Title. Exploring the Potential for the Commercial Application of Ecological Footprinting Analysis: An Airport Case Study.

Authors. Marcus Sutcliffe (Manchester Metropolitan University), Dr. Paul Hooper (Manchester Metropolitan University), Professor Callum Thomas (Manchester Metropolitan University).

Abstract

In recent years there has been an increase in the number of companies attempting to quantify their environmental impacts in support of external publications such as corporate environmental and corporate sustainability reports, and as part of environmental management systems. However, whilst the use of quantitative indicators of environmental performance has increased and allowed companies to assess progress against internal benchmarks, there has been a distinct lack of inter-company comparisons and certainly few attempts to benchmark performance against any absolute measure of environmental sustainability.

Key reasons for this lack of benchmarking have been the difficulties encountered in establishing consistent accountancy frameworks and acceptable aggregation metrics. This paper explores the potential of applying an emerging aggregation tool – Ecological Footprinting Analysis (EFA) – to the business context. To date, EFA has largely been used to assess the aggregate environmental impacts of national populations and to compare this with the global supply of environmental goods and services as expressed in 'global hectares' per capita. This has served to illustrate the extent to which many economies are exceeding their ecological carrying capacity. In partnership with Manchester Airport plc and Best Foot Forward Ltd. the research presented here sets out to identify some of the challenges and opportunities inherent in the application of this technique to a new business sector, with the aim of demonstrating its utility to airport managers charged with controlling future environmental impact and contributing to more sustainable development in the sector.

Introduction

In recent years there has been an increase in the number of companies attempting to assess, quantify and manage their environmental impacts. These attempts have evolved from brief statements in company reports in the early 1990s to become central issues, at least at the lead edge, in some sectors in recent years (Hooper and Lever, 2002). The range of tools used by companies to date to engage in environmental management, have included Corporate Environmental Reports (CER), Environmental Management Systems (EMS) and Sustainability Reporting (SR) (Kolk, 2003). Each have made contributions to companies' understanding of their environmental impacts, and in many cases have driven subsequent environmental performance improvements. However, despite these improvements, there has been a lack of inter-company comparison of environmental performance, and a lack of engagement with companies' environmental sustainability. The wide variety of Key Performance Indicators (KPIs) used within these management approaches has been cited for the lack of inter-company comparison, whilst the lack of a suitable impact aggregation technique has been cited for the lack of engagement with environmental sustainability (Hooper *et al*, 2003).

Where aggregation has taken place within environmental impact assessment to date, it has been at the policy, plan and project level. Tools such as Cost Benefit Analysis, Environmental Impact Assessment, Multi-Criteria Analysis and Life-Cycle Assessment have emerged since the 1960s as attempts to provide a simplified indicator to widespread and often diverse environmental impacts (Petts, 1999; Chambers *et al*, 2000). None of these tools appears to provide a suitable metric for companies to assess and manage the aggregated environmental impact of their ongoing business operations. Recently however, it has been argued that Ecological Footprinting Analysis (EFA) offers the potential to aggregate companies' environmental impacts, and contribute to the measurement of their environmental sustainability (Chambers and Lewis, 2001). EFA is used to analyse the total material and energy flows of a target audience, and to provide a single indicator of diverse environmental impacts, expressed as the number of global hectares of bioproductive land required to sustain the activity (Wackernagel and Rees, 1996).

To date EFA has largely been used to measure the Ecological Footprint of nations and individual cities. This work has shown that the combined global demand for bioproductive land exceeds that available, and has resulted in calls for more widespread engagement with environmental sustainability (Wackernagel *et al*, 2000). The UK Government has recently argued that individuals and organisations have to reduce current levels of consumption and waste production in order to meet the challenge of environmental sustainability (DEFRA, 2005). It is argued that EFA can be a powerful metaphor for demonstrating the unsustainability of current consumption patterns, and by highlighting the areas of greatest contribution to the aggregated environmental impact, provide a focus for action to reduce it (Bond, 2002). Recently EFA has been applied for the first time to commercial organisations, and it is argued that this approach to environmental management could be applied to other companies, providing an aggregated measurement of their environmental performance, and contributing to the measurement of their environmental sustainability (Chambers and Lewis, 2001).

The first aim of this research is to establish an EFA methodology for use at airports. Working in partnership with Manchester Airport plc. and Best Foot Forward Ltd. the research seeks to adapt current EFA technology to this new sector by measuring the Eco-Footprint of Manchester Airport, the UK's third largest airport. It is anticipated that this approach will provide managers at the airport with a decision-support tool with which to understand and manage the aggregated environmental impact of existing operations, and to test future development scenarios against EFA. The second aim is to consider its use as a strategic tool for use by Government in managing the environmental impacts of future growth in the aviation sector.

Background

Since the early 1990s CERs have evolved at a significant rate with an increase in sophistication and the breadth and depth of issues covered. This has enabled companies to track environmental performance better, and has had implications for agenda setting, staff motivation, better liability management and development potential (Hooper and Lever, 2002). CERs can be informed and underpinned by an EMS, which enables an organisation to systematically control the impact of its operations on the environment. A central feature of EMS is that companies seek continual improvement in environmental performance, thereby driving improved performance on an ongoing basis (Groundwork Trust, 2002).

There are numerous tangible and intangible benefits for companies engaging in systematic environmental performance. Tangible benefits include cost savings resulting from increased efficiencies, complying with current and foreseeable regulation (thereby avoiding sanctions for non-compliance), and potential for new products and markets. Intangible benefits include better relationships with stakeholders through improved company perception, and increased legitimacy in the marketplace or so called 'licence to operate' (Morhardt *et al*, 2002).

More recently Sustainability Reports (SR) have started to emerge as an attempt to present a balanced view of the benefits and trade-offs between social, economic and environmental impacts of companies, in line with conventional interpretations of Sustainable Development (Sustainability Report, 2005).

However, despite the increase in the numbers of companies addressing environmental issues, the depth of their engagement in environmental management in recent years, and the development of reports and systems which allow them to track and manage their performance, overall penetration of CERs, EMS and SR remains low. Furthermore where companies have engaged with these issues there has been a lack of inter-company comparison and benchmarking, and engagement with environmental sustainability (Kolk, 2003; Hooper *et al*, 2003). The varied use of Key Performance Indicators (KPIs) and the lack of willingness of senior managers to engage in comparison with other companies has meant that there has been a dearth of benchmarking against which stakeholders can compare companies' environmental performance. The lack of a suitable impact aggregation method by which to consider the overall environmental impact of companies' ongoing operations further hinders attempts to quantify overall environmental performance, and ease the process of inter-company comparison (Upham, 2003; Hooper and Greenall, 2005). Furthermore this lack of a suitable impact aggregation metric has meant that there has been no engagement with the concept of commercial environmental sustainability; i.e. how environmentally sustainable is a company? (Upham, 2003). This creates a challenge on two levels.

Firstly, increasing numbers of stakeholders are keen to know more about companies' overall environmental performance. It has been suggested that businesses can gain a competitive edge, increase their market share and boost shareholder value by adopting and implementing sustainable practices (Labuschagne *et al*, 2005). Implicitly this includes environmental, as well as economic and social performance. Those companies that can demonstrate high quality environmental performance, and importantly compare themselves favourably to sector norms have the potential to gain a competitive advantage over those that do not. Impact aggregation and willingness to benchmark are likely to empower leading performers in the search for competitive advantage. Secondly, the ability to aggregate the overall environmental impact of companies' ongoing operations is increasingly seen as an important step in finding workable solutions to the challenge of global environmental sustainability (Upham, 2003).

The lack of impact aggregation at the ongoing operational level of companies is at odds with that at the policy, plan and project level (Petts, 1999). Aggregation of environmental impacts at these levels has been common since the 1960s with the use of tools such as Cost-Benefit analysis (CBA), Environmental Impact Assessment (EIA), Multi-Criteria Analysis (MCA) and Life-Cycle Assessment (LCA). The following section analyses the extent to which each has been used to date, and considers whether any could be applied successfully to the search for a suitable aggregation tool at the ongoing operational level of companies.

Impact aggregation at the policy, plan and project level

Cost-Benefit Analysis (CBA) has been the preferred tool of economists and policy makers to value the environment in order to compare economic benefits of proposals with environmental costs. CBA attempts to aggregate the total costs and benefits of proposals in financial terms by way of attributing comparable monetary values to economic gains and environmental losses. However, attaching monetary values to environmental goods and services has attracted much criticism for being a subjective and inappropriate method (Petts, 1999). Relying largely on the *contingent valuation method*, whereby surveys of a sample groups' potential willingness to pay to protect the environment, or willingness to accept compensation for degrading it relies heavily on the subjective values of individuals who are often uncomfortable with the concept (Beder, 1994). Jacobs (1991) argues that CBA is underpinned by an assumption that the environment should only be protected insofar as its value to humans exceeds the cost of preserving it, and that it ignores humans' reliance on critical natural capital, other species right to exist and nature's intrinsic value. Beder (1994) argues that CBA represents economic theory transcending its natural boundaries into areas where it is inappropriate and potentially dangerous. Furthermore, CBA's *discounting* method, which reduces the value of environmental goods and services in the future has been criticised for being at odds with the temporal context of sustainable development, with its devaluation of future generations' needs. Petts (1999) argues against placing monetary values on issues more attuned to values of knowledge, wisdom, morality and taste, all of which, she argues are foreign to economic optimality

The use of Environmental Impact Assessment (EIA), often alongside CBA has been seen as an attempt to balance the physical environmental costs of development against the economic benefits. Whilst EIA is grounded in the physical sciences, and not economic, it is based on an approach of studying individual areas of concern within development proposals (similar to the KPI approach in ongoing commercial environmental management), and as such has not been able to offer a solution to either impact aggregation or environmental sustainability (Pope *et al*, 2004).

Multi-Criteria Analysis (MCA) has been developed in light of the limitation of EIA and CBA to aggregate the total environmental impact of a range of components. It apportions weightings to issues often difficult to compare within development proposals, so as to arrive at a balanced aggregated analysis. As with CBA however MCA relies on the subjective values of those involved. The points system used to quantify the overall costs and benefits of proposals, which underpins the technique, is not grounded in environmental science, but in the subjective opinions of the valuers (ODPM, 2005).

More recently Life Cycle Assessment has been developed to study the environmental impact of a product or service from *cradle to grave*. LCA offers the potential to consider and compare the environmental sustainability of individual products and services, and extends the possibility of aggregating overall resource use within a company. As such it is arguably the closest tool in the search for environmental sustainability assessment to date. However aggregation of all products and services in just one company would require enormous quantities of data, and would only give an indication of relative environmental sustainability, saying little about a company's contribution to global environmental sustainability. Furthermore the use of points in aggregating the impacts of products and services inherent in LCA analysis (e.g. Millipoints within Sima Pro software) is again subject to the subjective values and assumptions built therein (Chambers *et al*, 2000).

There have been criticisms that the use of existing aggregation methods at the policy, plan and project level has resulted in the domination of economic benefits at the expense of social and environmental costs (Pope *et al*, 2004). Even if there was widespread acceptance of the contested subjective values inherent in CBA, MCA and LCA, and agreement that they do offer a potential for impact aggregation, none of these tools attempts to engage with global environmental sustainability. The use of LCA in some companies' environmental management strategies has enabled a degree of engagement with product sustainability, but in general none of these aggregation methods appear to offer a credible solution to benchmarking and corporate environmental sustainability.

The emergence of Ecological Footprinting Analysis and its potential for use in the commercial sector

One tool has emerged in recent years that has the potential to measure the aggregated environmental impact of a target audience, and provide an objective, quantitative analysis, based in the physical sciences. Ecological Footprinting Analysis (EFA) measures the combined consumption of resources and energy, and production of waste of a given entity and equates this to the total bio-productive land area required to sustain this activity on an ongoing basis (Wackernagel and Rees, 1996). Using land as the currency (global hectares), a range of components can be aggregated into a single headline measure of environmental impact (Best Foot Forward, 2005). These components include the following and capture the majority of activities associated with individual and commercial resource consumption and waste production:

- Transport use
- Direct energy use
- Waste production
- Land-use
- Food and water consumption
- Materials consumption

EFA approaches environmental sustainability by reference to the carrying capacity of the planet and compares consumption of resources and energy, and production of waste to bioproductive capacity (Chambers and Lewis, 2001). As such it seeks to compare prevailing patterns of consumption (i.e. demand for resources and waste sinks) with available biocapacity (supply). The underlying presumption is that if overall demand exceeds supply, this is environmentally unsustainable (Chambers *et al*, 2000). In displaying the excess of consumption over capacity EFA is able to demonstrate how far prevailing patterns are from environmental sustainability, i.e. *distance to target* (Wackernagel and Rees, 1996). It is the only tool that can claim to measure global environmental sustainability (Bond, 2002), and has attracted the following observations which suggest it is also a powerful and unique communications tool:

> *EFA is one of the simplest and most easily-communicated sustainability indicators (Hands, 2002).*
>
> *The best method available for measuring how much consumption is exceeding bio-capacity (Ferguson, 2002).*
>
> *An unrivalled tool, which shows the effects of our impacts on the planet in a way no other tool can (Bond, 2002).*

To date however most applications of EFA have studied environmental impact on the macro scale with studies on the global, national and regional levels (Best Foot Forward, 2002; Bond, 2002). Applications in the commercial sector have been scarce, with a few exceptions, such as Anglian Water Services, Best Foot Forward and Countryside Council for Wales (CCW), all of which have recently commissioned EFA analyses of their ongoing activities (Chambers and Lewis, 2001; Best Foot Forward, 2005). Chambers and Lewis (2001) list a number of advantages and disadvantages for corporate engagement with EFA.

Advantages:

- Single index provides for ease of communication and understanding, as a variety of activities and services can be assessed and compared
- The link between local activity and global consumption can be made
- An assessment of environmental sustainability is possible
- The relationship between different impacts can be explored
- Values are based on ecological realities rather than arbitrary weightings

Disadvantages:

- Aggregation can oversimplify impacts
- The assumptions and proxies which derive the footprint are not always apparent
- Calculations can be hampered by lack of suitable data
- Footprinting focuses largely on consumption and waste, and less on pollution

Best Foot Forward, one of two consultancies specialising in EFA methodology in the UK has recently made advances in the contribution of pollution to EFA, particularly in the field of the so called *basket of gases* relating to climate change (Simmons and Piltz, pers. comm. 2005).

It is noteworthy that CCW's EFA followed on from the adoption of the tool by the National Assembly for Wales (NAW) as a headline indicator for sustainability and its own national EFA study in 2001 (Best Foot Forward, 2005). NAW has requested of all assembly sponsored public bodies to;

...promote sustainable development and to change the way they work in order to achieve this (Best Foot Forward, 2005 p2.).

CCW has adopted a commitment to environmental sustainability as a result, and were the first commercial organisation in Wales to commission an EFA in order to move towards a greater understanding of their current consumption patterns, as well as to understand some of the measures they might take to improve overall environmental performance (Best Foot Forward, 2005).

Global environmental sustainability; quantifying the challenge

The use of EFA to date, almost exclusively at the macro scale has served to illustrate the size of the challenge facing all countries in engaging fully with environmental sustainability. Based on 1995 United Nations consumption statistics, the 52 countries accounting for 80% of the world's population and 90% of world domestic product had a combined global environmental overshoot of 37%, compared with available bio-capacity (Chambers *et al*, 2000). This means that they were consuming 37% more resources than nature could reproduce in the same period. Globally, in 1997 this overshoot was put at 35% (based on all countries), a figure that had risen from 25% in 1992, showing how quickly humanity is moving away from environmental sustainability (Wackernagel *et al*, 2000). Many authors argue that this increase is the result of an almost unanimous political interpretation of sustainable development under a *weak sustainability* paradigm, or the *triple bottom line* approach (Gowdy and O'Hara, 1997; Kaivo-Oja, 1999; Tisdell, 2001; Giddings *et al*, 2002; Rajeswar, 2002; Ekins *et al*, 2003). This interpretation requires economic, social and environmental considerations to be accorded equal significance, and dictates that sustainability occurs as long as the combined sum of economic, social and environmental capital does not reduce. As such, substitutability of environmental capital for economic and/or social capital is compatible as long as the total remains at least equal. In his criticism of the weak sustainability paradigm, Sadler (1999. p13.) suggests that

..few countries have taken.. the inescapable actions necessary to end the current era of procrastination and half-measures. Meanwhile environmental deterioration and resource depletion continue at rates and scales that threaten to undermine and foreclose development options.

Chambers *et al*, (2000) suggest that current levels of consumption are being supported only by drawing down reserves of Natural Capital, and Carvalho (2001) suggests that this is likely to lead to an environmental crisis if not addressed. The authors above argue that attempts to balance the triple bottom line often result in decisions made for economic benefit over environmental protection, and that *weak sustainability* will not provide a solution to the problem.

As the paragraph above on global overshoot demonstrates, global environmental unsustainability is getting worse, not better. Within the global picture there are large variations between the environmental impact of countries in the developed and developing worlds. If every country consumed the same quantity of resources and energy, and produced the same quantity of waste as the UK we would need 3 planets. If they consumed the same as the USA, we would need 6 planets, termed a 3 and 6 planet lifestyle respectively within EFA (Rees, 2003). Conversely many less developed countries, including highly populous countries such as China and India consume less than a 1 planet lifestyle (Wackernagel *et al*, 2000). Recent economic growth and consumption trends in these two countries in particular suggest global environmental overshoot will accelerate without significant action to address it (Hands, 2002).

Many authors argue for a total re-think on the conventional triple bottom line interpretation of sustainable development (*weak sustainability*), and for a paradigm shift to embracing *strong sustainability* as the only way to engage successfully with global environmental sustainability (Gowdy and O'Hara, 1997; Kaivo-Oja, 1999; Tisdell, 2001; Giddings *et al*, 2002; Rajeswar, 2002; Ekins *et al*, 2003). This requires that economic and social costs and benefits must be balanced within overall environmental limits, and instead of the three interlinking, interdependent circles as conceptualised in the triple bottom line, this has been coined the *Russian dolls* model, where economic and social factors operate within environmental limits (Chambers *et al*, 2000). For such a paradigm shift, *strong sustainability* would need to take account of prevailing consumption and waste patterns, and these would need to be compared to available biocapacity (Chambers *et al*, 2000; Upham, 2003). This requires both the acceptance of environmental limits, and an agreed share of available global resources and waste sinks to be apportioned to each entity, whether it is a company, individual or population. It would also require a tool which has the ability to measure resource and energy demand and waste production against the available supply of resources and waste sinks. In the absence of such a tool, the most that can be said is that individual bodies, be they companies, individuals or populations are moving closer to, or further away from environmental sustainability. Critically nothing can be deduced about how far away they are from environmental sustainability, or so-called distance to target (Chambers *et al*, 2000).

In the latest UK Government publication on sustainable development, *Securing the Future; delivering UK sustainable development strategy*, March, 2005, there is evidence of an emerging acceptance of the need for a revised interpretation of sustainable development in line with *stronger sustainability* and the need to operate within environmental limits. It introduces sustainable consumption as a policy priority, and discusses the need for significant changes in behaviour to achieve sustainable development. The following quotes taken from the document illustrate the point (DEFRA, 2005);

> *Each of us needs to make the right choices to secure a future that is fairer, where we can all live within our environmental limits (Prime Minister, foreword).*
>
> *... agreed priorities – sustainable consumption and production…*(p6).

We all – governments, businesses, public sector…need to make different choices if we are to achieve the vision of sustainable development (p6).

In the same document the Government acknowledges the unsustainability of current UK consumption patterns and calls for business to engage now in new solutions based on current research:

Much current consumption, and business models based on it, remains unsustainable in the longer term

Sustainable consumption and production requires us to achieve more with less. Current developed country patterns.. could not be replicated world-wide.. this would require 3 planets' worth of resources

The government will therefore press to strengthen: EU efforts, by putting sustainable consumption.. at the heart of the new EU SD strategy

Businesses that anticipate this trend and develop "material light" goods and services will be best placed to benefit..(p43-51)

The government proposes a new approach to influencing behaviours based on current research on what determines current patterns (*of consumption*) (p6)

These comments appear to confirm the acceptance of the need to reduce prevailing consumption patterns, and call on business to engage with new, less resource intensive business models. The challenge for business therefore to adopt new models requires it to understand more about overall patterns of consumption of existing ones. As such, metrics which allow companies to aggregate overall material and energy flows will give them vital information about current patterns and enable them to highlight key areas for reduction. In this context it therefore appears timely to establish the suitability of EFA as a tool to engage with commercial impact aggregation and environmental sustainability.

Research Proposal: Establishing an Ecological Footprinting Analysis methodology for use at airports: A case study developing EFA in partnership with Manchester Airport plc.

The aim of this research is to develop an EFA methodology for use at airports by measuring the EFA of Manchester Airport, the UK's third largest airport. Support for the project has been secured from Manchester Airport plc and Best Foot Forward Ltd. It is anticipated that the software developed in this study will be used by the airport operator

- to improve the environmental sustainability of its operations
- as a strategic decision-support tool to assess the environmental sustainability of different development scenarios

Applying EFA to the aviation sector will be both challenging and interesting as it is undergoing a period of significant growth, projected to last well into the future. Aviation has been charged with making eco-efficiencies to compensate, at least in part for this anticipated growth (DfT, 2003). It is thought that EFA has the potential to contribute to this drive for efficiency. Globally air passenger demand has risen by an average 9% p.a. since 1960, and is forecast to rise by at least 5% p.a. in the next 10-15 years (Upham, 2003). This trend is likely to mean a doubling in passenger numbers by 2020 and almost trebling by 2030 (Upham *et al*, 2004). Conventionally the sector has been constrained by the adverse social and environmental impacts of aviation on the local environment of communities living near airports, such as noise, air quality, water quality and land use (Hooper and Greenall, 2005). Recent incorporation of the need to engage in global environmental limits (DEFRA, 2005) may mean an increasing focus is placed on aviation to demonstrate engagement with environmental sustainability.

The publication of *The Future of Air Transport in the UK* in 2003 by Department for Transport focuses on a balanced approach, where future growth is accompanied by increasing eco-efficiencies. Given the hitherto widely applied *weak sustainability* paradigm, this 2003 strategy concentrates on balancing the economic, social and environmental impacts of future growth in the sector (DfT, 2003). Arguably it avoids engagement with the overall environmental sustainability of the sector, although it does engage in the need to address aviation's contribution to climate change. The concept of overall environmental capacity has been discussed, however at the leading edge by some important players in the UK aviation sector, namely Manchester Airport Group plc and BAA Ltd. (Upham *et al*, 2004).

Environmental management in the aviation sector to date

Environmental management in the industry has developed significantly since 1990 to the point where environmental issues are a major factor in corporate life. The breadth and depth of issues covered has increased and the use of Key Performance Indicators has expanded. By 2001, nearly half of all European airports responding to a survey had formalised EMS with a further 47% working towards accreditation (Hooper *et al*, 2003). However the quality and variation of KPIs used between companies has resulted in a lack of comparable reports. Furthermore there has been a distinct lack of aggregation and benchmarking in the sector, and to date no airport or airline has engaged with global environmental sustainability reporting (Hooper and Lever, 2002; Hooper and Greenall, 2005). DfT (2003) called for eco-efficiencies to be made in the sector to compensate for projected growth over the next 20 years, but the question remains as to how environmentally sustainable aviation is now, and what if the projected growth of almost 300% by 2030 outpaces efficiencies? (Upham 2003).

Upham (2003) goes on to suggest that true environmental sustainability requires an assessment of total consumption and waste patterns, and a comparison against maximum allowable limits. This concept requires limits to be apportioned to and within the sector, or as Upham calls them *protocols*. This is commonly referred to as *earthshare* in EFA literature (Wackernagel and Rees, 1996; Chambers *et* al, 2000). There may be a precedent for this in calls for Co^2 emissions to be divided nationally by population post Kyoto (Upham 2003 cites RCEP, 2000). Clearly this would present many challenges, but

Upham suggests this is the only way environmental sustainability can be achieved. In the short-term, and until such time as earthshare quotas are apportioned, EFA output can be used to aggregate a company's environmental impact and offer indicators of the company's environmental sustainability by the use of *normalisation* with other management data. Examples of how EFA can contribute to the environmental sustainability in the absence of earthshare allocations are as follows; EFA can be divided by the total number of staff, number of customers, or in aviation's case the size of an individual's personal footprint accounted for by their passage through an airport, plus and minus the flight (see *proposed methodology* below) (Best Foot Forward, 2005). A further normalisation approach might be considering Manchester Airport's footprint as a comparison to the North West economy's GDP. This has the interesting potential to compare the airport's environmental impact (i.e. percentage of regional footprint) to its regional GDP contribution (percentage of GDP), a method likely to be of interest to managers conventionally driven by the need to balance the economic benefits of aviation with the environmental costs. As such, using EFA in the commercial context has the potential to make a contribution to aggregation, benchmarking, and environmental sustainability.

Proposed methodology

The airport study will adopt a similar methodology to that used by Best Foot Forward (BFF) in measuring and analysing the EFA of Countryside Council for Wales (CCW) in 2005, with the addition of food impact to this project (Best Foot Forward, 2005). It is thought the impact of food in the airport case might be significant due to the large number of food retailers at the airport and the potential for food consumption to be of significance within the airport EFA. This approach will measure the total material and energy flows, and waste produced in the following impact areas of operations at the airport:

- Land use
- Direct energy use
- Transport use
- Materials consumption
- Waste production
- Water
- Food

The scoping exercise required to consider each of these components in more detail is currently being undertaken. For example, transport will be broken down into user groups such as staff travel to work, business travel, ground operations, flights and customer travel to and from the airport.

As mentioned earlier these flows will be translated into the area of land required to support this pattern of activity on an ongoing basis, using Best Foot Forward's Corporate Stepwise EFA software package. It will be necessary to develop further the existing software to take account of aviation-specific requirements, such as the relative eco-efficiencies of different aircraft types. This will necessitate an active dialogue between the three partners in the study. This study will require a significant quantity of data to be made available by the airport, and discussions re the availability of these data are currently taking place.

Importantly it is worthy of note that airports, by the nature of their business often include a large number of service partners, including retail, ground handling, catering, and check-in. This may present a challenge both in terms of data availability across the site, and subsequent ability to engage in footprint reduction. Discussions to date have indicated the desire of airport management to be able to distinguish the areas of impact within immediate company responsibility from those requiring a partnership approach with service partners.

The ability of EFA to distinguish between the various contributors to the overall environmental impact is potentially an important one for managers in the decision-making context, as it could help concentrate investment and focus on the areas of most environmental significance. For example, 52% of CCW's EFA contribution came from materials and waste, while a further 42% came from transport, giving a combined figure of 94% of the overall impact from just two components (Best Foot Forward, 2005). Whilst acknowledging that there may be some relatively easy eco-efficiencies to be found in other areas, as a decision-support tool this gives CCW managers an understanding of where the areas of most significance are in the context of the organisation's aggregated environmental impact, and as such where to direct efforts to reduce the footprint. As mentioned above, EFA has the added ability to break down the footprint not only into the headline indicators noted above (i.e. direct energy, transport etc), but to break down the constituent parts of each. For example London's EFA highlighted materials and waste as the biggest contributor to the overall footprint (44%), but was then able to break this down into individual products, both in terms of weight and impact. It is noteworthy that of 5 key resource products highlighted, the weight of paper and paperboard was the lowest, but it had significantly the highest footprint, again giving direction to managers looking to address those areas of greatest impact (Best Foot Forward, 2002).

After the initial EFA has been measured and broken down into its constituent parts and analysed for the areas of greatest significance in terms of overall impact, it is planned to run business scenarios to consider a range of options. This is likely to include a business as usual scenario, based on prevailing patterns of growth at the airport and reduction scenarios based on addressing individual areas of impact. It is anticipated that EFA will also be used to consider different development options in due course. This is consistent with Best Foot Forward's *scenario* approach to EFA for London, which ran the following post EFA scenarios:

- Business as usual
- Evolutionary change
- Revolutionary change

(Best Foot Forward, 2002).

The final component of the research will be to consider the potential for the strategic use of this approach to aviation more widely. Interest has been shown in the proposal by DfT, and they have asked to be kept informed of progress with a view to studying the potential for wider application. This is consistent with the March 2005 sustainable development publication (DEFRA, 2005) and the government's desire to promote research and development of sustainable business models.

Some of the potential benefits to different stakeholders of using EFA to help manage aviations environmental impacts include:

- Industry - improved environmental performance using a strategic decision-support tool
- Government – potential to support policy formulation, regulation and planning controls
- Local communities – confirmation that the airport is engaging at the forefront of new methods to manage environmental sustainability concerns
- Investors – confidence that the airport is taking a long-term view of how it operates

Challenges

There are numerous challenges presented by this approach to corporate environmental sustainability management. This paper has already considered some of the challenges presented both by adapting EFA to commerce generally and by the nature of airport specific operations. For example in terms of engaging with the global environmental sustainability of a business, it is necessary to consider how the principles of *earthshare* can be applied to different sectors, and within that, different companies. Apportioning earthshare is a political responsibility, but the approaches to *normalisation* highlighted earlier go some way to overcoming this issue in the short-term. This paper has also considered the operational challenge in airport environmental management that is presented by the number of service partners operating on the site. Early discussions with Manchester Airport plc managers about the availability of data from service partners have been encouraging. Subsequent management influence in addressing impact areas involving franchise operations may prove to be more challenging however.

One of the challenges faced by those seeking to encourage companies to aggregate and benchmark environmental performance to date has been the lack of willingness of senior managers to follow a path of increasing transparency (Upham, 2003). This approach requires a leap of faith from the donor organisation to engage with impact aggregation and subsequent benchmarking, especially in a sector conventionally thought to impose significant environmental costs. A successful conclusion to the initial phases of this project (i.e. measuring the airport's footprint) will require the continuing support of Manchester Airport plc with provision of access to data. Subsequent engagement in scenario management is likely to require management to be convinced of the benefits to the organisation outweighing the costs, a situation supported by observations of companies engaging in EMS to date (Hooper *et al*, 2003). This is a challenge not only in terms of perceived economic cost-benefit analysis, but it may require a step change in senior management attitudes to engaging with the benefits of wider (i.e. global) environmental sustainability. This requires managers to accept that conventional environmental concerns in the sector have been limited, and that wider global concerns for environmental overshoot are part of the remit of corporate responsibility. It is arguable that this will require senior managers to act as citizens as well as managers, a philosophical step change in conventional management approaches. If society is to address the challenge of environmental sustainability, this will require radical changes in the way it operates. Individuals in both their private and corporate life will need to recognise the very significant challenge that lies ahead and find ways to change the way they live and make decisions (DEFRA, 2005). At this stage in the project, indications are positive that management can see the benefits to the company as well as wider society of such an approach, and indeed can see the potential long-term benefits for the company of an environmentally sustainable society. Subsequent progress will depend on continued support as results materialise.

The final aim of the project, to consider the potential for EFA to contribute to strategic policy formulation, may well be influenced by the support given by Manchester Airport. Conventionally Government has shown a preference for corporate environmental management to evolve rather than be regulated. Some commentators have called for regulation to force companies to benchmark (Hooper and Greenall, 2005 cite Synnestvedt 2001) whilst others suggest market forces should be left to drive changes (Hooper and Greenall, 2005 cite Friedman and Miles, 2001). The suitability of EFA in terms of its strategic application may depend not only on the reaction of Manchester Airport to the approach as a decision-support tool, but on the preference of Government in the evolution/regulation debate.

Opportunities

Most commentaries on EFA to date agree that it is a suitable impact aggregation tool, as its use of land as the measurement currency places it in objective physical science and not subjective economic theory. This project seeks to gauge its suitability not only as an aggregation metric, but as a commercial sustainability tool, accepting the limitations discussed in C*hallenges*. As such, it has the potential to contribute not only to better corporate environmental management, but to wider environmental sustainability aspirations too. This is something conventional corporate environmental management approaches have been unable to demonstrate.

It is thought that significant quantities of the data required to carry out a full EFA of the airport will be available from measurement of Environmental Performance Indicators (EPIs) to date, within current airport environmental management approaches. This ability to access readily available data allows the project to build on previous work, such as the airport's EMS, which will reduce the time spent collecting data. Importantly, there is potential for this methodology to make a significant contribution as a decision-support tool for managers. It could allow them to target effort and resources to the areas of most significance in terms of the company's global environmental impact.

The UK Government's original definition of sustainable development (DEFRA, 2005) based upon an underlying reliance on the *weak sustainability* paradigm (balancing the triple bottom line), underpinned the White Paper on 'The Future of Air Transport' (DfT, 2003). Given the Government's March 2005 Sustainable Development strategy *Securing the Future*, that introduces language more in tune with stronger sustainability (DEFRA, 2005) and the concept of environmental limits, EFA could be of considerable value to supporting the future sustainable development of UK aviation. With this in mind, the results of this study will be discussed with the UK Department for Transport .

Conclusion

If it is accepted that new methods are needed to engage more successfully with global environmental sustainability, the challenge is to find tools that are capable of informing and convincing individuals and organisations to take the necessary action required to move in the right direction, and importantly to understand how much further we need to go to achieve environmental sustainability. To date, only EFA appears to be able to do both, and it has been widely acknowledged to be an important mechanism in understanding the scale of the environmental challenge, and in driving the change necessary to succeed. In the absence of regulation to force companies to engage in environmental sustainability management, companies will need to see the benefit in so doing. It is thought that EFA has the potential to contribute in a way no other tool can. The scale of the challenge is considerable, but the opportunities for EFA to support positive change appear well founded.

Acknowledgements

The authors would like to acknowledge the contributions of Manchester Airport plc. and Best Foot Forward Ltd. to this research. In particular they would like to thank Jonathan Bailey (Head of Government and Industry Affairs), John Twigg (Head of Planning and Environment) and Chris Paling (Environment Adviser) of Manchester Airport plc., and Craig Simmons (Director) of Best Foot Forward Ltd.

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