TOWARDS A CONSENSUS OF EXPERT OPINIONS ON IMPLEMENTING ISO14001 IN THE ARCHITECTURE, ENGINEERING AND CONSTRUCTION SECTORS OF THE UK

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ABSTRACT

As society places greater emphasis on sustainability and environmental management, particularly within the Architecture, Engineering and Construction (AEC) sectors, it is vital to understand the effectiveness of the tools available to deliver change in these areas. The AEC sectors contribute to a significant impact on the environment, both in terms of materials used and waste produced. They are also seen as being environmentally negative. Therefore, the use of ISO14001 is of increasing importance in terms of demonstrating a commitment to working towards being more sustainable within their operations. Therefore, the aim of this study is to reveal the opinions of an expert panel of environmental management professionals working within the AEC sectors on the benefits and barriers of implementing ISO14001. A Delphi study was conducted, which consisted of two rounds (Round–1 involved n=15 participants; Round–2 involved n=9 participants). The participants were asked to independently rank 145 statements (comprising: n=86 benefits; n=59 barriers), across n=17 categories, which were derived from ISO 14001 and AEC literature. After two survey rounds and weighted average analysis, the results reveal the highest ranked benefits are: (i) improved relationships with stakeholders, (ii) tender requirement, (iii) community participation, (iv) industry standards, (v) efficient operations, (vi) employee environmental awareness, (vii) cost savings through energy efficiency and (viii) improved environmental performance; whilst the highest ranked barriers are: (i) open to public scrutiny, (ii) costs involved, (iii) top management commitment towards implementation (iv) lack of link to EIA, (v) public not interested; (vi) lack of support to assist staff; and (vii) legal compliance. However, unlike previous Delphi studies that have sought to gather consensus, most participants in this study were unwilling to shift their opinions towards a shared middle–ground. Therefore, whilst the survey results enlighten our appreciations of ISO14001 implementation within the AEC sectors, they also indicate significant differences in opinion by different environmental management professionals.
Keywords: *Environmental Management Systems, Obstacles, Opportunities, Delphi Survey.*

1 INTRODUCTION

ISO14001, an international environmental management system (EMS), has been in existence since 1986. EMSs were created to ensure organisations have a system that enables them to assess and mitigate their impacts on the environment [1]. An EMS also enables organisations to demonstrate they are legally compliant and have the relevant procedures in place to manage their operations in a sound environmentally safe manner [1]. As the ISO14001 system has become more well known, there has been an increase in its uptake across the

architecture, engineering and construction (AEC) sectors [2]. It is thought that this is a result of the wealth of benefits available [3]. However, there are several possible barriers restricting their uptake [4]. Therefore, the aim of this study is to reveal the consensus opinions of an expert panel of sustainability and environmental professionals working within the AEC sectors on their perceptions of the benefits and barriers of implementing ISO14001 in the UK.

2 BACKGROUND

AEC sector organisations are often scrutinised for their unfavourable impacts and influences on both sustainability matters and environmental issues [5]. Consequently, there is a greater expectation for organisations in these sectors to implement an EMS. However, as Horry *et al*. [6] has shown, there is an abundance of articles available that highlight reasons why organisations do and do not choose to adopt an EMS standard, such as ISO14001. The most frequently reported benefits for their implementation are: (a) improved corporate image (b) competitive advantage, (c) customer satisfaction, (d) waste management savings, (e) improved environmental performance, (f) compliance with legislation. Benefits can be considered to be internal or external to the organisation [7] and can be categorised in terms of organisational, financial, people, external commercial, environmental and communication. This can also be considered appropriate for the barriers. In contrast, the most frequently reported barriers against their implementation are: (a) cost, (b) lack of government pressure, (c) lack of experience, (d) lack of training and (e) lack of client support. Excluding costs, these can be seen as barriers [7], which discourage engagement.

To understand and comprehend the plethora of benefits and barriers of ISO 14001 reported in academic and industrial literature, it is necessary to gain a consensus of opinions from expert professionals who are time–served within the AEC sectors.

3 METHODOLOGY

This study adopts a positivism epistemological stance and observes a deductive research approach to address the aim of the research. The study follows a stepwise three phase process (Fig. 1).

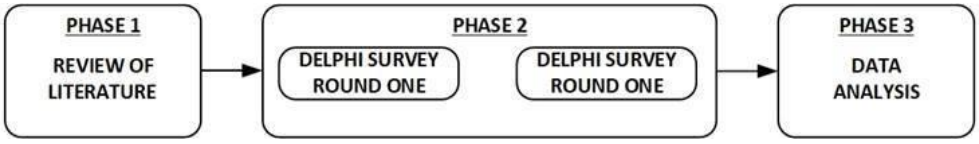

Figure 1: The phases of this research study.

3.1 Literature review (phase one)

A review of existing environmental management systems literature followed the PRISMA evidence–based transparent and complete reporting process. This is surmised in Horry *et al*. [6], which identifies an exhaustive list of the benefits (n=86) and barriers (n=59) of implementing ISO14001 in the AEC sectors. These factors were used in the next phase of the study.

3.2 Data collection (phase two)

A Delphi survey was selected as the data collection instrument. This enables the systematic collection and analysis of the opinions of experts on specific issues, where the purpose is to gain an unbiased consensus through a controlled feedback mechanism [8]. Throughout the process the researcher is working to reduce any variability in the answers throughout the rounds, using the mean or median scores of the previous round to inform experts of the consensus responses [9]. Normally, the Delphi is complete when there are diminishing returns, a convergence of opinion or the agreement did not improve [10]. At this point Babayan *et al*. [11] states that no further investigation is required.

The Delphi technique uses purposeful sampling, where experts are selected based on their interest or expertise on the subject [12], although criteria are often used to define an expert (e.g. participant qualifications and/or professional body membership, amongst others). Cantrill *et al.* [13] states that they are informed and knowledgeable individuals with relevant experiences and interests in the theme of the study. Okoli and Pawlowski [14] noted that choosing appropriate participants is extremely important within the planning of the Delphi process, as it is reliant on expert opinions and, therefore, is reliant on expert knowledge. The optimal number of experts for a Delphi survey has been a subject of debate. Okoli and Pawlowski [14] proposes that panels should be between 10 and 18 experts; while Linstone and Turoff [15] suggests between 10 and 50 experts is appropriate. Moreover, Mitchell and McGoldrick [16] recommends that panels should be no less than 8 experts. In this study 41 experts were approached to take part in the survey, which was administered using Qualtrics. This was done in accordance with the expectations of the UWE research ethics regulations.

3.3 Data analysis (phase three)

The data was scrutinised using the IBM Statistical Package for the Social Science (SPSS) statistics (v28) to determine the Kendall's coefficient of concordance (W), used to reveal the level of agreement amongst participants [17]; to determine basic descriptive statistics; and to determine the weighted average rankings of the responses [18].

4 RESULTS AND DISCUSSION

This section is divided into four sections, namely: (i) Delphi participants; (ii) EMS benefits; (iii) EMS barriers; (iv) Delphi engagement.

4.1 Delphi participants

Fifteen industry experts opted to accept the invitation to take part in the study. Table 1 shows the profiles of the Delphi participants. This reveals the participants are all employed in senior posts relevant to the theme of the study, they are very experienced in the AEC sectors, they are highly qualified, they are members of relevant professional bodies and they are very experienced in sustainability.

Each participant completed and returned a survey (Delphi Round One) that asked them to independently rate 145 statements, across 17 subject categories, using a Likert–scale (strongly agree, agree, slightly agree, neutral/neither agree nor disagree, slightly disagree, disagree, strongly disagree). These responses were analysed and used to inform the next stage of the Delphi process. A follow–up survey (Delphi Round Two) was returned to all of the participants, which showed the statistical mean response for each statement from round one, and asked them to confirm or adjust their original responses in comparison to the group responses. Nine of the original experts (a 60% response rate) opted to accept the invitation to take part in the second round. However, of these experts, only one participant wished to

make any amendments to their original selections. Consequently, the Delphi survey was closed after only two rounds.

Table 1: An overview of the industry expert profiles who opted to engage with the study.

#	Role	Sector	AEC Experience	Highest Qual.	Professional Membership	Sustainability Experience
1*	Sustain. Director	Architecture	>20	Doctorate	RIBA	>20
2*	Group Head of Env.	Construction	16–20	Bachelor	IEMA	11–15
3*	Sustain. Manager	Construction	11–15	Bachelor	IEMA	11–15
4*	Asst Design Manager	Construction	1–5	Master	ICE, CIOB	1–5
5*	Group Sustain. Manager	–	>20	Masters	–	>20
6	Head of Sustain.	Architecture	11–15	Masters	CIBSE	6–10
7	Group Head of Env.	Construction	11–15	Bachelor	IEMA	16–20
8	Director for Env. Man. and Sustain.	Engineering	>20	Masters	ISE	>20
9	Sustain. Ops. Director	Construction	>20	Masters	IEMA, ICWM, CEnv	>20
10*	Senior Env. Advisor	Construction	1–5	Masters	CEnv, IEMA, CIWEM, CIWM	6–10
11*	Associate Director Environment	–	16–20	Masters	IEMA, CEnv	>20
12*	Director	Construction	6–10	–	IEMA, IOSH	1–5
13	Head of Materials Development	–	>20	Doctorate	IoQ, GSL	>20
14*	Partner, Sustain Futures	Architecture	>20	Masters	RIBA	11–15
15	Group Env. Manager	Construction	6–10	Bachelor	IEMA	6–10

*denotes those participants who took part in rounds one and two

In respect of consensus there is debate about what is actually required with Duffield [19] defining consensus as being the stability of the responses between the rounds. Others have stated that it would be when most participants agree [20]. In this instance, a Kendall's W value greater than or equal to 3.5 was used, where the top three categories of benefits (Table 2) where agreement is found are: employee engagement, public relations and legal compliance. This is interesting, particularly in terms of employee engagement, as while it is flagged as a benefit in research it is not usually cited as the major benefit. Also interesting in terms of the barriers (Table 3) was the fact that the participants did not reach an acceptable level of agreement on any categories of the barriers, which would suggest that barriers maybe very specific to the individual organisations involved and depends on the reasons for the implementation of the system and/or what is deemed a barrier.

4.2 EMS benefits

The experts' responses (after two rounds) to the benefit statements are surmised in Table 2. This includes the weighted average rankings (BIV) for each of the eight categories, which reveals the highest ranked benefits of implementing ISO14001 are: (i) improved relationships with stakeholders, (ii) tender requirement, (iii) community participation, (iv) industry

standards, (v) efficient operations, (vi) employee environmental awareness, (vii) cost savings through energy efficiency, and (viii) improved environmental performance.

Table 2: A consensus of the expert responses to the reported benefits of implementing ISO14001 in the AEC sectors

Category code	Reported benefits of implementing ISO14001	Mean	SD	BIV	Kendall's W
PR1	Enriches corporate and public image	5.94	0.827	14.17	0.375
PR2	Enhances image with regulators	6.06	0.966	12.26	
PR3	Improves relationships with stakeholders	5.82	0.728	16.90	
PR4	Credibility of the organisation	6.24	0.752	14.40	
PR5	Green image	5.82	0.951	10.81	
PR6	Reduced complaints	4.35	1.455	8.46	
PR7	Reduced complaints	4.76	1.251	7.86	
PR8	Investor confidence	5.41	1.278	10.25	
ENV1	Competitive advantage	5.06	1.197	9.48	0.338
ENV2	Long term competitiveness	5.18	0.883	10.95	
ENV3	Higher profits	4	1.118	7.31	
ENV4	Market based pressures	4.76	1.147	9.76	
ENV5	Stakeholder pressure	5.41	1.121	11.37	
ENV6	New market opportunities	5.18	1.38	8.47	
ENV7	Tender requirement	6.53	0.514	19.75	
ENV8	Equal access to green market	4.94	1.519	8.02	
ENV9	Facilitate trade	4.59	1.176	8.99	
ENV10	Pressure from competitors	4.47	1.231	8.09	
ENV11	Remove trade barriers	4.18	0.951	10.00	
ENV12	To increased market share	4.59	1.278	8.26	
ENV13	Customer satisfaction	4.71	1.404	8.20	
ENV14	Improved customer perception	5.47	1.179	14.97	
ENV15	Customer trust	5.35	1.272	13.13	
SOC1	Improved community relations	4.65	1.539	7.97	0.163
SOC2	Social pressure (community/activists)	4.47	1.419	8.46	
SOC3	Increase stakeholder confidence	5.06	1.519	8.96	
SOC4	Social legitimacy and responsibility	4.88	1.495	8.76	
SOC5	Less complaints	4.29	1.105	8.81	
SOC6	Community participation	4.35	1.169	9.41	
SOC7	To improve industry/ government relations	4.71	1.49	9.08	
SOC8	Government support/ incentives	4.35	1.412	7.80	
LC1	Industry standards	6.06	0.556	15.00	0.359
LC2	Compliance with regulations	6.18	0.809	13.10	
LC3	Liability threats	5.59	1.064	11.37	
LC4	Ensuring legal compliance	5.76	1.2	9.10	
LC5	Reduction in fines	4.65	1.412	7.95	
LC6	Lower risk of liabilities/due diligence	5.41	1.121	13.67	
LC7	Cost of non–compliance	5.06	1.144	8.75	
LC8	Improved relations with regulators	5.76	1.393	9.47	
OP1	Efficient operations	5.53	0.8	13.10	0.317
OP2	Improved quality in product/service	5.24	1.091	9.99	

OP3	Cost savings through process improvements	5.06	1.209	9.62	
OP4	Improve organisational systems	6.06	0.827	11.37	
OP5	Increase in efficiency and productivity	5.24	1.091	11.04	
OP6	Management open to research/criticism	4.76	0.752	9.79	
OP7	Higher productivity	4.59	1.228	9.09	
OP8	Standardised processes	6	0.866	11.14	
OP9	Improved risk management (H&S)	5	1.225	10.29	
OP10	Corporate management	5.47	1.231	9.48	
OP11	Conformity	5.53	0.943	11.14	
OP12	Flexible	4.29	0.849	9.09	
SE1	Better employee morale	4.59	1.228	11.87	0.453
SE2	Employee environmental awareness	5.94	0.748	13.13	
SE3	Employee involvement and collaboration	5.24	0.903	9.74	
SE4	Motivated employees	4.53	0.874	9.32	
SE5	Employee satisfaction	4.35	0.996	8.61	
SE6	Subcontractor relations	4.59	1.604	8.71	
SE7	Involvement of senior management	5.82	0.951	10.39	
SE8	Top management commitment	6.06	0.966	10.88	
SE9	Increasing staff skills	5.41	1.064	9.81	
SE10	Better working conditions	5.06	0.899	10.95	
CS1	Cost reduction	4.65	1.32	7.81	0.099
CS2	Lower insurance costs	4.47	0.8	9.62	
CS3	Cost savings through energy efficiency	5.06	1.029	10.86	
EI1	Reduce resources used	5.47	0.874	11.52	0.249
EI2	Reduced carbon footprint	5.59	0.712	11.87	
EI3	Reduce waste generation at source	5.71	0.772	11.87	
EI4	Save costs related to water use	5.47	0.8	12.05	
EI5	Better environmental information flow	5.59	1.004	10.25	
EI6	Continuous improvement	6.18	0.636	12.61	
EI7	Reduction in pollutants	5.82	0.636	13.33	
EI8	Monitor and measure supplier performance	5.29	0.849	11.87	
EI9	Environmental impact reversal awareness	5.12	0.993	11.52	
EI10	Improved environmental performance	5.94	0.748	14.17	
EI11	Pollution prevention	5.94	0.748	12.24	
EI12	Increase public awareness of environmental issues	4.71	0.985	12.24	
EI13	Reduced env impact	5.94	0.748	14.17	
EI14	Reduced environmental risks	6.12	0.697	13.88	
EI15	Protect the environment	6.06	0.899	12.08	
EI16	Reduce waste generation at source	5.76	0.664	13.67	
EI17	Increased recycling	5.53	0.8	11.14	
EI18	Environmental awareness	6.06	0.827	12.08	
EI19	Desire for certification	5.59	1.176	10.77	
EI20	Reduce emissions	5.65	0.702	13.33	
EI21	Commitment to environmental responsibility	6.24	0.831	10.88	
EI22	Reduce environmental incidents	5.94	0.827	11.68	

Descriptors for the benefit category codes: PR= Public relations; ENV= Business improvements; SOC= Societal impacts; LC= Legal compliance; OP= Improved operations; SE= Staff engagement; CS= Cost savings; and EI= Environmental improvements

These benefits suggest that as systems develop there is more of a focus on the benefits in relation to the external environment in relation to (i) improved relationships with stakeholders [21], which could be a result of the impact of public pressure, (ii) tender requirement [18],[21], where more companies are looking at the impact of the supply chain (iii) community participation [22] (iv) industry standards [18], where there is increasing interest within sectors. Also noted are those areas where there are financial implications, such as: (v) efficient operations [20], which has the potential to increases cost savings, (vii) cost savings through energy efficiency [22] highlight the increasing pressure because of Covid and rises in energy prices. While those factors which focus on the environmental performance with (vi) employee environmental awareness [4], which assists in the running of an EMS, and (viii) improved environmental performance [4],[18] have become more significant again possibly due to an increase in public attention through the media.

4.3 EMS barriers

The experts' responses (after two rounds) to the barrier statements are surmised in Table 3. Again, this includes the weighted average rankings (BIV) for each of the seven categories, which reveals the highest ranked barriers to implementing ISO14001 are: (i) open to public scrutiny, (ii) costs involved, (iii) top management commitment towards implementation (iv) lack of link to EIA, (v) public not interested; (vi) lack of support to assist staff; and (vii) legal compliance.

Table 3: A consensus of the expert responses to the reported barriers of implementing ISO14001 in the AEC sectors

Category code	Reported barriers of implementing ISO14001	Mean	SD	BIV	Kendall's W
PR1	Negative publicity	2.59	1.06	4.75	0.28
PR2	Purely image building	2.76	0.97	5.47	
PR3	Open to public scrutiny	3.06	1.03	5.85	
C1	Cost involved	3.82	1.38	6.68	0.13
C2	Cost may be higher than benefits	3.41	1.70	6.44	
C3	Does not add value	2.82	1.38	6.01	
M1	Top management commitment towards	3.18	1.63	6.01	0.13
M2	Industry not ready	2.47	1.38	4.55	
M3	Setting up management structures required	3.65	1.50	5.47	
E1	Identification of environmental aspect slash impact	3.07	1.62	5.00	0.14
E2	Little improvement in environmental performance	2.87	1.60	5.64	
E3	Lack of link to EIA	3.87	1.25	6.29	
E4	Lack of environmentally sound technology	3.53	1.19	6.01	
E5	No environmental improvements	2.53	1.13	5.50	
OP1	Decreased competitiveness	2.82	1.13	5.23	0.20
OP2	Existing subcontractor system	3.59	1.33	6.34	
OP3	Unsuitable standard	2.88	1.36	4.88	
OP4	Change to existing practises	3.41	1.18	5.38	
OP5	Not required for export	3.47	1.23	7.28	
OP6	Public not interested	3.94	1.09	7.79	
OP7	Lack of resources	4.00	1.17	7.31	
OP8	Disruption to workflow	3.41	1.37	5.69	

OP9	Bureaucratic	3.41	1.54	5.83	
OP10	To increase sales not to improve environment	3.53	1.46	6.74	
OP11	Time	3.94	1.52	6.14	
OP12	Lack of awareness of standard	4.12	1.41	6.44	
OP13	Need for audits	3.53	1.59	5.75	
OP14	Documentation required	3.82	1.51	5.56	
OP15	Can use ISO 9000 to deliver the objectives	3.76	1.52	6.56	
OP16	Uncertainty of the benefits	3.76	1.64	6.48	
OP17	Lack of incentives	4.00	1.62	6.06	
OP18	Relies on peer pressure/manufacturing initiatives	3.35	1.41	5.38	
OP19	No major impact in the sector	3.12	1.50	5.67	
OP20	Lack of guidelines	2.88	1.11	4.80	
OP21	Incompatible sub–contracting system	3.59	1.28	6.01	
OP22	Suppliers and contractors must also improve	4.59	1.33	6.49	
OP23	Competitive pressures	3.59	1.42	6.34	
OP24	Lack of stakeholder support	3.59	1.42	5.87	
OP25	Lack of stakeholder demand or pressure	3.41	1.54	5.38	
OP26	Lack of rigour in the process	3.00	1.17	6.22	
OP27	Focus is on the process not the results	3.53	1.63	5.38	
OP28	Sector is weak in terms of environment	3.53	1.46	5.91	
OP29	Risk low	3.00	1.28	6.50	
OP30	Lack of materials/technology to assist	3.29	1.45	5.93	
EE1	Employee resistance	3.59	1.58	6.02	0.10
EE2	Complexity of the standards	3.53	1.63	5.22	
EE3	Lack of knowledge about ISO 14001	4.24	1.52	6.45	
EE4	Lack of support to assist staff	4.00	1.32	7.21	
EE5	Change is stressful	4.24	1.35	6.83	
EE6	Need for TaylorMade training	4.00	1.50	5.75	
EE7	Lack of experience consultants	3.59	1.77	5.55	
EE8	Lack of experience	3.71	1.61	6.14	
EE9	Lack of expertise	3.76	1.89	5.76	
EE10	Lack of training (general)	3.82	1.67	6.14	
EE11	Lack of knowledge	3.88	1.90	5.85	
LR1	Legal ramifications	2.76	1.35	5.53	0.19
LR2	Legal issues resulting from engagement	2.82	1.47	5.69	
LR3	Legal compliance	2.82	1.43	5.85	
LR4	No mechanical control	2.88	1.22	5.60	

Descriptors for the barrier category codes: PR= Public relations; C= Costs; M= Management; E= Environmental issues; OP= Organisational operations; EE= Employee engagement; and LR= Legal requirements.

A barrier that is now proposed as being important is that of being open to public scrutiny [23], which could be explained in relation to the ease with which information is obtained and negative publicity shared. The new version of ISO 14001 did put a requirement on senior management engagement, so it is understandable that this has now become a more significant barrier to engagement [4]. However, it is interesting how the other barriers have changed from being ones which are more to do with enabling the organisation to implement systems and how these system work as a whole with other projects, such as the linkages to the EIA process [24]. The inclusion of the lack of public interest [24] is a surprise as it is generally thought that there is more interest in the environment at this time however this is viewed as

a barrier by the participants. While training and experience have always been listed as barriers, in this study a lack of support to assist staff [4] was highlighted which of course may include training. (vii) legal compliance [25] is listed as a barrier to engagement, which given it is a necessity is a finding, needs further investigation to ascertain why it is a barrier.

4.4 Delphi engagement

Sample population sizes and response rates are points of debate amongst researchers involved in any studies using surveys. Whilst the suggested sample size of expert participants required for Delphi surveys is much smaller than traditional survey studies, the process of multiple rounds, revisiting the same questions repeatedly can mean participants lack motivation to participate in Delphi studies and it can contribute to a low response rate and drop–out [26]. Anticipating this may become an issue in this study, 41 experts were invited and 15 experts accepted the invite to take part in round one. This sample size (n=15) fitted well with the suggested size of Delphi studies. Further, the response rate to the second round (60%) was comparable to other Dephi studies (e.g. [27]).

As mentioned earlier, the Delphi technique is designed to gain an unbiased consensus through a controlled feedback mechanism [8]; whereby, after each round of the process the participants responses reach tend towards closer agreement. For instance, the Delphi survey by Asah–Kissiedu [27] generated Kendall's W scores of 0.38 after one round and 0.61 after two rounds. Those values indicate a shift in experts' opinions from having a '*fair agreement*' to having a '*good agreement*' [28]. However, in this study, the Kendall's W scores, which reached 0.45 (*moderate agreement*) for one category, remained the same after both rounds because the experts involved in this study mostly maintained their ~~repose~~ses responses between the rounds (except for one participant). This highlights a potential issue with the data collection method because, whilst the purpose of the Delphi process is working towards a consensus amongst the experts, it does not allow for any discussion between experts to permit an explanation for why decisions were made, which could provide important insights in terms of the perspectives of experts [29]. It is possible this issue may be unique to this discipline field (i.e. environmental management) or it could be unique to this particular profile of experts (i.e. senior, experienced professionals) who are steadfast in their opinions and do not respond well to having their judgements queried. However, further study searches and/or additional investigations are necessary to confirm these statements.

The duration and/or length of any questionnaire can influence a participant's decision to engage with a survey or not. In this study, the questionnaire was formed of 145 statements. This may have restricted the participants decisions in choosing not to shift their responses. In other words, rather than re–running the survey and comparing their original responses with the collective responses, it was simply easier and more convenient for them to respond by saying they did not wish to change their opinions. Feedback comments, such as *I don't have time to complete this"* and *"there are too many options"*, support the possibility of this notion.

5 CONCLUSIONS

The study has revealed a consensus of AEC expert opinions on the benefits and barriers of implementing ISO14001 in the AEC sectors. The responses of the experts to the various types/categories, which were originally identified by Horry *et al.* [6], have been ranked to ascertain the main benefits and barriers of implementation. The highest ranked benefits were: (i) improved relationships with stakeholders, (ii) tender requirement, (iii) community participation, (iv) industry standards, (v) efficient operations, (vi) employee environmental

awareness, (vii) cost savings through energy efficiency and (viii) improved environmental performance. The highest ranked barriers were: (i) open to public scrutiny, (ii) costs involved, (iii) top management commitment towards implementation (iv) lack of link to EIA, (v) public not interested; (vi) lack of support to assist staff; and (vii) legal compliance.

Based on these findings, the study has highlighted how priorities appear to be changing in respect of the benefits and barriers of engaging with ISO14001. There is an increasing focus on external issues, in terms of the improved relationships with stakeholders and the need to have ISO14001 for certain tenders. Not forgetting changes in industry standards, which promote engagement. In respect of barriers, except for cost, these seem to have shifted focus too, with greater emphasis on concerns about public scrutiny and the lack of top management commitment, which could be because of the inclusion of this requirement in the 2015 version of the ISO14001 system. Similarly, another barrier that has emerged is legal compliance, which has traditionally been seen as a benefit but has now come forth as a barrier. These shifts are something that requires further investigation to ascertain the reasons for these changes in perspective in relation to the EMS, and whether this is influenced by the length of time that organisations have held ISO14001.

Whilst Delphi studies have been acknowledged as useful instruments when ascertaining a consensus, the study has highlighted several engagement issues, namely: the type of discipline, the seniority of the participant profiles and the duration/size of the survey may all be factors which influence participant decisions to take part or re–engage in subsequent rounds of the Delphi study.

To delve deeper and further understand the benefits and barriers of implementing ISO14001 in the AEC sectors, it is proposed that future investigations should examine the personal 'lived–experiences' of those persons with direct responsibility for overseeing and implementing EMSs in AEC organisations. Adopting a phenomenological approach, using semi–structured interviews, could provide a useful means of uncovering what is fundamental for improving uptake across the AEC sector and why discipline experts in this field seem fixed in their opinions.

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