KES Transactions on Sustainable Design and Manufacturing I
Sustainable Design and Manufacturing 2014 : pp.205-217 : Paper sdm14-007

Eco-Efficiency versus Eco-Effectiveness: A Case Study from the UK Exhibitions Industry

Claudia Newton[1], Fiona Charnley[2], Zoe Rowe[2], Leigh Tymms[3], Dawn Mills[3]

[1]The University of Warwick, Coventry CV4 7AL
claudia.newton@warwick.ac.uk
[2]Cranfield University, Cranfield, Bedfordshire MK43 0AL
f.j.charnley@cranfield.ac.uk
[3] Clarity Sustainability, Woburn, Bedfordshire MK17 9HD
leigh@think-sustainability.co.uk

Abstract This paper details an exploratory study surrounding the environmental impacts of the UK exhibition industry, particularly in relation to the design and build of bespoke exhibition stands. A mixed methodology of face-to-face surveys and expert interviews were conducted, alongside an in-depth case study with an exhibition stand designer, to gain insights into perceptions of sustainability and current practices across the exhibition industry. Insights gained from these formed design criteria for a sustainable exhibition stand solution. The paper explores wider principles and recommendations for the industry and concludes that designers and contractors are in an ideal position to improve the industry through the adoption of environmental management practices, sustainable design principles and systemic thinking.

1. Introduction

Environmental challenges have been at the forefront of worldwide concern with increasing pressure on all commercial sectors operating within the current economy. The Exhibitions industry is a significant contributor to economic growth, with thousands of large scale exhibitions being held yearly, attracting millions of visitors and contributing £5.6 million to Gross Domestic Product (GDP) in 2010 in the UK alone [1]. Despite growing awareness surrounding environmental impacts and resource scarcity the industrial system that surrounds the exhibition industry continues to be linear in its approach. Branded exhibition stands in particular involve the use of toxic materials and energy intensive processes, have a very short lifecycle and frequently result in the generation of large-scale waste.
The bespoke nature of exhibition stands typically incorporates components that are so unique; they are often unwanted by the client once the exhibition has ended. Once an exhibition has finished, it is the contractor's job to dismantle and dispose of all bespoke exhibition stands. Due to the fast turnaround times, many of these contractors destroy the stands, without disassembling graphics beforehand,

thereby rendering the waste as non-recyclable. This waste is either incinerated or sent to landfill.
The small amount of literature available on this subject suggests that awareness of these impacts is relatively low across the industry due to a lack of knowledge of environmental issues. The industry still largely operates as it did over a decade ago, calling for extensive research into sustainability-related issues of the industry. The aim of this study was therefore to undertake a case study of the UK exhibitions industry to:

- Explore the perceptions of stakeholders within the exhibitions industry and current sustainable practice,
- Identify opportunities for change within the industry,
- Develop a set of criteria for the development of a more sustainable exhibition stand,
- Make recommendations as to how environmental impacts can be significantly reduced.

2. Background

There is a limited body of academic research addressing the exhibitions industry and its environmental impacts. Most research discusses tourism and sustainability, and there is some research into the events industry, albeit limited [2]. Arcodia and Cohen [3] suggest that sustainable development strategies in tourism should extend its activities and include the impact of events on the environment and much the same can be said about the exhibitions industry. The exhibitions industry is renowned for its extremely rapid turnover and abundance throughout the UK. Millions of people visit various exhibitions on a yearly basis, thereby making the industry highly profitable. Due to these reasons, the industry also produces a substantial environmental impact which sprawls across a wide system including transport, lighting, heating and maintenance of venues, multiple supplier and contractor activities and the effect on local communities. In a physical sense, tangible outputs such as stands, lighting and other consumables have extremely short lifecycles, particularly if designed on a bespoke basis.

Landfill Waste in the UK

Research has indicated that around 60-70% of the UK's waste is sent to landfill and a large proportion of this is comprised of materials used for point of sale production [4]. This is due to the current selection of materials used for events, exhibitions, signage, billboard advertising and packaging such as PVC banners, Foamex, stretched fabric, MDF, timber, vinyl and laminates. Despite this, the total amount of waste in the UK is gradually declining as of 2008 – the largest contribution to this waste arose from the construction and demolition sector [5].

62% of waste from this sector was recycled or recovered and 26% of this was sent to landfill. In terms of commercial and industrial waste, 52% of generated waste in 2009 was recycled or reused and 24% was sent to landfill. In 2009, the proportion of waste produced from textiles/wood/paper/publishing – which are commonly used throughout an exhibition - was 3,450 tonnes, with 58.9% of this being either recycled or reused.

The Sustainable Exhibitions Industry Project funded by Biffa was conducted in 2001 and its aim was to investigate the amount of waste and inefficiency involved in the exhibitions industry through phone interviews and case studies with venues, organisers, contractors and associations. At present, this report appears to be the main source of information when exploring exhibition waste in the UK. The culture uncovered is that due to the comparatively cheap landfill costs in the UK compared to mainland Europe; emphasis is placed on rapid turnover rather than environmental impact [6]. The study found that there was little pressure to reduce waste: only 13% of respondents had taken steps towards waste minimisation; most respondents did not believe waste to be an issue; 95% of venues were not asked by organisers about waste disposal schemes; 94% of organisers said that there was no encouragement by venues to reduce their waste and 92% said that exhibitors did not check the contractor's waste disposal arrangements. In terms of the amount of waste generated from different areas within an exhibition, a waste audit report for an exhibition in a leading UK venue identified the highest amount of waste to be produced from the assembly of exhibition stands [6]. Impacts do tend to vary, but it is evident that for the majority of up-scale exhibitions that utilise the construction of bespoke stands produce a considerable impact on the environment, purely due to their bespoke status and the materials used.

Current Sustainable Practices

As the awareness of environmental issues are becoming increasingly known, action has been implemented so that the environmental impact from the exhibitions industry is mitigated. Since 2001, improvements have been made by the industry to become more sustainable. The Event Supplier and Services Association (ESSA), the Association of Event Venues (AEV) and the Association of Event Organisers (AEO) have collectively formed the Sustainability Working Group, comprised of relevant employees from venues throughout the UK. This group works together to resolve sustainability related issues faced by the industry and to minimise its environmental impact even further. ISO20121: Sustainable Event Management System encompasses all elements of sustainability enabling a more holistic view to be achieved as does the more recent WRAP on-line tool on Events Resource Management Planning which was developed to specifically support event organisers, venues and suppliers to reduce the waste generated from an event [7]. Accreditation initiatives have also been launched so that exhibitors can gain recognition for their sustainable offerings. Dickson and Arcodia [2] highlight

that accreditation programs are highly sought in the industry, but as there are a limited number of known accreditation schemes, there is little motive for exhibitors and contractors to monitor their practices, make changes and become recognised for their activities. Information that is provided for greening events tends to be largely impractical for users [2] and is more of a generalisation of event management across all sectors (i.e. business conferences, festivals, exhibitions and trade shows). Some organisations are investing in the use of sustainable materials for their products and services. There are contractors that offer sustainable alternatives to bespoke stands but many organisations still opt for traditionally built stands largely comprised of the core materials: softwood (e.g. MDF, plywood, timber and pine); Foamex; vinyl; stretched fabric; steel and aluminium. To gain an accurate appreciation for the environmental impact of specific materials, particularly when considering replacement of a material for a sustainable alternative the whole life cycle of the stand should be taken into account. Environmental analysis methodologies such as Life Cycle Assessment (LCA) and Environmental Product Declarations (EPD) are among the most widely used tools available to empirically identify and assess the impacts of a product throughout its life cycle. Jones [6] suggests that all contractors and suppliers of exhibition stands can become more sustainable in their activities ranging from greening their offices to their choice of energy supplier. To make a larger and more positive impact, companies can work with their contractors and encourage them to actively change their sourcing of materials and their waste management strategies. By challenging these issues, motivation alone can result in key changes [8].

Sustainable Design: Eco-efficiency or Eco-effectiveness

Due to the nature of the industry, there is an underlying problem in that there will always be a tangible and intangible environmental impact. Current steps towards mitigation are largely incremental and focus on what is known as eco-efficiency strategies. These place emphasis on the value of economic output alongside the reduction of economic activity upon ecological systems [9]. Eco-efficiency adopts a linear flow of materials (cradle-to-grave) through industrial systems [10]. Recycling is a significant example of eco-efficiency; though recycling is a step in the right direction, many materials are not designed to be recycled and thus lose their value once exposed to the process, this is known as downcycling. Many authors have cited that to be eco-efficient simply means to be ‘less bad’, to ‘get more from less: more product or service value with less waste, less resource use or less toxicity’ [9], but these are considered to be inadequate solutions for the long term ‘*less bad is no good, to destroy less is not positive’ [11].* Eco-effectiveness is a concept that proposes a reinvention of products. A cyclical relationship between ecological and economical systems is encouraged through the use of cradle-to-cradle design. This refers to the framework of turning materials into nutrients through the use of biological and technical metabolisms [10]. Biological metabolisms refer to materials

that are biodegradable and can be safely returned to nature during disposal, whereas technical metabolisms refer to materials part of a closed-loop system of manufacture, recovery and reuse [10]. An eco-effective approach attempts to maintain resource quality and productivity through multiple cycles of use, rather than aiming for zero waste [10]. An exhibition using no material resources is an unachievable goal for the exhibition industry however the Sustainable Exhibition Industry project [6] found that there is a huge scope for waste minimisation. Current steps towards waste minimisation are eco-efficient (rather than eco-effective) and often considered impractical during and after the exhibition [2]. If the existing literature highlights that the exhibition industry should be moving towards more radical, effective and circular methods of design, manufacture and disposal, this paper asks what factors must be considered to achieve this transition?

3. Methodology

To ensure a deep understanding of the exhibition industry the research involved working closely with a company that deals first hand with the design and implementation of exhibition stands. In addition to this surveys and expert interviews were undertaken to enable a holistic perspective to be achieved.

Survey

Surveys were conducted at a sustainability-focused exhibition attracting over 7000 visitors each year, with questions for exhibitors and visitors. The aim of these surveys was to uncover perceptions of sustainability and to discover current practice of exhibitors. As the Biffa [6] study was identified as the most prominent in relevant literature, it was also important to explore whether perceptions and opinions had changed during the last decade and to see whether exhibitors had shifted their current practice towards more sustainable options. The intention of carrying out these surveys was also to develop criteria for a sustainable stand solution (i.e. what exhibitors desire) in order to meet the demands of both the client and exhibitors. The surveys were comprised of open and closed ended questions which were developed following the analysis of findings from the review of literature, the results of which were analysed to identify the key areas of concern and to uncover baseline figures from which to work from [12], these would then be used to compare with insights gained from subsequent methods of data collection. The questions asked covered three key areas which were: 1) Areas of perceived environmental impact, 2) Waste minimisation strategies and 3) Priorities of a successful stand. A convenience sampling method was used, exhibitors were approached based on their willingness to complete the survey, their time constraints and their knowledge of the company's exhibition stand and its sustainability credentials. This method was selected over a more structured sampling approach, as it wasn't possible to gain insight into the range of exhibitors

that would be available prior to the event.
The sample size from the exhibition was 37, which included exhibitors and visitors. Surveys were selected as the most appropriate means for data collection in this context, as opposed to other available methods such as interviews, due to their efficiency in collecting a large amount of data in a short period of time [13]. It was acknowledged that the data could be affected by the characteristics of respondents [13] and is subject to the respondents' experience at exhibitions i.e. how many exhibitions they had attended, whether they were involved in the preparation process for an exhibition and whether they were aware of the potential environmental impacts. Social desirability response bias [13] is also a major issue in surveys, and it is possible that exhibitors in particular were more inclined to state that they operate sustainably rather than casting their company in a bad light. Due to the low number of responses to the survey (37) the results of this phase were limited however the insight gained was valuable for the generation of a description of the research problem during the expert interviews where further validation was achieved.

Expert Interviews
Eight hour long interviews were conducted with relevant professionals within the industry (Table 1) to validate and build upon the findings from the surveys. An interior design expert was approached following the company's recent design and build of a sustainable exhibition stand. Stand and graphics designers and marketing and communications specialists were approached in order to learn about current practice within the industry, what materials are usually used and perceptions of sustainability. A construction company specialising in prefabricated buildings was approached in order to identify whether any technologies used within that industry could become applicable to the build of an exhibition stand. These interviews were critical for learning more about the industry, its requirements and the reality of environmental concerns within the industry. It also gave an opportunity to gain advice, guidance, feedback and validation for the development of criteria for the exhibition stand.

Participant Background	**Data Analysis Code**
Sustainable interior design	P1
Prefabrication construction	P2
Exhibition stand designer	P3
Marketing and environmental management	P4
Communication consultants	P5, P6
Graphic designers	P7, P8

Table 1: Expert interview participants

Semi-structured interviews were selected to uncover current and best practice within the industries the interviewees operate in. King [14] suggested that flexible interviews are the most effective means of data collection where particular phenomena are to be explored. As the study focused on perceptions of sustainability within the exhibitions industry, conducting in-depth interviews with participants that were both aware and unaware of sustainability issues meant that meaningful insights were gathered across different 'extremes' of participants [13].

4. Results

Responses from the exhibitor surveys uncovered different perceptions of sustainability within the industry. It was found that 53% of exhibitors perceived the amount of waste generated by exhibitions to be high; 29% perceived it to be medium and 18% perceived it to be low. When exhibitors were asked about the perceived areas of impact, it was found that 8% of exhibitors perceived that exhibition stands created the largest environmental impact; 12% perceived food and drink to create the largest impact; 13% responded with carpet; 21% responded with energy and paper and promotional literature and 25% perceived travel to create the largest environmental impact. These statistics suggest that awareness of sustainability is relatively low. Exhibitions produce significant environmental impacts, but only 53% of respondents were aware of this and only 8% considered exhibition stands to have a significant environmental impact. This suggests that there is a lack of awareness within the industry that could be addressed by providing information to exhibitors and exposing them to the process of building, dismantling and disposing of stands. In terms of waste minimisation strategies, 82% of exhibitors stated that they had worked to make their stand sustainable whereas 12% said they had not. When asked how, it was found that: 68% of exhibitors reused their stand, 16% recycled their graphics, 11% put their stands in storage and 5% did not know. When asked if these exhibitors altered their stand design when attending sustainability-focused exhibitions, it was found that: 70% did not alter their stands at all, 12% partially altered their stand, 6% completely changed their stand and 12% did not know. These statistics suggest that although sustainability is a key aspect that exhibitors consider during the design of their stand they are unaware of the environmental impact that stands have within this sector. It is important to acknowledge the role that social desirability response bias [13] may have, as highlighted in section 3. As the survey was conducted at a sustainability-focused event this may have influenced responses and has to be accounted for during data interpretation. Future research is required to validate these results across a larger number of both sustainability and non-sustainability focused exhibitions. Qualitative discussion with respondents highlighted that a significant number were not involved in the process of designing and building their exhibition stand, suggesting that they are unaware of associated issues.

It was important to identify what exhibitors desired from an exhibition stand. When asked about the priorities of a successful stand, it was found that: 21% desired sales; 20% strived to provide information to customers and communicate their brand message; 13% stated that reusability was their biggest priority; 11% stated data capture; 9% stated waste minimisation and 6% stated low cost to be the biggest priority. It was evident that the visual impact of a stand was the most important feature, so this could not be compromised within the final design concept.
A shortened version of the same survey was also given to visitors in order to gain an insight into their opinions of exhibitor behaviour. It was found that 75% of respondents perceived the amount of waste generated at exhibitions to be high and 75% believed that sustainable exhibition stands particularly at sustainability-focused exhibitions were very important. When asked to elaborate, around half of respondents stated that exhibitors should have sustainable stands due to the nature of the exhibition and the remaining half said they should have sustainable stands regardless of exhibition genre. These findings suggest that visitors of these exhibitions believe that exhibitors have an obligation to design and build sustainable exhibition stands.
The insights gained from undertaking expert interviews (P1 – P8) unveiled the reality of environmental impacts within the industry and led to the identification of the following criteria for the development of a more sustainable exhibition stand:

Flexibility and Versatility: All participants addressed the need for flexibility. This was highlighted by P1 who suggested that *"you have to have a certain amount of flexibility because every year, a client will promote new products and they do want a refreshed look for their stands"* and P3 who stated that *"most companies won't want to use the same stand time and time again as this weakens the visual impact of a stand"*. This finding validates the findings from the first phase of the research, which highlighted 'sales' as being the most significant priority of a stand. With regard to versatility, all participants addressed the need for a stand solution that is able to be adapted into different configurations and geometric shapes so that creativity is not compromised.

Graphics: P 1, 3 and 5 highlighted the fact that exhibition venues are a relatively challenging physical environment – *"venues can get very cold during the night, and very warm during the day due to the high footfall and congestion within the venue"* (P1). This means that graphics must be durable and strong enough to maintain their integrity within hot and cold conditions. As the initial survey highlighted that only 16% of exhibitors recycle their graphics, design needs to focus on creating graphics that can be easily removed to aid in disassembly and recycling.

Cost: P2-6 highlighted the need for sustainable options to be cost effective. With

regard to materials, P3 stated that *"it all comes down to cost"* and P4 said, *"This solution has to compete on par with existing non-sustainable materials on the market".* After their recent design and build of a sustainable exhibition stand, P1 said that *"initial upfront costs were a bit higher, but in the long term, it saves a huge amount"*, thereby suggesting that alternative materials are potentially going to be more expensive than the core materials such as MDF and plywood, but the long term return on investment supersedes this.

Modularity: P1 and 2 have experience within the construction industry and highlighted the potential of modularity in the design of exhibition stands. When asked about their experience of exhibitions, P2 said, *"the biggest problem I've found with trade shows is that some exhibitors have stand walls that are formed as one lump. Moving these were an absolute pain and they were a pain to store…Small components within a modular design would work, particularly if they've got an interlocking mechanism*". The survey indicated that 68% of exhibitors already re-use their stand and therefore making this process easier through modularity would be a popular option. P3 and 5 stated the drawbacks of modular design; seeing the hairline between modules and largely linear shapes.

Green Design vs. Design for Sustainability: A key finding from the interviews was the focus on green design principles, such as selecting recyclable materials (P3) and the focus of considering the entire process of a stand, such as sourcing, waste management, staff and visitor wellbeing as well as materials (P1). When referring back the participant extremes (section 3), P3 worked within the industry but was unaware of environmental issues, whereas P1 was a specialist in sustainable design and also worked within the industry. The two participants had significantly different perspectives.
Figure 1 illustrates a hierarchy of design for sustainability. Principles lower down the hierarchy can be described as eco-effective and on par with issues such as green washing. Principles further up the hierarchy aim to tackle the root problems by developing more radical solutions. It was interesting to note that P3 focused on the bottom of the hierarchy of design (Figure 1), suggesting that the biggest need in the industry was a change in materials. Whereas P1 focused on the top referring to more radical re-design of the system and suggesting *"the biggest need within the industry, which sounds simple is information"*.

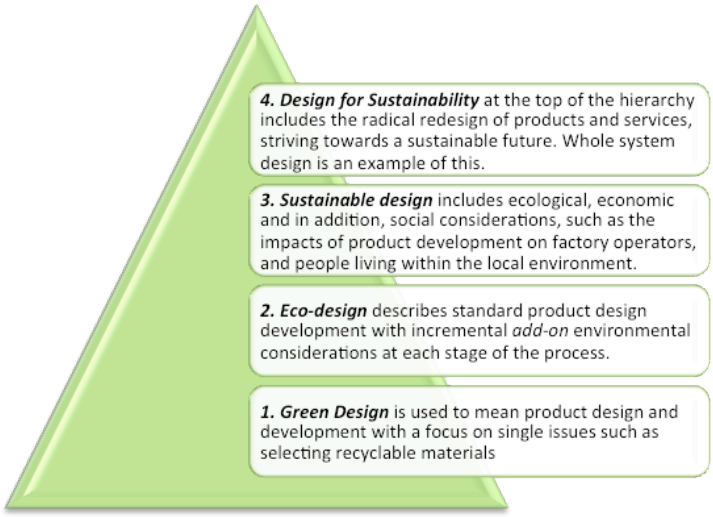

Figure 1: Hierarchy of Sustainable Design

The insights gained from the interviews were analysed alongside observations made from working closely with the exhibition stand design company to form criteria for the development of a more sustainable exhibition stand:

1. The design must be flexible enough to create different shapes in order to allow the stand to maintain a bespoke status for each individual client,
2. Graphics must be easily removable, but strong and durable enough to last within a challenging physical environment,
3. Assembly of the stand must not be overly complicated or take too long,
4. Walls of the stand must be durable for health and safety requirements,
5. At a minimum, all materials used must be recyclable,
6. At a minimum, all wood used in the structure must be sourced from the Sustainable Forestry Initiative (FSC accredited),
7. The hairline between each board should be easily coverable with graphics,
8. Walls must maintain structural integrity, particularly when 3ft and above,
9. Materials must be cost effective and ideally on par with existing non-sustainable materials,
10. The whole process of manufacture, use and disposal must be considered,
11. Schemes such as the SKA Rating should be utilised to support decisions.

5. Discussions and Conclusion

The survey results uncovered relatively primitive perceptions of sustainability within the industry. A lack of widespread knowledge was evident from exhibitors when carrying out this research. Current practice seems to steer towards re-use and

recycling (i.e. eco-efficient strategies), hence the primitive and under-developed nature of their perceptions. The findings uncovered confirm the results from the most prominent existing research within the field the Sustainable Exhibitions Industry Project [6]. Therefore it can be extrapolated that awareness of sustainability remains low across the industry and current practice is still largely based on the use of traditional core materials and the process of disposing of materials as waste once an exhibition has finished. Findings suggest that there are a number of companies portraying themselves to be 'sustainable' in terms of the products they offer and the sector they operate in, however frequently sustainable considerations are not incorporated into the design and build of their exhibition stand. This highlights a significant opportunity for a large company to buck the trend, demonstrate best practice and potentially meet consumer expectations – perhaps creating a market advantage in doing so.

The interview results uncovered interesting perceptions of sustainability amongst designers in particular. Contractors and designers that have worked in the exhibitions industry for decades are largely unaware of what can or cannot be recycled, and thus focus their thoughts on green design and eco-efficient strategies. Designers that are aware of sustainable design strategies were seen to focus on the top of the hierarchy, design for sustainability, and often have a systemic perspective on such matters. This is in agreement with a growing body of literature, which argues that a systemic perspective is needed in order to achieve more radical approaches to design for sustainability [15]. Instead of dissecting a problem down to its component parts, systemic thinkers try to see the problem as a whole, allowing for interconnections to be discovered. This could create leverage points leading to more solutions and ultimately longer term, radical and most importantly, systemic changes [16]. The study highlighted a need for more information about sustainability-related issues specifically within the context of exhibitions. Designers would benefit from working within a multi-disciplinary team and bringing together these 'extremes' of designers. By doing so, these designers would expand their current knowledge and expertise and be placed in a position whereby multi-faceted challenges can be solved more extensively [17] towards more innovative and sustainable designs [18]. Eco-briefing could also be utilized; a methodology that facilitates the communication of environmental issues amongst a multi-disciplinary team comprised of environmental experts and designers [19].

The research highlighted that the touch-points and environmental hotspots associated with the exhibitions industry are diverse and the huge number of variables means that environmental improvements cannot be achieved through incremental innovations alone. Literature has suggested that 'to be less bad is no good – to destroy less is not positive' [11]. By incorporating the principle of eco-effectiveness to the design of a stand, these negative environmental impacts have the opportunity to become greatly reduced. A reusable exhibition stand that is part of a closed-loop system of manufacture, recovery and reuse could become a

technical metabolism. An exhibition stand would then become a product of service for the client. Biological metabolisms could be created in the form of the utilisation of any material that is biodegradable. Graphics will almost always need to be replaced, however there are biodegradable graphics, which are becoming more commercially available. The conditions for degradation need to be extensively reviewed but there is an opportunity for this component to become a biological metabolism for eco-effectiveness. Due to the extremely short lifecycle of traditional exhibition stands, the passive approach of recycling is unable to cope with the increasing environmental burden the stands have on the environment. It is imperative that a sustainable stand solution maximises the overall usage of resources and minimises the damages subjected to the environment during the early stages of product development [20] via an increase in the longevity of a stand, or at the very least, the core of it. Tseng *et al.*, [20] suggest that modularity could play an important role in achieving this in product development due to the employment of common modules, thereby increasing the chances of efficient reuse and recycling, ease of upgrade and maintenance, as well as the opportunity to assemble components effectively into new configurations to cope with the rapid change of customer demands. Modular design is important for improving product performances such as upgradeability, reusability and recyclability [21].

This research concludes that there is a significant opportunity to re-shape the linear system of the exhibition industry, reduce the reliance on valuable, unrecyclable raw materials and reduce the waste going to landfill. Designers require more information about negative environmental impacts and systemic and radical approaches to sustainable design, enabling them to make design changes at a whole system level. Based on the findings from this study further work is being conducted to create a prototype of an exhibition stand using the criteria identified. To demonstrate the potential reductions in environmental impact a LCA will be conducted to compare impacts of the re-useable prototype over the duration of its multiple lifecycles with a standard single use exhibition stand.

References

[1] Oxford Economics. The Economic Impact of the UK Exhibitions Industry Available online: www.facetime.org.uk/files/economic_impact_study_preview.pdf (Accessed: 18th July 2012)

[2] Dickson, C., Arcodia, C. Promoting Sustainable Event Practice: The Role of Professional Associations. International Journal of Hospitality Management, 29, 236-244 (2009)

[3] Hammond, T.D., Broomfield, D.D. Eleventh International Waste Management and Landfill Symposium (2007)

[4] Department of the Environment, Food and Rural Affairs. Waste Data Overview (June 2011) Available online:

http://webarchive.nationalarchives.gov.uk/20130123162956/http:/www.defra.gov.uk/statistics/files/20110617-waste-data-overview.pdf (Accessed: 1st February 2014)

[5] Biffa. The Sustainable Exhibition Industry Project: A waste focused first step towards sustainable development by the UK's exhibition industry. Available online: www.mebconline.com/Portals/0/PDF/Sexi.pdf (Accessed: May 14th 2012)

[6] Jones, M. Sustainable Event Management. Earthscan, London (2010)

[7] WRAP, Resource Management Plan (RMP) Tool. Available online: http://www.wrap.org.uk/content/sustainable-event-management (Accessed: 21st February 2014)

[8] Verfaillie, H.A., Bidwell, R. Measuring Eco-Efficiency: A Guide to Reporting Company Performance. World Business Council for Sustainable Performance (2000)

[9] Braungart, M., McDonough, W., Bollinger, A. Cradle to Cradle Design: Creating Healthy Emissions – A Strategy for Eco-Effective Product and System Design. Journal of Cleaner Production, 15, 1337 – 1348 (2006)

[10] Berkhout, P., Muskens, H.G., Jos, C., Velthuijsen, J.W. Defining the Rebound Effect. Energy Policy, 28, 425 – 432, (2000)

[11] Sieber, S.D. The Integration of Fieldwork and Survey Methods. American Journal of Sociology, 73, 1335 – 1359, (1973)

[12] Robson, C. Real World Research 2nd Ed. Blackwell, Oxford (2002)

[13] King, N. The Qualitative Research Interview. In: Cassell, C., Symon, G. Qualitative Methods in Organisational Research. Sage, London (1994).

[14] Anarow, B., Greener, C., Gupta, V., Kinsley, M., Henderson, J., Page, C., Parrot, K. Whole-Systems Framework for Sustainable Consumption and Production. Denmark: Danish Ministry of the Environment, 807, 1 – 51 (2003)

[15] Senge, P. the Fifth Discipline. Century, UK (2006)

[16] Katzenback, J., Smith, D. The Wisdom of Teams. Harvard Business School, Massachusetts

[17] Charnley, F., Lemon, M., Evans, S. Exploring the Process of Whole System Design. Design Studies, 32, 156 – 179, (2010)

[18] Smith, J., Wyatt, R. Project Interception: A Performance Brief Approach. In: Proceeding of CRIOCM International Research Symposium on Advancement of Construction Management and Real Estate, 1 and 2, 29 – 38, (2006)

[19] Yan, J., Feng, C., Cheng, K. Sustainability-oriented Product Modular Design using Kernal-based Fuzzy C-means Clustering and Genetic Algorithm. Journal of Engineering Manufacture, 0, 1 – 13, (2012)

[20] Tseng, H.E., Chang, C.C. and Li, J.D. Modular Design to Support Green life-Cycle Engineering. Expert Systems and Applications, 34, 2524 – 2537, (2008)

[21] Gu, P., Sosale, S. Product Modularization for Life-Cycle Engineering. Robotics and Coputer Integrated Mfg, 15, 387 – 401, (1999)