ structural barriers, a lack of integration between the different project stages and professions, and the predominance of the carbon agenda at the expense of a broader coverage of issues. Calls are emerging for a more holistic approach to sustainability, and for this to be reflected across the stages of the project and the resultant building lifecycle. In order to realise this, current project management approaches need to reflect this broader view and to engage effectively with the array of sustainability assessment methods available. Sustainability action plans have been applied in a number of contexts as a means of ensuring that sustainability objectives are planned, measured and achievable in practice. This research considers the potential offered by sustainability action plans within construction projects, by evaluating the experience in its application by forward thinking developers BioRegional Quintain Ltd in the Greater Middlehaven Regeneration Project. The analysis outlines the rationale for its application, its structure, the role of sustainability assessment and its contribution to the projects development. Interviews were conducted with five key members of the project team, revealing the benefits for wider practice of providing a framework around which sustainability can be managed and assessed through a series of integrated tailored action plans for each project stage, in addition its role in facilitating the sharing of knowledge, communicating aspirations and in providing the necessary leadership to project team members.

Keywords: action plan, case study, project management, sustainable construction.

INTRODUCTION

An appreciation is emerging at a policy level of the need to develop along a sustainable path. In the UK evidence is provided through the array of Government strategies and action plans introduced in recent years e.g. Sustainable Development Strategy (2005), Sustainable Communities Act (2007), the Climate Change Bill (2009) and Low Carbon Transition Plan (2009) with its staged carbon reduction programme. The built environment has emerged as a key context within this evolving agenda given its extended lifecycle and associated impacts, but also due to its role in shaping our lives. Vanegas (2003) argued that the construction industry has a responsibility as the 'custodians' of this environment to evolve its product and practices, and has been

¹ craig.thomson@gcu.ac.uk

² m.elharam@dundee.ac.uk

identified explicitly within policy as a key enabler to the delivery of its wider carbon reduction targets and broader principles of sustainable development. Its predominance is emphasised by the strategies tailored for the construction industry i.e. the revised Strategy for Sustainable Construction (2008); changes in Construction Procurement Strategy (Berry and McCarthy, 2011), and the Climate Change Bill (2008) and the significance of the Code for Sustainable Homes in England and Wales (CHS) (2006) and the Sullivan Report in Scotland (Scottish Building Standards Agency, 2007) for driving change. A step change is required in the way projects are delivered across the different development stages, to reflect not only carbon reduction targets but the wider environmental and social considerations, and also its long term economic viability. A holistic view is required which captures the economic and social dimensions associated with the life-time ability of each building to promote quality-of-life integrated with environmental systems integrity. This requires a cultural shift that moves the response beyond mere compliance within an enforced agenda with its limited coverage of issues and insufficient targets; and instead to view sustainability as an aspiration that is core in the delivery of a project and its building(s) (Head, 2008; Rees, 2009). Current policy changes are clearly driving improvements in building performance, but have so far failed to change the mindset of construction professionals away from viewing sustainability as a set of ever increasing targets which they are forced to satisfy. Professionals need to re-examine their practices with a view to making sustainability something they aspire to deliver through choice. The challenge this presents is not underestimated, but it is apparent that a solution is required if a truly sustainable path is to be found.

The ability of the industry to meet these changes quickly has been called into question in recent reviews BIS (2010) and Wolstenholme (2009), identifying the need to improve process management and the integration of decision making across the different stages and between the various project teams and professions involved. This is vital if sustainability is to be delivered in practice, as only when decisions reflect the needs of the overall building lifecycle can the benefits of sustainability be realised at later stages of the project and in the final product (Reed and Gordon, 2000). The principles of project management can play a pivotal role in evolving the way teams engage with sustainability, providing the means to embed it as a core consideration within the project vision's and objectives, its activities, and the tools available to enable the project manager to control its delivery. Utilising the landscape of sustainability assessment tools and methods, if applied from an early stage of the project has the potential to monitor, audit and provide feedback to the project team to manage the delivery of sustainability in practice. Calls have emerged for a process by which project stakeholders can engage in the necessary discourse associated with delivering a sustainable project with access to tangible information amongst teams in an inclusive and transparent manner with the potential to forge a shared understanding of both sustainability and in its implications (Mathur *et al.*, 2008). The application of existing assessment tools has so far failed to provide integration between the various stages of a project, and instead tended to be viewed as static tools applied reactively taking one off snap shots of performance.

A rethink is required around the way the management of sustainability is approached during construction projects, with a need to see it not as an extra consideration during already complex decision making processes, but instead as a core to its vision and objectives (Rees, 2009). To achieve this, sustainability requires to be embedded within the processes and practices associated with the delivery of a construction

project. The delivery of such an approach in practice will not be easy, but examples are emerging of developers who are evolving their practice by providing a structure or framework around which sustainability and its assessment plays a key role.

It is necessary to consider the role of the sustainability action plan as a tool for project managers to help facilitate such a change. This research considers this potential through an empirical case study, which evaluates the experience encountered by the project team during the application of a sustainability action plan as part of the Greater Middlehaven Regeneration Project by developer BioRegional Quintain Ltd. The paper explores the rationale for the application of this innovative approach and evaluates its contribution to the project, its structure, and considers the use of sustainability assessment as a key tool in monitoring sustainability performance across the different project phases. BioRegional Quintain Ltd have embraced sustainability as a cultural value and look to evolve their practice aided by the sustainability action plan, and their experience can help shape improvements to wider practice.

EVOLUTION OF SUSTAINABILITY ACTION PLANS

The sustainability action plan can be traced back to the Agenda 21 Plan for Action (UNCED, 1992) which provided a comprehensive plan of action supported by an associated framework for delivering agreed sustainability objectives and a supporting monitoring programme. Whilst starting at a global level; national and local governments have adopted the Agenda 21 framework ('Local Agenda 21') and produced action plans to ensure that they plan and then monitor the delivery of the sustainability principles in their actions. With an emphasis on developing a managed approach towards an agreed vision and set of objectives/ targets, a planned delivery process is agreed upon with a focus on assessment and feedback to the decision makers. These principles align very much with the principles of project management. Indeed these principles are being applied in the UK to a range of agreed strategies in the form of associated action plans with direct relevance to the construction industry, demonstrated for example by the Low Carbon Transition Plan and the Sustainable Procurement Action Plan. Recently unveiled is a series of five sustainability action plans developed to improve resource efficiency and a campaign to cut the carbon footprint of specific products e.g. plasterboard and windows (Greenwise, 2010).

The SUE-MoT research project (Thomson *et al.*, 2010) identified evidence that sustainability action plans are increasingly being considered to provide a structured approach to its delivery and to move away from viewing sustainability as an add-on to the project. However, these have tended to leave the coverage of sustainability issues and the setting of targets for the project stakeholders to establish with a bias towards energy and carbon. Whilst providing flexibility and aligning to reflect project context; a failure can be observed to align this to a more holistic view of sustainability around which to develop a framework in the form of a sustainability action plan. Vanegas (2003) suggests that a broader view can be delivered if principles are expressed in specific objectives, with associated measured goals and a detailed execution plan to achieve them is presented. This research considers the application of a sustainability action plan by a developer who aims to realise this through a proactive approach to delivering sustainability.

BACKGROUND TO CASE STUDY AND ONE PLANET LIVING

Following 10 years of failure to effectively develop Greater Middlehaven in Middlesbrough (Teesside, UK), a strategic plan was developed to promote investment

to address the high levels of unemployment, social deprivation and poor environmental quality around the site following the decline of its industrial base. In, 2003 urban designer Will Alsop was commissioned to develop a master plan to inspire the realisation of a new Middlesbrough College, 2,400 homes, 800,000 ft² of commercial offices, sports and leisure facilities and outdoor space, hotels, bars, restaurants and shops; which aims to provide ‘a reason for people to go over the tracks’ and to support the Riverside Stadium. Phase 1 represents 750 residential flats and a mix of bars, café’s, office units and shops on the lower levels (Riverside One, 2010). The master plan placed sustainability at its heart and shaped a response to stimulate economic activity and create jobs, promote a mixed use of development, enhance the public realm both aesthetically and through landscaping, facilitate a sustainable community, improve the ecology of the site and provide renewable energy solutions.

For phase 1 a developer was sought that responded in an innovative manner to develop a truly iconic development in not only product but also in process. Each developer was encouraged to submit an application, of which 15% of the selection criteria were focused on sustainability. BioRegional Quintain Ltd (2010) responded to the brief and outlined plans to make sustainability a core objective through their innovative approach to its delivery through sustainability action plans applied across the project and significantly through the application of 10 principles for One Planet Living® (OPL) (Desia and King, 2006). They proposed not only a demonstration of sustainable construction, but that through its design an enabling environment is created where residents can live a sustainable lifestyle from day one and into the future. Emerging from analysis of the performance of the BEDZED eco-village (BioRegional, 2009) were the 10 OPL principles displayed in table 1.

Table 1: 10 Principles of One Planet Living® (Desia and King, 2006)

Zero Carbon	Local and Sustainable materials	Land use and Wildlife
Zero Waste	Local and Sustainable Food	Culture and Heritage
Sustainable Transport	Equity and Local Economy	Health and Happiness
Sustainable Water		

The focus of this research is not to review the merits of the OPL principles, but instead to consider the challenge of implementing these within the management of project sustainability. In taking a developer’s role in Greater Middlehaven, a range of measures were proposed targeting design, materials, construction practices, facilities management, and amenities provision to deliver these in line with these principles. A marketing suite has been completed as well as the first phase of the public realm, but construction of residential buildings is still in the early stages.

METHODOLOGY

Located within the phenomenological paradigm, the use of a case study approach allows the researchers the opportunity to observe and explore the social setting around which decisions are taken and to consider the role of the sustainability action plan in shaping the construction project. A series of interviews driven by a topic guide, were conducted with those members of the project team involved or influenced by the application the sustainability action plan within the project. The interviews were split in two stages, the first with the project director (Tees Valley Regeneration Company) to establish an understanding of the background, the approach to sustainability and its management across the project process. The second stage focused in detail on those

who participated specifically in the delivery of sustainability in order to gain practitioners insight into the rationale, structure and experience of using a sustainability action plan within the project. The interviews conducted were the design manager; sustainability manager and assessor; sustainability integrator (responsible for delivering sustainability on site) all from the developer BioRegional Quintain Ltd, and a member of the contractor's team.

Each interview lasted around 2 hours with the topic guide used to help support the discussion, but the detailing of the questions were responsive to the experience of the interviewee. The interviews were recorded and transcribed and with the analysis forming codes and categories which emerged from the data itself. Support was provided through its triangulation with consideration of the sustainability action plan and supporting information such as the assessment reports, project plans and reports, and consultant's reports. Finally, those interviewed were revisited to explore the emerging findings, to ensure legitimacy and to reflect on changes in the project as it progresses and to consider their implications. At present, Phase 1 of the development project is still in the early stages of site activity, and therefore the paper explores the experience of those involved in the application of the sustainability action plan up to this point and explores their view and its contribution to managing sustainability the delivery of sustainability within the project.

SUSTAINABILITY ACTION PLAN

The sustainability action plan developed by BioRegional Quintain Ltd set out the overall sustainability vision and how it relates to the project context, and then for each of the 10 OPL principles the plan provides: an outline of the established standards and targets (regulations, building standards); aspirational standards and targets set for this project; the agreed minimum targets set by the project board; outlined methods for achieving these and an identification of those responsible for their delivery, with an illustrative layout provided in table 2 for Zero Carbon.

Table 2: Illustrative layout of the action plan for Zero Carbon

ZERO CARBON- <i>Reducing carbon dioxide emissions by optimising building energy demand and supplying from zero/ low carbon renewable resources</i>	
Context	Global and regional context/ local context
Targets	Regulatory requirements and aspirational targets
Assessment	Assessment tools, expected performance targets and project stage of application, responsibilities
Approach	Mechanism
High thermal performance standards of built form	For example specified insulation materials and air tightness and levels, and how much above building standards expected.
Energy efficient applications and fittings	e.g. specified detailing for design (i.e. light fittings)
Low/ Zero carbon energy generation	e.g. decentralised renewable energy system(s)

Significantly, a key component of the action plan was the identification of assessment tools to be applied to ensure that the performance is effectively monitored at identified points across the project process. The plan provides an overall project document, which is then distilled for the various project stages to form a sustainable design action plan and a sustainable construction plan tailored to the needs of these stages and the professionals involved. For example the construction plan provides tough targets aimed at defining the behaviour and code of conduct for contractors, sub-contractors and suppliers engaged in the construction process to ensure their

alignment with the OPL principles. These targets were set deliberately ambitious to stimulate innovation in the practices adopted on site. An updated sustainability action plan is to be developed to guide estates management. These provide a framework explaining to the team and supply chain members the philosophy in a practical language they can relate to. The action plan is not static and responds to the evolving needs of the project and is regularly updated following performance monitoring against the agreed OPL targets and this iterative process is illustrated in figure 1.

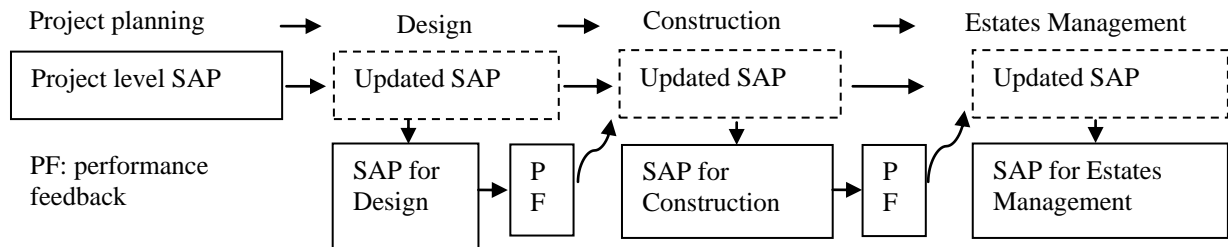


Figure 1: Illustration of project level SAP, tailored versions for design, construction and estates management, and the role of performance feedback

Such an innovative approach depends on a change in mindset, but this approach challenges those involved to aspire to deliver sustainability through innovation, as opposed to placing artificial ceilings which reflect the limitations of established practice, and low targets set in planning and building sustainability standards. An example of this is demonstrated in the design team’s decision to aim to deliver the first residential buildings at levels above Ecohomes ‘Excellent’ and to aspire for Code 6 (CSH). A perception exists that these levels are tough to deliver, although no problems were reported in this project with the completed design for the first building ‘Community in a Cube’ achieving a pre-assessment and post occupancy rating of ‘Excellent’. The design team argued that by evolving their practices with a view to designing a sustainable building as opposed to merely modifying existing practice, then delivering current planning and building standards should not be a problem.

Evidence within this project illustrates that a clear management framework provides a basis around which designers, contractors, suppliers, service providers, and even the future residents and users of the buildings can be inspired to change, but only if they understand the rationale for doing so. BioRegional Quintain Ltd acknowledge that whilst they can control to a certain extent the alignment of the design and construction practices with OPL principles through effective project management, they have limited control over the behaviour of the future residents and users of the buildings but instead rely on the provision of incentives to make sustainability the easy choice.

BENEFITS OF SUSTAINABILITY ACTION PLANS

The focus of the research considers the potential benefits which a sustainability action plan plays in delivering a more ambitious and holistic approach which is integrated with the activities of project development. Analysis revealed six key benefits:

- 1) Establishes sustainability as a project aspiration
By placing sustainability at the core of its project vision, its delivery objectives and supporting it with an action plan; the developer provided the structure around which a cultural change can be established. Project stakeholders were encouraged to go beyond established practice and to rethink the way they approach sustainability. This is significant in removing a reactive culture to sustainability which enforces targets set by planning and building standards which provide artificial ceilings. The

sustainability manager argued that *"a mindset change in the way projects view sustainability is necessary, as only when it is viewed proactively can sustainability be viewed as something to aspire to through innovation and change in practice"*.

2) Provides a clear framework and assessment methodology

A key element of the sustainability action plan is the development of a clear framework around which the project team can consider sustainability and its implications for the project activities. The benefits are evident when comparing the approach to its delivery before and after the application of the sustainability action plan. During the inception and master planning stages of the project, the Regeneration Company provided strong leadership with regards to placing sustainability as key to the overall vision for Greater Middlehaven, but this was very much shaped by addressing the socio-economic issues faced, and complying with the latest environmental requirements. The project director argued that the means of assessment were very much responsive to the standard local authority planning and sustainability appraisals, in addition to an EIA and appraisals by the public funding bodies. Therefore, no overall framework is provided around which the different issues of sustainability could be assessed and thus its performance could not be monitored. The sustainability action plan provides a unified framework of agreed sustainability indicators with associated targets around which an assessment regime can be provided for the project stages. Indeed, the sustainability integrator argued that *"this provided an understandable reference document around which members of the team could relate the OPL philosophy to the individual indicators and tools required to assess the performance of the emerging design, construction and operation of the project"*. If such a framework can be initiated at the earliest stage of the project lifecycle, then the reactive approach to assessment observed prior to the developer's involvement can be avoided and an integrated approach to managing sustainability provided.

3) Encourages a holistic view of sustainability and promoting achievable targets
Whilst the approach taken to developing the master plan considered sustainability at its core, as described was interrupted in a slightly haphazard manner attempting to satisfy different strategic and policy agendas at once. This is not a criticism as it is typical of urban regeneration project in the UK. From a construction point of view, such approaches tend to lead to a dominance of environmental considerations but the approach taken by BioRegional Quintain Ltd aims to shift the approach to a broader view of sustainability incorporating the socio-economic dimensions as well. OPL provides a philosophy which attempts to deliver this framework around which existing indicators and assessment tools can be aligned. Although it is too early to conduct an assessment of the actual performance in practice, indications from preliminary design based assessments are encouraging. Lessons have been learnt from the post occupancy assessment of the BEDZED development (BioRegional, 2009), illustrating reductions in the ecological footprints of its resident's lifestyles. As concern continues to emerge over the dominance of environmental issues (to the neglect of the social and economic) of the UK Governments 'Zero Carbon' homes strategy, Bioregional Quintain Ltd are trying to demonstrate a possible alternative path. The sustainability action plan aims to provide a holistic set of issues, with targets set to encourage innovation and change in practice, care is taken to ensure that they are realistic in their delivery given the parameters set. The sustainability Integrator argued that *"you are not going to get buy in from the project team unless the targets are seen to be achievable and have an understandable logic behind them, this is potentially the primary role of the sustainability action plan"*.

4) Encourages the use of experts to guide project sustainability

A sustainability action plan by nature recognises the value of supporting the project team in the delivery of sustainability with expert knowledge. BioRegional Quintain Ltd themselves brought expertise in the delivery of OPL principles through past projects, and were able to draw on this knowledge through their management approach. Demonstrated was the considerable value of specialist sustainability roles in the form of a sustainability manager, integrator and assessor. These provided guidance at different levels of the project hierarchy and aid the integration of the sustainability objectives and their assessment across the lifecycle. These individuals displayed an understanding of the OPL principles and technical expertise improved the team's overall ability to engage with the sustainability agenda and to effectively interact with its assessment across the project lifecycle. In addition, the value of drawing on external expertise was demonstrated in the shape of specialist consultants to provide advice and conduct aspects of the assessment that were out with the skill set of the project team. The sustainability manager stated that *"recognising and supporting a limited knowledge base is essential in delivering such a novel approach to sustainability and its assessment"*.

5) Facilitates the flow and sharing of knowledge

The case study highlighted the importance of managing the flow of knowledge between those involved during the delivery the key sustainability decisions and the assessments. The analysis revealed that the effective flow of information between the design team and the sustainability assessor was crucial to enhancing the ability of the team to recognise the opportunities to evolve the design in order to improve performance. The sustainability manager argued that *"having information available to decision makers enables a more flexible approach to design development, however to make this work a degree of contact is required between these parties to realise this potential"*. Thomson *et al.* (2010) observed the problems caused by poor information flow in managing sustainability, and by comparing the experience within that research it is possible to argue that through regular meetings and a monthly report outlining the sustainability performance against each of the OPL targets, sufficient opportunity has been provided to support the necessary formal and informal contact between the team members. Enabling the design team to communicate directly with the developer's sustainability management team provided the opportunity to ask questions and learn more about OPL principles and the implications of the assessment regime. The same principles are being deployed for the site based teams in the hope that this significantly enhances the teams' ability to benefit from 'social learning' which is necessary to improve practice (Pope *et al.*, 2004).

6) Provides leadership for sustainable practice

Leadership was demonstrated to be an extremely important characteristic of the management of sustainability within this project. From the outset the Regeneration Company placed sustainability as a priority in the development of Greater Middlehaven and demonstrated their commitment through the selection of a developer with such a strong articulation of the principles of sustainability. BioRegional Quintain Ltd brought a conceptual grounding to their sustainability vision and were able to communicate this for practice. The project director stated that *"this provided a confidence to the rest of the project team and they wanted to learn more about how this can be delivered in practice"*. Convincing construction professionals that the approach to delivering sustainability in practice has firm rational and achievable targets is vital to removing scepticism. The project management structure provided by

the developer's structure provided by the developer set out this understanding and the sustainability action plan was the communication tool which outlined the principles, targets, assessment points and individual responsibilities required for its delivery. This provided the basis for all project documentation and enables sustainability to be addressed formally within project meetings ensuring stakeholder involvement and allowing adequate feedback with the decision points across the project lifecycle. The developer provided a clear vision to the rest of the project team regarding sustainability, demonstrating their commitment to its principles at every level of the project and by effectively resourcing the assessment. The sustainability integrator provided an example of the commitment provided to deliver the principles, as he was responsible at a site level to ensure that the agreed specifications and standards displayed within the sustainability action plan were being delivered practice. Examples of this relate to his role in checking that the materials arriving on site comply with the agreed specification, and the conduct of sub-contractors complies with the site waste management plan and wider carbon reduction targets. The integrator *"if they don't align with the agreed terms of the contract then they are off the project. We treat sustainability that seriously"*. Providing leadership to this degree creates a project culture where sustainability is seen as important as traditional construction management performance indicator of quality, time and cost.

CHALLENGES FOR WIDER PRACTICE

Our findings on the whole portray a positive view of the approach taken by the developer to managing sustainability. However, analysis revealed a feeling that it is ambitious to deliver targets that go beyond the basic requirements in challenging times for the construction industry. The contractor suggested that the high profile enjoyed by the Greater Middlehaven project provided the supply chain a confidence to chase higher sustainability levels due to the future marketing opportunities and the investment secured from the public and private sectors. Despite delays in phase 1 caused by economic downturn, £13 million of investment has recently been announced from the private sector in March, 2011 reflecting confidence in the vision and its current status as the largest low carbon development in the UK. However, it was suggested that in other projects such an approach may put unrealistic risk at present on the supply chain as the drive is more for value for money.

CONCLUSIONS

The case study revealed that sustainability action plans have a future for managing the delivery of sustainability through project management. However, the researchers acknowledge that firm conclusions can only be made following the completion of the project and through post-occupancy evaluation. The next stage of the research aims to conduct follow up interviews with the project team during the completion of the early buildings of phase 1 and to consider the extent to which the sustainability action plan has helped deliver the targets set. However, comparison with previous work explored by Thomson *et al.* (2010) suggests that in taking a holistic view, providing a clear framework and project structure and methodology, the use of a sustainability action plan has the potential to provide a unifying project management tool.

ACKNOWLEDGMENTS

Appreciation is extended to BioRegional Quintain Ltd and Tees Valley Regeneration Company for access to the project, and the funding of the EPSRC (EP/C008030/1) as part of the SUE-MoT research project.

REFERENCES

- Berry, C. and McCarthy, S. (2011), *Guide to sustainable procurement in construction (C695)*, CIRIA, London, UK.
- BioRegional (2009), *BedZed seven years on- the impact of the 3 UK's best known eco-village and its residents*, BioRegional Development Group, BedZed Centre, Sutton, UK.
- BioRegional Quintain Ltd (2010), *Company objectives* <http://www.bioregional-quintain.com/objective.php> [Date accessed 24 May, 2011].
- BIS (2010), *Low Carbon Construction- Innovation and Growth Team*, Emerging Findings. Spring, 2010, Department for Business, Innovation and Skills, Crown Copyright, UK.
- Desai, P and King, P (2006), "One Planet Living – A Guide to Enjoying Life on Our One Planet", Alastair Sawday Publishing, Bristol, UK.
- Greenwise (2010), *Construction industry unveils sustainability action plans*, Greenwise, <http://www.greenwisebusiness.co.uk/news/construction-industry-unveils-sustainability-action-plans-1876.aspx> [Date accessed 24 May, 2011].
- Head, P (2008) "Entering the ecological age: the engineer's role". Institution of Civil Engineers Brunel Lecture Series, Institution of Civil Engineers, London.
- Mathur, V .N., Price, A. D. F. and Austin, S. (2008), "Conceptualising stakeholder engagement in the context of sustainability and its assessment", *Construction Management and Economics*, **26**(6), 601-609.
- Pope, J., Annandale, D., and Morrison-Saunders, A. (2004), "Conceptualising sustainability assessment", *Environmental Impact Assessment Review*, **24**, 595-616.
- Scottish Building Standards Agency (2007), *A low carbon building standards strategy for Scotland*, Scottish Building Standards Agency, Livingston, UK.
- Reed, W. G. and Gordon, E. B. (2000), "Integrated design and building process: what research and methodologies are needed?", *Building, Research & Information*, **28** (5/6), 325-337.
- Rees, W. (2009), "The ecological crisis and self-delusion: implications for the building sector", *Building, Research & Information*, **37**(3), 300-311.
- Riverside One (2010), *Riverside One Middlehaven sales and marketing*, www.riverside-one.com [Date accessed 24 May, 2011].
- Thomson, C. S., El- Haram, M. A. and Emmanuel, R. (2010), "Managing the knowledge flow during sustainability assessment", *Proceedings of Institution of Civil Engineering, Urban Design and Planning*, **163**(2), 67-78.
- UNCED (1992), *Agenda 21: An agenda for the 21st Century: report of the United Nations Conference on Environment and Development*, UN Publications, New York, USA.
- Vanegas, J. A. (2003), "Road map and principles for built environment. Environmental Science Technology", *American Chemical Society*, **37**, 5363-5372.
- Wolstenholme, A. (2009), *Never Waste a Good Crisis- a review of progress since Rethinking Construction and thoughts for the future*, Constructing Excellence, London, UK.