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Abstract:	In this paper we briefly review the state of academic research in the UK in the field of Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA). Through consideration of the number of articles related to EIA and SEA published in academic journals and the contribution of post-graduate students' (PhD and master level) dissertation theses we aim to understand where activity has occurred in the field over recent decades. Simple literature and database searches reveal that the UK is an active environment for researchers and students in the field with numerous universities engaged in research and teaching (although not always both activities). However, we have also collected evidence to suggest that research funding is lacking and that there is variation over time in the number and scale of research projects being funded in the UK.
Response to Reviewers:	We are grateful for the reviewer comments and have revised the manuscript accordingly. Primarily adding suitable references to provide examples and evidence for the points made.

Environmental Impact Assessment and Strategic Environmental Assessment Research in the UK

Abstract

In this paper we briefly review the state of academic research in the UK in the field of Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA). Through consideration of the number of articles related to EIA and SEA published in academic journals and the contribution of post-graduate students' (PhD and master level) dissertation theses we aim to understand where activity has occurred in the field over recent decades. Simple literature and database searches reveal that the UK is an active environment for researchers and students in the field with numerous universities engaged in research and teaching (although not always both activities). However, we have also collected evidence to suggest that research funding is lacking and that there is variation over time in the number and scale of research projects being funded in the UK.

Introduction

In the UK, Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA, including Sustainability Appraisal – SA) are slowly developing into an 'Environmental Assessment' (EA) profession/discipline. This is driven in part by the EIA/SEA 'industry' (i.e. consultancies conducting assessments and preparing documentation) and the Institute of Environmental Management and Assessment (IEMA) which in 2014 had about 15,000 members and which is actively engaged in the process of drawing up professional standards, including the voluntary accreditation scheme 'EIA quality mark' (Fischer and Fothergill, 2015) and certified training. Furthermore, there is an active, albeit small, associated research community based in several universities (which in the UK are quasi-privatised) and some private consultancies. With regards to research, since the 1980s, there have been various EIA/SEA projects, also including PhD dissertations. There are many associated taught degree programmes at the post-graduate level. These are mostly connected with subjects of wider environmental management and are offered in about 52 UK higher education institutions (Jha-Thakur et al, 2013).

Whilst there is therefore a reasonably sized academic body teaching on the topic, there are few researchers that have made EIA/SEA their main area of research interest, despite the numerous associated doctoral research projects in many universities (see below). Most of the research active scholars (judging from research funding and outputs) are currently based in four institutions, the University of East Anglia, Oxford Brookes University, Imperial College London and the University of Liverpool. Other universities with at least some related research activity include Strathclyde, Dundee, Newcastle and Manchester. These institutions usually do not have more than one to two or

a maximum of three permanent academic members of staff plus temporary research staff. However, looking at the situation in other countries (e.g. the Netherlands, Canada, Sweden and Germany) these numbers appear to be normal, rather than exceptional, for EIA/SEA research.

Extent of EIA/SEA research outputs – a scopus review

In order to say anything meaningful regarding research outputs, it is important to clarify first what we mean by EIA/SEA as terminology is used differently in different disciplines. Apart from the ex-ante, procedural and participatory environmental management policy, plan, programme and project decision support tool we are writing about here, the term EIA is also used by environmental scientists and engineers in a different way. A scopus database (the biggest academic research output on-line database) search, using 'strategic environmental assessment' and 'environmental impact assessment' as search terms for the period 1994 until today, for example, in mid January 2015 resulted in over 21,000 hits. Journals with the largest number of publications (together making up about 11% of all outputs) include 'Science of the Total Environment', 'Environmental Monitoring and Assessment' and 'Environmental Science and Technology'. However, most of the associated publications do not deal with the decision support instrument EIA, but rather focus on environmental science and related auditing (Reflected in the titles of papers, such as 'Comparison of produced water toxicity to arctic and temperate species'; Camus et al, 2015) and engineering (e.g. 'Environmental impact assessment of hydrometallurgical processes for metal recovery from WEEE residues using a portable prototype plant'; Rocchetti et al, 2013). Whilst these publications may include information which could potentially feed into a specific EIA or SEA process, we do not see them as being integral parts of the emerging EA discipline we are focusing on here¹.

We estimate that about 19,000 scopus hits fall within environmental science and engineering, leaving only 2,000 (or about 10%) being from the EIA/SEA ex-ante environmental management decision support instrument community. This is supported when limiting the search to the three main journals of that community, namely Environmental Impact Assessment Review, Impact Assessment and Project Appraisal and the Journal of Environmental Assessment Policy and Management (which, according to Fischer and Onyango, 2012, publish about 50% of all related papers), which results in 1,056 hits. Around 20 other journals occasionally publish papers on the subject (including e.g. 'Journal of Environmental Management', 'Environmental Management', 'Journal of Environmental Policy and Planning' and others). Of those 1,056 publications, over 21%

¹ Not being clear about what is focused on in a database search can result in gross misrepresentations, as recently happened in e.g. Li and Zhao (2015) who claimed to have identified over 100,000 key EIA and SEA publications, but which for the most part were actually papers from environmental science, technology and engineering.

are from UK based authors, followed by Canadian (12%), US (10%), Australian (10%), Dutch (6%) and South African (4%) authors². This means about one fifth of all associated papers in the international English language literature are from UK authors, i.e. UK research in the area is very visible internationally.

Of UK authors' papers, 40% were specifically dealing with EIA, 28% with SEA and about 10% with SA. About another 10% of the papers were dealing with impact assessment in general and then there were more papers looking at EIA/SEA through the lense of social impact assessment, health impact assessment, biodiversity impact assessment and others. There was a change of focus over time with EIA featuring more extensively over the first decade (i.e. from 1995 to 2004) and SEA more extensively over the second (2005 to 2014) decade. Nearly 20% of the papers were more conceptual or theory based (e.g. Chanchitpricha and Bond, 2013; Fischer, 2003; Weston, 2011) and about 10% were explicitly dealing with aspects of effectiveness (e.g. Arts et al, 2012; Eales and Sheate, 2011). Although few of those were looking at effectiveness based on empirical research findings. Nearly half of the papers included some systematic practice reviews, e.g. reporting on the quality of environmental statements (making up 10% of the entire set of publications) or the quality of assessment procedures (e.g. Fischer, 2010; Bonde and Cherp, 2000). In this context, spatial/land use (e.g. Therivel, 2013), infrastructure (transport related; e.g. Fischer, 2006; 2005) and energy (e.g. Philip-Jones and Fischer, 2013; Marshall and Fischer, 2006) were the most widely covered areas. Other areas covered included planning in developing countries (e.g. Nadeem and Fischer, 2009), waste management (e.g. Fischer et al, 2011), mining (e.g. Jha-Thakur et al, 2009), tourism (Lemos et al, 2012), events (Pereira et al, 2014) and resource management (Jackson and Dixon, 2006). The latter three were only explicitly addressed in one dedicated paper for each. The SEA Directive was the main focus in about 5% of all papers. Publications reflect an international outlook, with 33 countries being covered in them next to the UK. Public participation was the main focus in 8% of all papers (e.g. Bond et al, 2004). Other themes covered in over 2% of the publications (equivalent to at least 5 papers) included GIS/scale and data issues (e.g. Riddlesden et al, 2012), health (e.g. Fischer et al, 2010), cumulative effects (e.g. Bragagnolo et al, 2012), legal aspects (e.g. Therivel, 2013), methods overviews (e.g. Perdicoulis and Glasson, 2012), climate change (e.g. Wende et al, 2012), flooding (e.g. Hayes et al, 2014), disaster management (e.g. Tajima et al, 2014), policy (e.g. Axelsson et al, 2012), and follow-up/monitoring (e.g. Hanusch and Glasson, 2009; Gachechiladze-Bozhesku and Fischer, 2012).

² Looking at all 21,354 scopus hits, this is distinctly different, with US authors leading the list (22%), followed by UK (11%), Chinese (7%), Canadian (6%) and German (6%) authors.

Agriculture/forestry, private sector/industry, development of guidance, learning through EIA/SEA, associated higher education and offshore EIA/SEA were the main focus of between 1% and 2% of the papers (e.g. Jay, 2007; Fischer, 2006a). Aspects that are currently the main focus in only about 1% or less of the publications (which usually means one or two papers) include transboundary EIA/SEA, cultural aspects in EIA/SEA, environmental governance, environmental justice, specific methodological aspects, such as screening, scoping, determination of impact significance, generation of baseline data, use of indicators, mitigation and conference reports (eg. Weston, 2011; Jones and Slinn, 2008; Fischer, 2006b; Wood et al, 2006).

Numerous papers mentioned good practice cases with regards to different aspects, including e.g. quality of documentation, public input, impact on decision making, innovative methodological approaches and others (see references provided above). Furthermore, comparative studies, for example comparing different systems or sectors, also featured heavily. Overall, there is a good link with both practice and theoretical aspects. However, to date no overarching EIA/SEA theory as such has been developed. We were also somewhat surprised to find a rather low number of publications on legal issues as well as specific methodological aspects.

EIA/SEA PhD research projects and M level dissertations

To understand more about the volume of PhD research being carried out on environmental assessment related instruments in the UK, the British Library e-theses online service (EThOS) was used as a starting point. Searching EThOS for PhD theses which include the phrases 'EIA', 'SEA', 'SA' (Appraisal and Assessment) in their abstracts produced 145 results with entries from 1981 to 2014. Limiting the search to include only those theses that specifically include the search terms in their abstracts provided a more select list of theses which are directly focused on such instruments, producing 80 results from 1989 to 2014. Going through this list of theses, we found some dissertations that could not be considered as belonging to the emerging EA discipline, but were again environmental science/engineering related. Overall, about 65 PhD theses remained. Checks of repositories of several universities show that a substantial number of related theses are currently not actually listed in the British Library system and it is safe to assume that the actual number is at least 100. Most PhD dissertations result in other publications, usually book chapters and articles in refereed journals, few PhD dissertations are published as books by international publishers (see e.g. Marr, 1997; Fischer, 2002).

With regards to master level dissertations, it is even more difficult to provide for any reliable estimation of the number of outputs produced. Few institutions keep records on dissertations for

specific themes, however, with access to the University of Liverpool records we can see that over the last decade (2004 – 2014) 28 master students undertook dissertations related to EIA or SEA. More generally, judging from the number of students going through the over 50 UK degree programmes every year (although not all of them would necessarily prepare a dissertation on SEA/EIA) and if it were possible to include records of dissertations since the 1980s (e.g. from UEA, Aberystwyth, Liverpool and Manchester), this is likely to be several thousand dissertations. However, few master level dissertations result in academic publications (Discussed further in the next section). Examples for master dissertation based publications include; Therivel et al (2009) and Gore and Fischer (2014).

EIA/SEA related Master Level Programmes and their implications on research outputs

The number of EIA/SEA related master programmes in the UK has been steadily increasing. Based on an internet survey conducted during European Union funded projects of PENTA³ and its follow-up project T_{wo}EA-M⁴, the number of EIA/SEA related master level programmes taught in the UK was 15 in 2007 and 31 in 2009. However, in the case of the latter, EA(M) (Environmental Assessment and Management) related master level programmes were taken into consideration. It was further noted that the UK accounted for about a third of all EAM related programmes across the 27 EU member states (Fischer and Jha-Thakur, 2013). Based on a recent survey⁵ and dedicated only to EAM related programmes within the UK, this number has now increased to 52 (Jha-Thakur et al, 2013). Therefore, the UK is very visible with regards to EIA/SEA related higher education programmes. However, a majority of these focus more on management, including a strong scientific component. This echoes what has been observed in terms of research publications described above. Of the 52 programmes, 45 were MSc programmes.

Lack of publications from higher education students within the emerging discipline of EIA/SEA may be related to two aspects; (a) the student composition of these programmes, and (b) the length of master level degree programmes, which in the UK for a full time degree is one year only. The 2013 study surveyed the course directors of these programmes and received a response rate of 28%.

³ PENTA (Promotion of European Education on Environmental Assessment for Third Country Audience) was initiated by a consortium of three institutions, led by the University of Technology Bratislava (Slovakia) and joined by the University of Liverpool (UK) and the Austrian Institute for the Development of Environmental Assessment (An!dea). PENTA is financed by the European Commission's Erasmus Mundus programme.

⁴ T_{wo}EA-M was a follow-up project from PENTA (see twoeam-eu.net). It was initiated by the same three institutions and led by University of Liverpool. The project's life span was from 1st December 2008 until 1st December 2010.

⁵ This study was titled 'Enhancing Attractiveness and Relevance of Environmental Assessment and Management related Higher Education in the UK' and was funded by the Liverpool University Knowledge-Exchange Scheme and was carried out in early 2013 in collaboration with the Environment Agency and the Planning and Design consultancy BDP.

Survey results revealed that in the represented sample of the 15 courses, over a 5-year period (2008-2013), 501 students were UK and 495 were international students. 21% of the international students were Chinese and 28% other Asian students. The one year master level programmes do not usually provide enough time for empirical research which would be sufficient for publication in refereed journals. Also, many students are simply not interested in publishing papers, as their main career destination was environmental consultancies, followed by the public sector. Least common destinations were research, academia and non-governmental organisations. 39 degree programmes have accreditation either from IEMA or the Royal Town Planning Institute (RTPI) and this trend appears to be accelerating further.

Barriers and enablers to researching EA more extensively in the UK

There are currently important barriers for researching EA more extensively in the UK. To start with, the current conservative-liberal democrat government is not showing any interest in the development of EIA and SEA. As a consequence, guidance documents have not been updated for many years and there have not been any initiatives on any related aspects, neither the support of research, nor the development of inventories, advice or capacity building activities. If anything, EIA and SEA are to be scaled down, in line with the so-called 'cutting-red tape' objective of the current government. At the national level, the development of EIA/SEA is thus largely left to IEMA, with the Environment Agency also taking an interest in the development of the instrument. Furthermore, the devolved government of Scotland has shown a keen interest; developing a dedicated EA team, national guidance and a SEA database to co-ordinate and maintain a repository of Scottish practice. It is therefore a key enabler of EIA and SEA research in Scotland.

Secondly, it remains difficult to obtain research funding for EIA/SEA projects through national research funding bodies (RCUK). Only four completed research projects on EIA and three on SEA were identified on the database (covering projects since the 1980s) of the Economic and Social Research Council (ESRC), valuing about £450,000 in total. Institutions that obtained funding include the University of Manchester, Oxford Brookes University, the London School of Economics and the University of Liverpool. The latter having the only project conducted over the last decade ('Developing the learning potential of appraisal in spatial planning'; see Jha-Thakur et al, 2012). Also, a collaborative seminar of UK and Japanese EA researchers and practitioners in the area of disaster management was recently supported (see Tajima et al, 2014). In addition to those projects, the ESRC has funded a range of PhDs in the area, but the exact number of those is unknown. In addition to research council funded projects, there have also been occasional small projects supported by other UK funders such as the British Academy (e.g. the University of Liverpool project on comparing UK

and Chinese SEA practices), as well as small university project funds. Over the past 20 years, the UK has also featured in projects supported by European funders, including the two above mentioned research projects on EA higher education, funded through Erasmus Mundus, PENTA and T_{wo}EA-M (University of Liverpool); two EU Fifth Framework Research (FP5) Programme projects, including 'Analytical SEA' – ANSEA (UK partner ERM) and 'Building Environmental Assessment Consensus on the Trans-European Networks' – BEACON (various UK sub-contractors); and a recent Seventh Framework Programme project 'Linking Impact Assessment Instruments to Sustainability Expertise' - LIAISE (University of East Anglia).

However, overall, and considering both the extent of practice and higher education teaching, research funding, in particular National Research Council related, has clearly remained low. One reason is that those judging research proposals mostly come from more established disciplines, such as Geography, Policy Analysis and Planning. These perhaps give preference to more disciplinary research (in particular in times of tightening research budgets) and often engage little in 'practice-based' research, which is at the heart of most EIA/SEA projects.

Conclusions and Outlook

EIA and SEA research from the UK is very visible internationally with a quarter of all publications in international English language journals being associated with UK authors. However, considering the amount of EIA and SEA practice in the country (following IEMA, 2011 and Therivel and Fischer, 2012, about 800 EIAs are completed every year and authorities are involved in up to 1,000 SEAs at any one point in time) and the number of master and doctoral level dissertations, related research endeavours remain underdeveloped. In order to make EIA and SEA a topic that academic researchers consider worthwhile pursuing in the UK there is a need to develop a more robust EIA and SEA theory. This should be connected with more evidence-based, empirical research. In this context, research should focus on the benefits arising from EIA and SEA, and considering the costs of conducting EIA and SEA. Furthermore, there is a need to look at the factors that make EIA and SEA effective tools for supporting a more sustainable development. Finally, more research on legal and specific methodological aspects (e.g. methods for scoping or selection of suitable alternatives) is needed.

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