

The Economic Cost of Attending Educational Conferences

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Abstract: Conference attendance and presentation are ubiquitous practices across international academic, scientific and professional communities. However, their financial costs and implications have been little studied. Through an empirical analysis of a UK educational conference over three years (N=1,261), this paper examines the financial cost elements of fees, travel, accommodation and financial support that are common to international conference delegates. The findings show significant individual expenditures for both domestic and international delegates. When extrapolated to published global researcher populations, these costs indicate a multi-billion expenditure. However, this is balanced against issues of environmental impact that were raised in the study, and a reported climate of ‘lost conference research’ where conference presentations are not developed into accessible published work. The article concludes that in the face of such expenditures and negative impacts, concerted efforts are required to make conference attendance an objectively sustainable educational activity, especially in terms of fiscal and knowledge economies.

Keywords: Conferences, Efficiency, Economic impact, Return on investment, Scientific communication

Introduction

Conferences are a common part of academic, scientific and professional (ASP hereafter) practice. Evidence of their use can be seen across all of the major academic disciplines, as well as in the activities of learned societies and associations (Rowe, 2017a, 2018a). Conference presentations are used to disseminate research and information, and afford delegates with the opportunity to make an active contribution to the events they attend (Rowe 2018a, p. 718). In terms of numbers, conference presentations have been conservatively estimated to exceed peer-reviewed journal articles by some 80% (Rowe 2018b, p. 50), thus making conference presentations the major medium of scientific communication across the ASP spectrum. However, as an activity of continuing education and development, conferences have not been granted particular attention in educational studies. In the 19th century, universities increasingly provided events for disseminating information within academic circles, and during the 20th century, trade and industry began to invest heavily in meetings, hosting events aimed to develop staff and sales (Rogers, 2008; Shone, 2009). At both trade and academic meetings, established and trainee delegates get together to share information, interact, and discuss matters of professional interest (see Rowe 2017a for an in-depth discussion). As such, conferences have become an integral part of Higher Education (HE) practice in terms of knowledge exchange, professional formation and the continued professional education activities of the ASP sector. Conferences have mainly been studied by the ‘MICE’ Industry (Meetings, Incentives, Conference and Exhibition/Event), however ASP conferences are poorly differentiated from other meeting and event types. Breiter and Milman (2006) found that no specified user-group studies had been conducted by the MICE sector, and despite conference outputs (i.e. conference papers and abstracts) being widely spread throughout the multi-disciplinary literature, in the education discipline there appears to be no clear distinction of conferences as a unique field of learning. When viewing the MICE literature, ‘education’ is seen as the most prominently expressed motivation for attending conferences, and ASP conference events are held to facilitate knowledge exchange and networking amongst delegates (see Rittichainuwat, Beck, & Lalopa, 2001; Severt, Fjelstul, & Breiter, 2007; Huang, Davison, & Gu, 2008; Yoo & Chon, 2008; Severt, Fjelstul, & Breiter, 2009; Kim, Lee, & Kim, 2011; Neves, Lavis, & Ranson, 2012; Lee & Min, 2013; Kordts Freudinger, Al Kabbani, & Schaper, 2017).

Given the widespread presence of conferences and their lack of collated reporting, it is not possible to quantify the number of conference attendees or presenters in any reliable way. These numbers are likely to be considerable, and conference attendance involves costs that are common to all delegates. However, the cost of conference attendance has not been examined in any depth in mainstream literature, despite the MICE industry literature being mainly economically oriented. Educationally-oriented meetings covered by the MICE industry may be included in conventions, congresses and membership organizations (PWC, 2014), professional associations and institutions, societies, and educational and academic groups (UKCAMS, 2016), non-corporate

meetings (ECM, 2012), or simply within meetings and conventions (BECA, 2015). This mixture of meeting types makes it difficult to separate ASP conferences from other forms of meetings. Additionally, when describing levels of conference performance and return, the MICE Industry tends to refer to venue types or corporate/non-corporate/association hosts, and not any value which relates directly to their client base. As such, this leads to economic value-based reporting, and the annual direct spending figures reported for meetings are incredible: The UK reports a £19.2 billion economic contribution, with 1.34 million events (UKCAMS, 2016); Australia \$A 28 billion with 412,004 events (BECA, 2015); Canada \$C 32.2 billion with 671,000 events (MPIFC, 2006); and Denmark DKK 20.8 billion with 187,900 events (VisitDenmark, 2012). However, far out in front is the USA with an annual direct spending of over \$US 280 billion and 1.83 million events (PWC, 2014), exceeding even those generated by the U.S. automotive, film, or media communications industries (Kovaleski, 2011). However, whilst it is easy to envisage the expenditure of ASP sector delegates as being substantial, no research has been undertaken to explore this issue.

This study sets out to determine the main delegate costs of conference attendance on an individual level, taking into account conference fees, accommodation, travel and paid support, relating to domestic and international delegates. By way of extrapolating the findings to published data, it also projects economic implications at national, regional and global levels.

Methodology

The Society for Research into Higher Education conference was selected for analysis, as representative of a mid- to large-scale education conference with domestic and international delegates. Events were studied for 2015, 2016 and 2017. Anonymised delegate demographics were obtained from the conference organizers, detailing their home institution and country of origin. No further data was required.

Travel

For travel estimations, the return road mileage of domestic delegates was measured from their institutional location to the conference location using an online facility. Domestic delegates were classed as having their parent institution based in the UK. Those based in Northern Ireland were included as domestic delegates, but for travel estimations, they were treated as having flown to mainland UK, then travelled to their destination by road. International delegates were assumed to have flown directly to the UK, then travelled to the event by road. For standardisation, their return air route was measured from their home institution directly to London Heathrow (as a central internationally accessible hub), and measured using the same online facility. It was acknowledged that delegates may have used alternative forms of transport and routes to travel from the airport to the event venue (e.g. bus or train), but without individual contact and in-depth analysis, any individual analysis was not considered to be a practical undertaking. Additionally, the conference facility was located in an area that required the use of taxis to transport delegates from a train/bus terminus, and the venue was not directly accessible from the nearest regional airport. Additional expenses such as the conference dinner, additional nights' accommodation, and accompanying persons were also not accounted for.

Reimbursement

To establish travel reimbursement rates, random UK university websites were studied to access their reimbursement policies. In total, 21 university policies were accessed which showed their road travel reimbursement rate (Figure 1). All were publicly available. The amount of reimbursement was fairly consistent, with an average of £0.43 per mile. A standard deviation of 0.04 showed this sample to be sufficiently representative of national practices, however, a more conservative level of £0.40 was chosen due to the relatively small size of the sample. All of the published rates were current during the surveyed period.

It was acknowledged that international delegates will have used different airlines and routes to reach the event, and thus have incurred different costs. But, again, without individual contact and in-depth analysis, it was neither possible nor practical to establish exact costs. Especially, any precise records of costs, discounts etc. would be unlikely to be retrieved or confirmed on a reliable and consistent level. To address the situation, the air fare cost per mile model produced by Cameron (2013) was used to calculate the journey cost. The model encompasses 1,780,832 price points, and groups airfares by distance and selects the 20th percentile fare for each distance (where 20% of fares are less, and 80% are more). Notably, the model shows a relatively linear

relationship between distance and fare, and offers the formula of $\$50 + (\text{Distance} * \$0.11)$ for airfare calculation. However, it was acknowledged that the model was produced in 2013, and that air fares would have changed in the interim period. To adjust for this, published fluctuations in pricing (Statista, 2018a) between 2013 and 2017 were accounted for, and a 7% increase adjustment was made to the 3-year average.

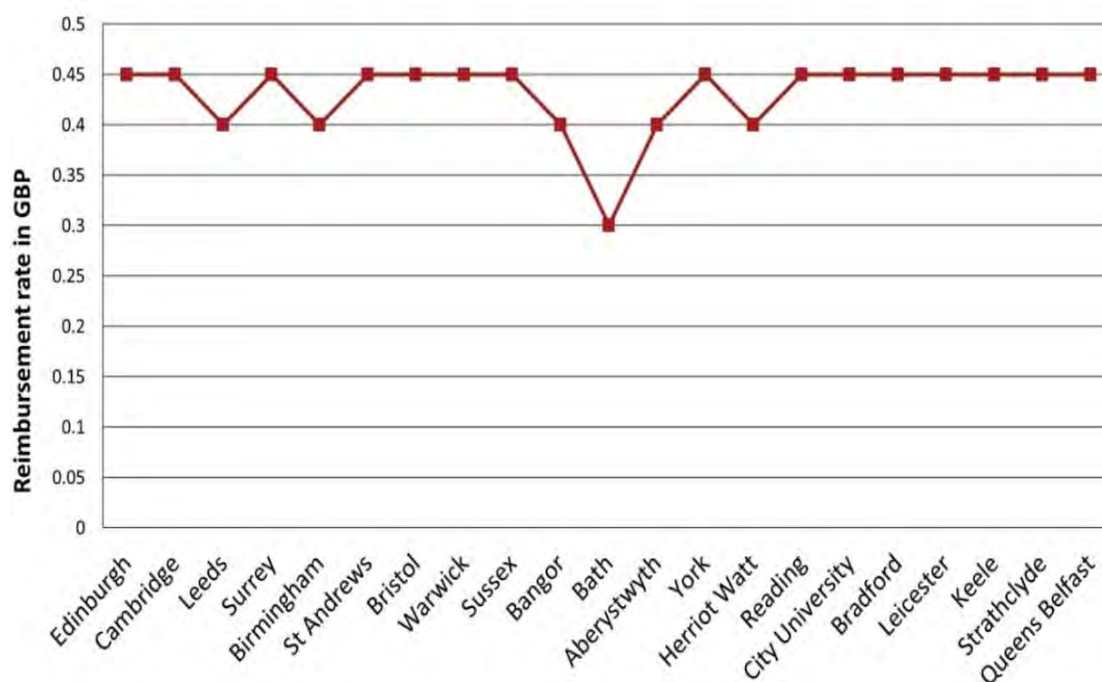


Figure 1. Road Travel Reimbursement Rates Taken from UK Universities 2015–2017

Conference Fees and Accommodation

Conference fees varied, with member / non-member rates, and discounts for early registration. For convenience, an average was taken from the member / non-member rates published on-line for each year. Due to the location of the event and the low numbers of ‘local’ delegates (living less than 50 miles from the venue), it was taken that the majority of delegates would adopt the residential package which included accommodation, as opposed to seek alternative accommodation that entailed further travel.

Paid Support / Funding

It was envisaged that conference delegates would have received some form of paid support relating to their conference attendance. This could take various forms, such as supplemental funding to attend the event, or waged time either to prepare work for the event or covering the time spent at the event itself. It is also common to access conference funding from established research budgets provided by public and private enterprises, justified with an aim of disseminating research results among peer-communities.

However, ascertaining levels of support on an individual basis was again deemed practically impossible, especially given the potential national and individual variations in attendee demographics and payment arrangements. To address the situation, an average of the UK HE single pay spine (UCU, 2018) was used to represent the salary of educators for the mid-point of the study period (2016), together with published rates of UK student payment (Bangor University, 2017), and the pay range for professorial appointments published in a mid-point UK job advertisement (Heriot-Watt University, 2016). Thus, conference delegates ranging from student, academic and professional backgrounds were accounted for. The conference itself spread over 2.5 days, however further time would be needed for arranging attendance, travel, and the preparation of any work presented. Accordingly, an average rate of £23.86/h over a single 37.5 UK working week was applied, and deemed sufficiently conservative to account for any differences between individual delegates.

Results

The 3-year study yielded a sample of 1,261 delegates, averaging 420 delegates per event. Of these, 899 (300 av. – 71.3%) were classed as ‘domestic’ stemming from the UK, and 360 (127 av. – 28.6%) were classed as ‘international’ stemming from outside the UK. The overall average presentation rate was 68% (see Table 1). Domestic delegates travelled an average of 318 miles per delegate at a remunerated cost of £127 per delegate. An average event entailed 95,305 miles of domestic travel, at a cost of £38,122. International delegates travelled an average of 7,032 miles by air at an average cost of £674 per delegate. Combined, an average event entailed 925,597 miles of international air/road travel, at a cost of £98,556, averaging £776 per international delegate (Table 1).

Table 1. SRHE Conference Demographics, travel Calculations and Costing

	SRHE Annual Research Conference (N=1,261)			
Conference Demographics				
	2015	2016	2017	<u>3 year average</u>
Total Delegates (N = 1,261)	443	392	426	420
Domestic Delegates (n = 899)	317 (72%)	271 (69%)	311 (73%)	300 (71.3%)
International Delegates (n = 360)	126 (28%)	121 (31%)	113 (27%)	127 (28.6%)
Presentation Rate	54%	62%	88%	68%
Travel				
Domestic Road Miles (home institution > venue return)	98,004	89,912	97,998	95,305 miles (153,378 km) (318 miles av/dom. del.)
Domestic Travel Cost (national reimbursement rate £0.40/mile)	£39,202	£35,965	£38,199	£38,122
Av. Travel Cost per Domestic Delegate	<i>£123.66</i>	<i>£132.71</i>	<i>£126.04</i>	£127.07
International Road Miles (LHR > venue return)	34,000	31,986	31,552	32,513 miles (52,325 km) (256 miles av/int. del.)
International Road Cost (host national reimbursement rate £0.40/mile)	£13,600	£12,794	£12,621	£13,005
International Flight Miles (home institution > LHR return)	912,236	870,740	896,276	893,084 miles (1,437,279 km) (7,032 miles av/int. del.)
International Flight Cost (total) (Fare = \$50 + \$0.11 per mile) + 7% adjustment for reported fare increases 2013–2017	(\$114,111) £87,448	(\$108,960) £83,725	(\$111,537) £85,480	\$111,536 £85,551
International Travel Cost	£101,048	£96,519	£98,101	£98,556 \$128,611 €111,741
Av. Travel Cost per International Delegate				£776.03 \$1,012.69 €879.76
Carbon Footprint In 2016, an average EU citizen produced on average 8.7t CO ₂ each year (0.0238t/day). Attending this 2.5 day conference raised the individual carbon footprint by more than <u>6.70 times</u> the normal daily level of production.				
Travel CO₂ production per Domestic delegate (myclimate.org: medium petrol car)				52.3 t > 0.1743 / dom. del.
Travel CO₂ production per International delegate (myclimate.org: medium petrol car) + (BlueSkyModel: 0.24 pounds of CO ₂ per passenger per air mile)				17.9 t (road) + 97.2064 t (air) = 0.9063 / int. del.
Travel CO₂ production for a 420 delegate conference / 2.5 days				167.4064 t 0.3986 / av. del.

Discussion and Implications

The findings of this study represent the cost implications of an annual UK higher education conference, taking into account the measured expenditures of 1,261 delegates over a 3-year period. The events were relatively consistent in terms of delegate numbers and their domestic/international distribution. Practical measures have been taken to ensure consistent measurement across the study period, and adjustments have been made to ensure the calculations reflect current-day circumstances. As described in the introduction to this study, conferences differ greatly in size, type and discipline. At time of writing, the 10times conference website advertises 771 upcoming education and training conferences in the UK, Conal Conference Alerts lists 200 higher education conferences worldwide, PaperCrowd lists 625 conferences for education, etc. When broadened to include disciplines outside education, the broad use of conferences as a scientific communication platform becomes immeasurable. Education conferences can be small local events with less than 50 attendees, to ‘mega events’ that attract thousands; an example of which is the American Educational Research Association Meeting (2017) which had 15,200 attendees and 11,704 presentations. Because of the widespread distribution of HE conferences and their lack of collated reporting, it is not possible to place the studied event in terms of representational size.

The conference fee was found to be commensurate with the returns of a random web search for ‘UK conference fees’ (n=100: see Figure 2). In the sample, the average conference duration was seen to be 2.73 days - similar to the SEHE event studied. Elsewhere, the average number of days for conference events is reported as 3 (U.S.A.), 2.9 (France and Spain, Belgium and the Netherlands), 2.8 (Europe), 2.7 (UK), and 2.4 (Denmark and Sweden) (Statista 2018b). The average lowest discount fee seen in the UK sample was £251.62, and full cost fee £472.85. The overall average UK fee was £362.24 (£133 per day), and this compared well with the SRHE event fee of £325.25 (£130 per day) once the accommodation element had been deducted.

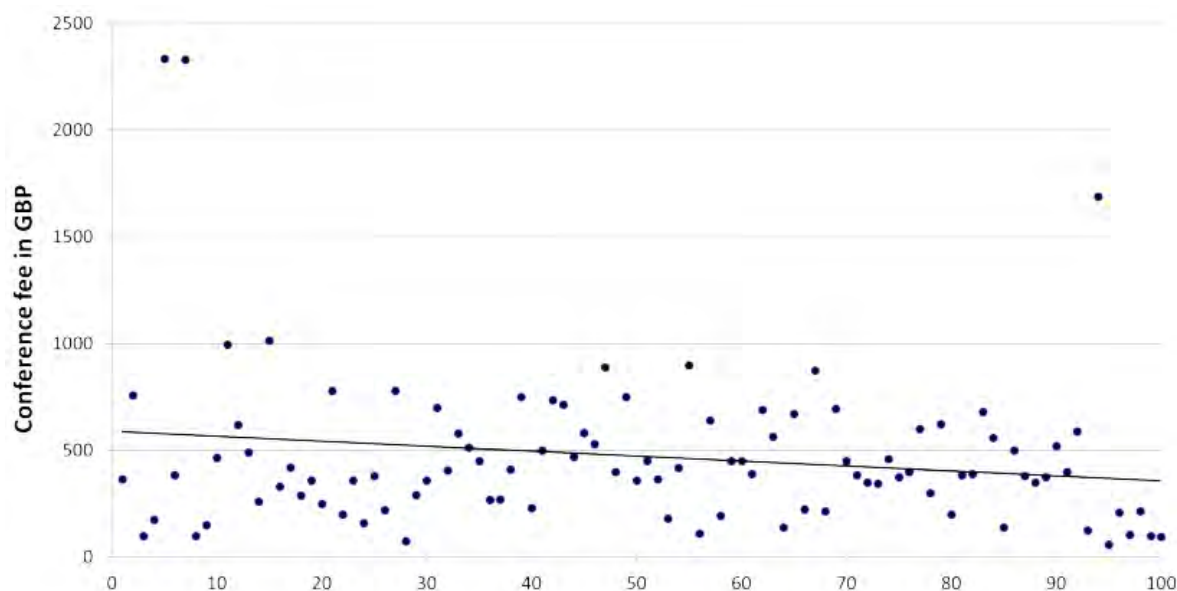


Figure 2. Random UK Sample of 100 Conference Fees – 2016/2017

Accommodation costs for this event were extracted from the registration package, at a rate of £87.50 per night, and fell close to the 2015 average UK hotel price of £74.60 / \$97.45 (Hutchinson 2016). On a global level, the 2017 daily rates of hotel accommodation (in US dollars) were \$100.57 – Asia; \$118.23 – Europe; \$126.43 – Americas; \$140.94 – Middle East / Africa (Statista 2018c).

The cost findings of this study are presented at an individual level, and the analysis approach can be internationally replicated using comparable data. However, the importance of these findings becomes more apparent when they are applied to other events and wider contexts. Firstly, if applied to the American Educational Research Association Meeting detailed earlier, the average of £1,763 per delegate would amount to an incredible £26,797,600 (\$34,931,243 / €30,383,068) in delegate cost expenditure for this single meeting. Of course, there will be differences in delegate demographics at every event, but even allowing for a narrow confidence interval, the resulting costs are likely to be economically significant. Thus, a more meaningful use of these figures is to extrapolate them to a wider level, and gain an insight into the implications of this study for national, regional and global economies.

Extrapolating the Findings

It is possible to get an idea of how much investment goes into conference attendance by looking at who is likely to host conferences worldwide, how frequently these might be held, and then apply the findings of this study. However, as there is no collated reporting of conferences on national or international levels to provide this information, it is necessary to predict wider cost estimations by extrapolating the findings of this study to other source data. The Cybermetrics Lab of the *Consejo Superior de Investigaciones Científicas* has compiled a detailed listing of global academic institutions in its Webometrics Ranking of World Universities (CSIC, 2018). They currently list 28,077 individual universities and institutions of higher education from 212 countries, derived from their presence on the web. The geographical spread of the registered universities is represented in Table 2 (overall global percentage shares shown in brackets). Most of these academic institutions can be envisaged to organise at least one conference per year. Many of the larger university faculties will in fact hold individual conferences of their own, so this additional activity is anticipated (in terms of our estimations) to compensate for institutions with a lesser conference activity. As a qualification for this assumption, freedom of information requests to Oxford and Cambridge universities (personal communications) revealed that they held between 300-600 conferences each year, with anything from 50 to more than 1000 delegates. Thus, the allowance for a single conference per HEI is seen as an absolute minimum estimation marker, and actual numbers are liable to be considerably higher, even if some of the institutions hold no conferences at all. Conference size is also an inconsistent variable, but the Convention Industry Council (PWC, 2014, p. 2) report 273,700 conventions, conferences and congresses being held in 2012 with 60.96 million attendees, so this yields an average attendance of 223 delegates. In relation to the countries that have published reports on the economic contribution of their conference sectors: according to the CSIC database (2018), the UK hosts 280 HEIs ^{1%} of world total, USA, 3257 ^{11.6%}, Canada, 355 ^{1.3%}, Australia, 188 ^{0.7%}, and Denmark, 76 ^{0.3%}.

Table 2. Geographical Spread of Higher Education Institutions

North America ^(16.1%)	4529	Asia ^(46.6%)	13090
USA ^(11.6%)	3257	Middle East ^(4.9%)	1369
Canada ^(1.3%)	355	South Asia ^(16%)	4495
		South East Asia ^(11.2%)	3145
Latin America ^(13.3%)	3724	Oceania ^(8.1%)	2267
Central America and Caribbean ^(10.2%)	2874		
Europe ^(30%)	5892	Africa ^(6%)	1687
European Union ^(12.8%)	3583	North Africa ^(2.1%)	594
Cen. and Eastern Europe ^(10.3%)	2894	Sub-Saharan Africa ^(3.9%)	1101

Aside from higher education institutions, associations and learned/professional societies are also major conference organizers. The World Guide to Scientific Associations and Learned Societies (Saur 2006) has previously been used as source material to account for these bodies (e.g. Rowe, 2017a, 2017b). However, the source is dated and the series has since been discontinued. Associations are seen as important economic contributors (ASAE, 2014), and also as key contributors to the \$280 billion USD direct spending contribution of the US Meetings industry (ASAE, 2014, p. 17). Commonly, associations and learned/professional societies are identified as a non-profit tax sector, but this has resulted in their reporting being related directly to their tax status listing (see e.g. HM Revenue and Customs, 2017; ASAE, 2015). As a further complication, many learned societies also function as professional associations, and host conferences for academic and professional communities. Whilst the U.S. IRS Data Bank recognized 66,985 trade and professional associations in 2013, it also recognized 1,052,495 charitable and philanthropic organizations (ASAE, 2014), any of which may or may not be involved in conference hosting and support. Conferences may also be provided by commercial for-profit organizations, so discerning a substantive picture of this group is difficult. As an additional complication, the associations and learned societies of different countries are recorded in different forms and spread over different national databases. This makes any precise analysis impractical, so as a practical measure to address the situation, the Union of International Associations (2018) lists over 68,000 organizations, including federations, and regionally, nationally and internationally defined organizations, including autonomous conference series and research institutes. Particularly, they cite 37,500 active organizations (and 38,000 which are dormant), so this lower figure seems appropriate to use for representative purposes, and also improves on previous sources. However, it is acknowledged that associations / learned societies (societies hereafter) may have annual or bi-annual meetings, so an allowance should be made for this in any estimation.

If higher education institutions and societies host one conference each year, this will involve 28,077 HEIs plus 37,500 societies (18,750 if bi-annual). If the median society figure is used, then this yields (28,077+28,125) 56,202 conference events per year. Many conference alert sites advertise greater numbers of events per year, but in the absence of more concrete data, this figure presents a practical but highly conservative estimation.

Global Estimates

If the globally registered HEIs and societies held a single event of average published size (223 delegates), this would amount to 12,533,046 attendances. Applying the study's average cost finding of £1,763 per delegate would amount to an incredible £GB 22,095,760,098 (\$US 28,981,516,689 / € 25,133,119,350) cost expenditure for our annual global conference activity.

Relating to regional and national areas, the UNESCO Science Report (2015, p. 32) offers the most current outline of the global share of researchers, and these divisions may be used to predict the conference cost expenditure for different regions and countries (Table 2). According to the report (UNESCO 2015, p. 33), there are approximately 7.8 million researchers worldwide. As can be seen in Table 3, when applying global researcher share as a division of the total estimated conference cost expenditure, Europe, North America and Asia all incur multi-billion annual expenditures related to conference attendance. By examining this expenditure by global researcher share, even the smallest identified areas can be seen to have expenditures of tens- and hundreds- of millions, and when compared to GDP, these spendings are significant for most countries. On a national level, the estimated cost expenditures for countries that have published reports on the economic contribution of their conference sectors are the UK ^(3.3% of global researcher share) – £729,160,083; USA ^(16.7%) - £3,689,991,936 / \$US 4,839,689,257, and Canada ^(2.1%) - £464,010,962 / \$C 787,246,094. Australia and Denmark are not differentiated in the UNESCO report, however 19 separate countries are, and their estimated conference expenditure may be calculated accordingly.

Table 3. Estimated Annual Conference Cost Expenditure in GBP by Region and Country, Determined by Global Researcher Share (UNESCO, 2015 - shown in percentages)

North America ^(18.5%)	£4,087,715,618	Asia ^(42.8%)	£9,456,985,322
USA ^(16.7%)	£3,689,991,936	Arab States all ^(1.9%)	£419,819,442
Canada ^(2.1%)	£464,010,962	South Asia ^(3.1%)	£684,968,563
		South East Asia ^(36.9%)	£8,153,335,476
Latin America ^(3.6%)	£795,447,364	Oceania ^(1.6%)	£353,532,162
Caribbean ^(0.1%)	£22,095,760		
Europe ^(31%)	£6,849,685,630	Africa ^(2.4%)	£530,298,242
European Union ^(22.2%)	£4,905,258,742	Arab States in Africa ^(1.4%)	£309,340,641
Southeast Europe ^(0.2%)	£44,191,520	Sub-Saharan Africa ^(1.1%)	£243,053,361
Other Europe ^(7.7%)	£1,701,373,528		
Other groupings			
OECD ^(57.8%)	£12,771,349,337	High-income econ. ^(64.4%)	£14,229,669,503
G20 ^(86.9%)	£19,201,215,525	Upper middle-inc. econ. ^(28%)	£6,186,812,827
		Lower middle-inc. econ. ^(6.4%)	£1,414,128,646
		Low-inc. econ. ^(1.3%)	£287,244,881

The Negative Implications of Conference Attendance

Environmental Sustainability

As seen in the study findings, delegates undertook significant amounts of travel, with domestic delegates undertaking 95,305 miles of road travel and international delegates 925,597 miles of air/road travel. Aside from cost, a number of sources have expressed concern about the levels of carbon emissions that conference travel produces (e.g. Hicks, 2016; Spinellis & Louridas, 2013; Kalmus, 2013). Using the online calculators of myclimate.org (medium petrol car), domestic road travel for this event created an average of 52.3t CO₂ (0.1743t / delegate). International delegates created 17.9t CO₂ with road travel, and 97.21t CO₂ with air travel (BlueSkyModel) (0.9063t / delegate). The total travel related CO₂ production for a 420 delegate conference / 2.5 days was 167.4064t, at an average of 0.3986t per delegate. In 2016, an average EU citizen produced on average

8.7t CO₂ each year (0.0238t/day)(Eurostat, 2018). Thus, attending this 2.5 day conference raised the individual carbon footprint of delegates by more than 6.7 times the normal EU daily level of production. Hicks (2013) calculated the CO₂ footprint of a US conference, with an average of 1.2 tons per delegate, and this is 3 times higher than the UK event presented here. However, 98% of this was related to air travel, and the UK event accounted for 0.9063 tons per delegate (+ their road travel). So, the emission rates may in fact be similar, if differences in travel modes and distances are accounted for. This observation bears particular importance when viewed in conjunction with the recent severe warnings on climate change (United Nations, 2018), and any activity that creates such excesses without tangible need requires immediate consideration.

Knowledge Economy

As a final consideration, it is necessary to consider the knowledge economy related to conferences and their outputs. As early as 1996, the OECD viewed that the economies of OECD countries were increasingly based on knowledge and information (OECD, 1996). Recently, Rowe (2018b, p. 50) has identified the presentation outputs of conferences to be the numerically prevalent medium of scientific communication across disciplines. However, as far back as 1963, UNESCO expressed concerns about the influence and availability of these sources of knowledge. Disseminating and accessing knowledge is seen to be the major objective of ASP conference attendance (see Rowe, 2018a, Appendix 1), yet a systematic review of 79 reports covering over 29,000 conference abstracts by Scherer, Langenberg and von Elm (2007) found that only 45% were subsequently published as peer-reviewed journal articles (thus allowing the research to reach beyond the conference event). A decade on, the study has been repeated, now capturing 425 reports including 307,028 abstracts (Scherer et al., 2018), and this comprehensive analysis shows that our conference abstract conversion has now dropped to 37.3%.

If conferences are allocated a 50% presentation rate (68% was seen over the presented 3-year study), then the annual monetary cost of this potentially 'lost research' in terms of poorly disseminated or potentially unseen work amounts to £GB 4,120,859,258 (\$US 10,507,298,258/ € 9,304,623,346). Regionally, this amounts to sums measured in the hundreds of millions every year: North America - \$US 1,023,113,826 (£802,661,804), Europe - €1,440,733,192 (£1,277,466,370), Asia - CNY 1,561,595,003 (JPY 25,552,211,510, £1,763,727,763), Oceania - \$AU 116,566,272 (£65,933,748), Latin America - \$US 188,915,338 (£148,350,933), and Africa - \$US 125,956,746 (£98,900,622) (see figure 3). Given the magnitude of these projections, it is hard to justify a continuance of the status quo of conference presentation and dissemination practices.

There is a clear indication that conferences are an internationally significant means of scientific communication, but data on the largest geographical player is significantly absent. According to the CSIC database (2018), Asia accounts for 46.6% of the world's HEIs and has a 42.8% share of global researchers (UNESCO, 2015). Yet, there is a noticeable lack of information on Asian conference activities across academic, scientific and professional spectrums. The rise of Asia in the World University Rankings (Times Higher Education, 2019) is noted, and assuming that the continent's conference practices are similar to those reported elsewhere, then the fiscal and knowledge implications for this oversight are considerable. When applying the study findings, Asia is predicted as having a £GB 9,456,985,322 / \$US 12,364,056,909 annual expenditure on conferences, and if the rates of 'lost research are similar to those reported elsewhere, then this will amount to £4,255,643,394 (\$US 5,564,027,660) in potentially wasted funding. Thus, conducting further research into conference practices is especially important for this region.

As a final consideration, even within conferences, it can still be difficult to manage the large volumes of information that are presented, and issues such as reading capacity, motivation and accessibility influence the amount of information we can process and potentially use. An 'average' reader will process in the region of 250 effective words per minute, whereas a 'good' reader will process 500 effective words per minute (ReadingSoft, 2016; Perfetti, 1985). Only 1% of us will be classed as an 'excellent' reader with over 800 effective words per minute. Appendix A shows our capacity to consume information over a range of different conference sizes and presentation rates, based on reading rate. Especially, it makes clear that even processing the titles of presented work to determine interest can require hours of reading, and beyond smaller events, the processing requirement to effectively access and share conference information becomes prohibitive. As a result, despite massive volumes of information being presented at conferences, there is a high potential for it to be 'lost' and go unseen. Thus, issues of pre- and post-conference information management have negative impacts on the overall knowledge economy relating to conferences, and compound any evaluations of return on investment.

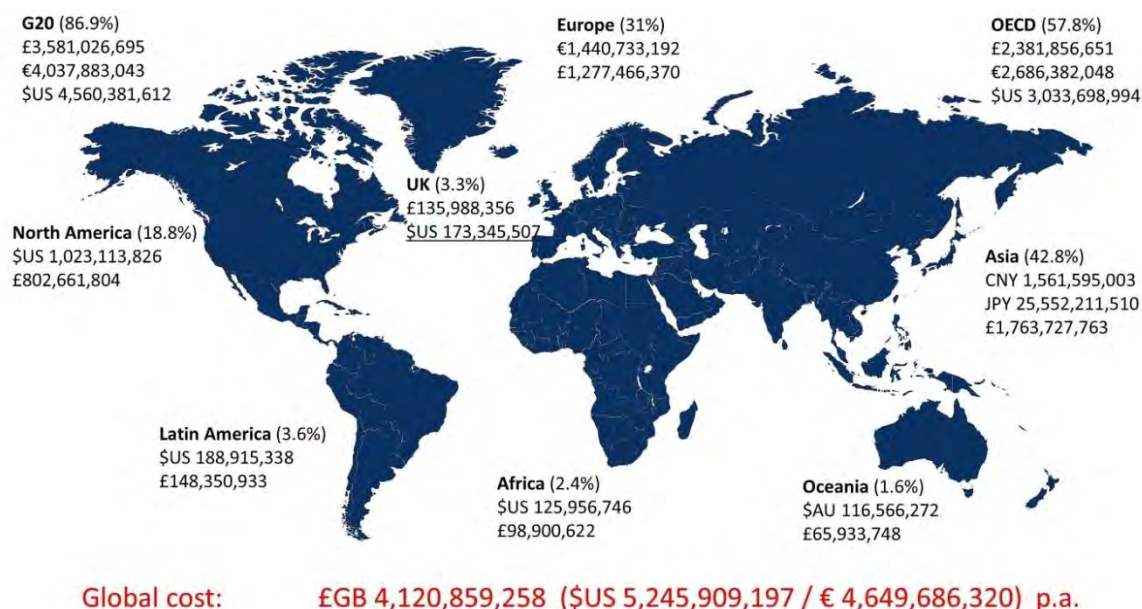


Figure 3. Extrapolated Annual Cost of 'Lost Research' determined by Global Researcher Share (UNESCO 2015) and Published Loss Rates (av. 37.3%)

Conclusions

This study has presented a method by which to assess the main cost elements of conference attendance. The results show that the common delegates' costs are significant, especially when seen beyond the individual level. Extrapolating the results of this study has revealed a multi-billion level of global expenditure, but significant negative impacts linked to the environment and the knowledge economy are also raised, and detract from conference attendance and presentation being seen as objectively sustainable in terms of monetary and knowledge economies. In light of these findings, funding bodies and government education ministries should consider whether the tangible benefit that conference attendance provides is commensurate with the multi-billion levels of investment presented, and also whether current levels of conference travel are ecologically sustainable. Whilst it is not disputed that conference attendance is an enjoyable and well-established global practice, given the significant findings of this study, further development is required to raise our conference activities beyond a level of subjective and individual appreciation, and ensure a justified and sustainable return on investment. Conference costs are evidently affordable on an individual basis, as supported by our consistently increasing conference engagement. This is quite possibly enhanced by the provision of institutional or external funding, although there is no research that explores this issue. However, it must be asked whether the multi-billion projections seen in the extrapolated findings of this study can be justified in the absence of either demonstrably useful outputs and in the face of the assertions of 'lost research', and given the evidence, it no longer seems appropriate to allow conceptions of conference benefit to be formed on a solely individual level.

Recommendations

There is a clear lack of research into conference activities, which is surprising given the significant position they hold in formative and continuing education, and also their cross-disciplinary reach across the sciences and professions. The multi-billion levels of investment in conference activities has so far gone uninvestigated, but given their potentially high significance in terms of fiscal and knowledge economy, even the smallest of actors in this area need to gain an accurate picture of the returns on their conference investments, and to assess whether such investment is sustainable under current conditions.

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Appendix A. Conference Information Processing Capacity

Abstract Reading Capacity

Time needed to read available abstracts (in non-stop hours)

< 1 working day (8h) > 1 working week (40h)

250 word abstracts

Average reader (250 ewpm / 15,000 ewph)

Event size (delegates)	20,000	166.6	200	232	266 (6.65 weeks)
	15,000	124.9	150	174	199.5
	10,000	83.3	100	116	133
	5000	41.6	50	58	66.5
	4000	32.2	40	46.4	53.2
	3000	24.9	30	34.8	39.9
	2000	16.6	20	23.2	26.6
	1000	8.3	10	11.6	13.3
	500	4.1	5	5.8	6.65
	200	1.4	2	2.32	2.66
	100	0.8	1.0	1.16	1.33
		50%	60%	70%	80%
	Presentation rate				

500 word abstracts

Average reader (250 ewpm / 15,000 ewph)

Event size (delegates)	20,000	333.2	400	464	532 (13.3 weeks)
	15,000	249.8	300	348	399
	10,000	166.6	200	232	266
	5000	83.2	100	116	133
	4000	64.4	80	92.9	106.4
	3000	49.8	60	69.6	79.8
	2000	33.2	40	46.4	53.2
	1000	16.6	20	23.2	26.6
	500	8.2	10	11.6	13.3
	200	2.8	4	4.64	5.32
	100	1.6	2.0	2.32	2.66
		50%	60%	70%	80%
	Presentation rate				

Abstract Reading Capacity

Time needed to read available abstracts (in non-stop hours)

< 1 working day (8h) > 1 working week (40h)

250 word abstracts

Good reader (500 ewpm / 30,000 ewph)

Event size (delegates)	20,000	83.3	100	116	132 (3.3 weeks)
	15,000	62.45	75	87	99
	10,000	41.65	50	58	66
	5000	20.8	25	29	33
	4000	16.1	20	23.2	26.4
	3000	12.45	15	17.4	19.9
	2000	8.3	10	11.6	13.2
	1000	4.15	5	5.8	6.6
	500	2.08	2.5	2.9	3.3
	200	0.8	1	1.16	1.3
	100	0.4	0.5	0.58	0.66
		50%	60%	70%	80%
	Presentation rate				

500 word abstracts

Good reader (500 ewpm / 30,000 ewph)

Event size (delegates)	20,000	166.6	200	232	266 (6.65 weeks)
	15,000	124.9	150	174	199.5
	10,000	83.3	100	116	133
	5000	41.6	50	58	66.5
	4000	32.2	40	46.4	53.2
	3000	24.9	30	34.8	39.9
	2000	16.6	20	23.2	26.6
	1000	8.3	10	11.6	13.3
	500	4.1	5	5.8	6.65
	200	1.4	2	2.32	2.66
	100	0.8	1.0	1.16	1.33
		50%	60%	70%	80%
	Presentation rate				

Time to scan abstract titles for interest (15 words)

Average reader Good reader

Presentations	5000	5 hours	2.5 hours
	2000	2 hours	1 hour
	1000	60 minutes	30 minutes
	500	30 minutes	15 minutes
	200	12.0 minutes	6.0 minutes
	100	6.0 minutes	3.0 minutes
	50	3.0 minutes	1.5 minutes

- Only at smaller events could the abstracts presented be read in 1 working day.
- Less than 1% of adult readers are 'excellent' readers (800+ ewpm).
- Reading in a foreign language and reading from a screen both impede reading rate.
- At larger events, even scanning titles for interest is time consuming.