COMMITTEE ON STATISTICS
19th meeting
UNWTO Headquarters, Madrid, Spain
26-27 February 2019

THE TOURISM DEMAND PERSPECTIVE AND ALLOCATING ENVIRONMENTAL FLOWS ASSOCIATED WITH TRANSPORT ACTIVITY

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1. Introduction

One essential step of the MST initiative – which from the beginning the World Tourism Organization (UNWTO) has pursued with the partnership of the United Nations Statistics Division (UNSD) – is to submit the Statistical Framework for Measuring the Sustainability of Tourism (SF-MST) to the United Nations Statistical Commission (UNSC), the highest body of the global statistical system. This is scheduled for 2020, with the aim to have SF-MST adopted as an international statistical standard[1], which is desirable since the document will be the main methodological reference for statistical information intended to support the MST project.

SF-MST aims to be a comprehensive framework for the organization of suitable statistics to support the measurement of the sustainability of tourism. It must therefore also include a well-defined demand perspective for the data to be developed. In this regard, allocating the environmental flows associated with transport activity to visitors is a matter that has attracted particular attention.

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[1] A presentation on the current version of SF-MST is included in the programme of the 19th meeting of the Committee on Statistics and the Tourism Satellite Account, session 2.

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Quantifying visitor expenditure for transport and at the same time the environmental flows that can meaningfully be associated with that expenditure may be complicated. With the progress over the past two years in the discussions for of drawing up SF-MST, it now appears that this issue can be clarified somewhat more easily.

The linkage of the well established statistical frameworks set up for tourism and the environment has been considered fom the outset as a promising approach in order to provide adequate guidelines for measuring tourism-related environmental flows[2].

Relaiable and feasible ways for describing the environmental dimension of tourism sustainability through official statistics are presented in specific sections of SF-MST. After an in-depth discussion on environmental flow accounting for tourism industries, followed by reflections on the consumption perspective vs the production perspective, some issues are highlighted specifically in relation to transport activity and related environmental flows. What is considered particularly problematic concerns the air emissions caused by air passenger transport. An important issue is how to attribute these emissions to polluters taking into account the need to meet a demand for statistics on tourism and environment also focused on visitor activity.

There is agreement that key national accounting conventions should be applied for the supply perspective in SF-MST. Economic units which carry out tourism productive activities are assigned to economic territories according to the principle of residence. The allocation to the economic territory of reference of the environmental flows directly caused by tourism businesses allows a proper link between the relevant economic and environmental aspects. A statistically sound principle for the attribution of environmental flows to economic territories is thus established with regard to the production perspective.

As concerns the consumption perspective, instead, it seems necessary to go further into the question before submitting SF-MST to the UNSC. In fact, the air emissions associated with air passenger transport services may be an issue when the statistical information should focus not on the activity of air transport operators but on visitors traveling by air. This relates to the fact that an essential element of visitor activity is the geography of origins and destinations of the various trips; these can be located beyond the boundaries of the economic territory which is the spatial reference for data, particularly outside the country of reference in the case of statistics on a national scale.

In the following sections, some basic conceptual elements of SF-MST are recalled which reflect important criteria generally followed in official statistics (section 2). The allocation of environmental flows is then discussed in the light of the relevant international statistical standards, deepening complex aspects concerning the use of international air passenger transport services by visitors, which is the subject around which the present document is centred (section 3). After making a specific focus on the principle of focusing first on direct flows, and on the consequent common practice of attributing the environmental flows

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[2] International statistical standards are established for the economy in general, tourism in particular and the interrelationships between the economic system and the natural environment SF-MST is very much based on the International Recommendations for Tourism Statistics 2008 (IRTS 2008) and other international statistical standards based on accounting approaches such as the Tourism Satellite Account: Recommended Methodological Framework 2008 (TSA: RMF 2008) and the System of Environmental-Economic Accounting 2012 - Central Framework (SEEA-CF). Although not currently a standard, also the System of Environmental-Economic Accounting 2012 - Experimental Ecosystem Accounting (SEEA-EEA) is considered crucial for SF-MST.

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associated with transport in the first instance to the industries providing the service, the discussion considers in particular on the linking of tourism satellite accounts and air emissions accounts for the purposes of calculations aimed at attributing environmental flows to visitors. In section 4 some reflections are presented on how to cope with limits that have to do with constraints linked to the use of data from tourism satellite accounts and with the breakdowns recommended for the data in the international statistical standards. The importance of a global level statistical work is highlighted, also by making reference to specific work carried out first by UNWTO and later on within international academia. Whether to try or not to develop further guidance through more detailed recommendations to be included in the final version of SF-MST is also questioned. Section 5 contains a few concluding remarks.

2. Complexity of dealing with transport-related phenomena and official statistics' basic criteria

Within statistics intended to support analyses and decision-making inspired by the "polluter pays" principle, identifying and estimating relevant economic flows concerning visitor activity and estimating the environmental flows that can be meaningfully associated with these economic flows may involve complex questions to statisticians. In fact, in the case of international air passenger transport services, the allocation of associated environmental flows can be a particularly complex task if the allocation is based on visitor activity, as in the case of the SF-MST consumption perspective.

In order to start disentangling this complexity, it is worth recalling some basic concepts which characterize SF-MST and that reflect important criteria generally followed in official statistics.

The distinction in SF-MST between the consumption and the production perspectives – which also underpins the international statistical standards concerning tourism – essentially responds to a fundamental articulation in information needs of users of data on the economic aspects linked to tourism. This is particularly so as concerns defining and monitoring tourism policies, which in general are clearly focused on the demand or supply side of tourism activities.

Clearly distinguishing the above perspectives also helps to organize the consideration of environmental flows in a quite straightforward way in SF-MST. In fact, even when these flows are similar in terms of physical content, they may correspond to distinct phenomena with separate environmental impacts, generated on the supply side or the demand side of tourism, which makes sense to distinguish.

For example, certain air emissions stemming from the operation of road transport services provided to visitors are best recorded in SF-MST if taken into account based on the production approach, while similar flows associated with the fuel use of visitors on the occasion of driving cars on holiday are better accounted for based on the consumption perspective. As a matter of fact, the two amounts of environmental flows, which may measure same category residuals, consist of distinct material flows, which occur on the supply side of the tourism sector, the former, and on the demand side, the latter; for this reason they are kept clearly separated in SF-MST.

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Such a way of structuring data is guided by the principle of focusing first on direct flows, which is normal practice within official statistics. In fact, special attention is given in these statistics to the production of data that measures direct flows, both economic and environmental, which is an obvious way to systematically describe the "facts" observed.

The particular importance attached to the registration of direct flows was stressed in documents prepared on the occasion of previous meetings[3]. Considering this importance, the scope of measurement in SF-MST includes, as far as the consumption perspective is concerned, the consumption of products that stems directly from visitor activity together with the environmental fows directly connected to that consumption. The environmental flows to be measured are primarily those deriving from directly observed consumption processes[4]. In addition, it is also considered that all tourism-related environmental flows ultimately occur as a result of activities on the demand side of the economy, including both visitor consumption and intermediate consumption along the whole supply chain linked to tourism.

It is noted that an organization of statistical data according to a linear structure, as outlined above by referring to some basic features of official statistics, is considered an appropriate way to allow multiple different uses of the same data. It is the more so when it comes to complex phenomena like those considered by linking the economic and the environmental dimensions.

One further point is added to the above, also along the lines of the previously mentioned document on the demand perspective and environmental flows: it is important to distinguish, among visitor activities based on consumption of products, the use of services and that of goods.

3. Allocation of environmental flows to the use by visitors of international air passenger transport services on the basis of international statistical standards

3.1   The principle of focusing first on direct flows

Among the different types of products that are characteristic of visitor consumption concerning transport, the transport services provided by transport operators and the fuel used for driving on holiday are of specific interest from an environmental point of view.

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[3] See the following discussion papers: "Options for allocating environmental flows to tourism through integration of data from tourism and environmental-economic accounts" – prepared by Cesare Costantino, UNWTO Consultant – presented to the Committee on Statistics and the Tourism Satellite Account at its Seventeenth meeting, Madrid, 24-25 January 2017; "The demand perspective in measuring the sustainability of tourism with specific focus on environmental aspects" – same author – presented to the Working Group of Experts on Measuring the Sustainability of Tourism, at its Second meeting, Madrid, 24-25 October 2018.

[4] Visitor activity also includes the use of ecosystem services obtained directly and free of charge from the natural environment, such as e.g. in the case of enjoying amenities in protected areas (see section 3.6 – Measuring impacts on the environment from visitors' activities beyond the use of products – in the already mentioned document "The demand perspective in measuring the sustainability of tourism with specific focus on environmental aspects"). This aspect is also taken into consideration in SF-MST.

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Although the use of transport services is one of the main consumption activities that characterizes tourism, it is the environmental flows caused by transport on own account that are recorded as directly related to the activity of visitors.

Thus, when considering the allocation of environmental flows, the consumption perspective is applied systematically as regards the visitor use of goods, provided, of course, that there are environmental flows generated directly at the stage of the consumption of the good. In general, only the use of certain goods is relevant as concerns environmental flows. For visitors, the use of vehicle fuel for driving on holiday, is certainly essential[5].

As far as transport services are concerned, the principle of focusing first on direct flows suggests that environmental flows generated at the stage of their production be in the first instance attributed to the producing industries – as in the case of other types of services – and not to the visitors, regardless of the circumstance that on the demand side of the transport sector there is the visitor. This applies in particular to international air passenger transport services.

3.2 *Moving from the production perspective to the consumption perspective*

It already emerged whithin the presentation in SF-MST of the accounts for environmental flows for tourism industries that, differenty from the production perspective, the allocation of environmental flows associated with air passenger transport services is not equally straightforward when considering the consumption perspective.

In order to clarify here what the point could be, it may be useful to argue from an example: what is the best way to consider, based on the consumption perspective, allocation of the GHG emissions from a British Airways aircraft traveling between New York and Paris and carrying visitors residing in different countries[6].

In this respect, an overarching rationale such as that provided by official statistics core criteria underpinning SF-MST may help, as can be seen in the following.

In relation to the example above, within the national statistical system of the United Kingdom it would be appropriate – and it makes sense based on the physical phenomena involved – to associate the GHG emissions to the service provided by the aircraft considered as a whole from the production perspective, regardless – on the demand side –

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[5] Among the data potentially provided by national statistical systems concerning the environmental flows attributable to the use of vehicle fuel, the most appropriate statistics are those developed according to the System of Environmental-Economic Accounting - Central Framework (SEEA-CF). In particular, Physical flow accounts include the Physical supply and use table for Energy and the Air emissions account. The first includes data on consumption of "oil products" and "biofuels" by households; this consumption is relevant in terms of contributing to depletion of environmental assets. The Air emissions account includes data on the emission of air pollutants by households; these residual flows contribute to climate change and degradation of air quality. This statistical information describes environmental flows with reference to households, but through appropriate apportioning procedures it should be possible to identify from those estimates parts that could be associated with visitor driving on holiday.

[6] The example resembles the one formulated in the Tourism Satellite Account: Recommended Methodological Framework 2008 (TSA 2008), para 2.30: " … a resident of the United States of America flying directly from New York to Paris on British Airways ... ". A similar question - "What is the best way to consider allocation of the GHG emissions from a British Airways plane travelling between Singapore and London and carrying passengers from the United States and Australia" - can be found in the Consultation Draft of SF-MST prepared for the Working Group of Experts on Measuring the Sustainability of Tourism (Second meeting of the WGE, Madrid, 24-25 October 2018, item 2.1 of the agenda).

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of the countries of residence of the different passengers, because: a) the GHG emissions originate directly from the production process of the transport service between New York and Paris; b) the production process is run by an enterprise, British Airways, with its center of predominant economic interest in the UK[7].

An association of economic and environmental flows like this is foreseen in SF-MST in various sections concerning the environmental flow accounts for tourism industries. These accounts are based on linking the Tourism Satellite Account: Recommended Methodological Framework 2008 (TSA 2008) and SEEA-CF. The implementation approach for such methods is known as the production approach[8].

When it comes to the demand perspective, however, the feeling is that things get complicated.

3.3   Linking international statistical standards on tourism and on environment as a basis for the allocation of the GHG emissions from international air transport to visitor consumption

The complexity of the case of the international air passenger transport services considered according to the consumption perspective emerges clearly in the light of the approach of linking statistics on tourism and on environment aligned with international statistical standards, in particular by referring to TSA 2008.

In TSA 2008, tourism consumption is defined in terms of the use of goods and services associated with visitors taking trips within, towards or from the country of reference.

This implies – with reference to the example above and again from the UK point of view - – that in tourism satellite accounts, while the service provided by the aircraft would be recorded according to the production perspective, as mentioned before, the use of the same service by the resident visitors would be ignored, since such consumption would happen without any contact with the economic territory of reference.

As for the national statistical system of the United States of America, the country of departure of the flight, the situation would be different. With regard to the purchase of air passenger tickets, account would be taken of those passengers who would qualify as visitors residing in the USA, and in principle the expenditure relating to such visitors would be regularly taken into account in tourism satellite accounts; in fact, this expenditure would contribute to the estimate of outbound tourism consumption.

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[7] Actually this is a hypothesis made for simplicity, useful for the discussion on the example. There can be exceptions, in fact, to the principle that an institutional unit - as in the example British Airways - resides in an economic territory determined by the centre of predominant economic interest of the unit. Exceptions can be made for multiterritory enterprises - such as airlines - that run a seamless operation over more than one economic territory, provided that it is feasible to break down the enterprise into separate branches. By the way, it would be necessary to prorate the total operations of the enterprise into the individual economic territories. See System of National Accounts 2008, para 4.13.
[8] In practice, based on the type of statistical information on environmental flows that it can be presumed will be available in the majority of countries, apportioning procedures could be applied to environmental accounting data for calculating proper amounts of environmental flows attributable to industries serving visitors. This point is discussed in the first of the two previously mentioned discussion papers.

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The situation concerning the national statistical system of the country of arrival of the flight, that is to say France, would be still different. As the flight would terminate in Paris, in principle all arrivals of visitors from New York would be recorded in the French official statistics; some might correspond to French outbound visitors returning to France and the rest to visitors residing in different countries, who therefore would qualify as part of inbound tourism. With regard to visitors residing in France, the expenditure for their use of the air passenger transport service would be included in outbound expenditure according to TSA 2008.

Turning to the GHG emissions, it would be of interest that in each country's national statistical system a share of the emissions associated in the first instance with the service provided by British Airways were associated – based on the consumption perspective – with the consumption of resident visitors who were among the users of the international air passenger transport service, overcoming the fact that this consumption would occur without any contact with the economic territory of reference.

As far as the United Kingdom is concerned, there would be an interest in having resident visitors traveling between New York and Paris considered in official statistics if methods were available to allocate a proper share of aircraft GHG emissions to them.

Turning to the national statistical system of the United States of America, no allocation of GHG emissions would be considered based on the production perspective, because the company that would operate the aircraft would not be one residing in the USA. For the country of departure of the flight, the focus would be on outbound tourism, then on the allocation, based on the demand perspective, of a proper share of the aircraft GHG emissions to the resident visitors using the air passenger transport service provided by British Airways.

In the case of the French national statistical system, similarly to the USA case, no allocation of GHG emissions based on the production perspective would be considered. Of all visitors arriving in Paris with the aircraft, only resident visitors returning to France would be considered in the allocation of GHG emissions according to the demand perspective; inbound visitors would be ignored.
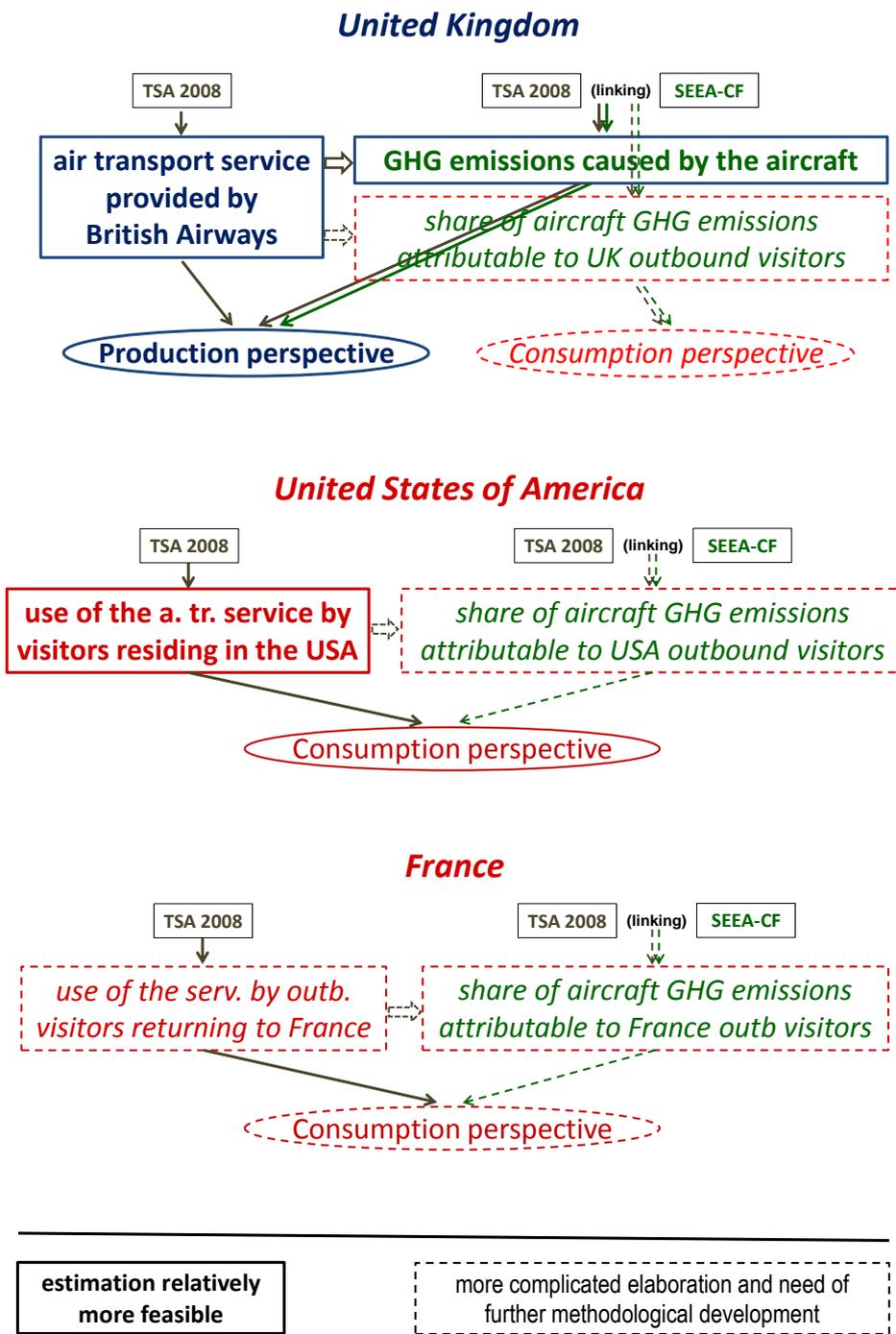
Figure 1 illustrates in summary the key aspects highlighted so far with the aim of contributing to overcome complexity

Key points in the graphical representation are the alternative production and consumption perspectives and the different positions from which the various national statistical systems consider the economic fows of tourism and the related environmental flows both it concerns the production perspective and the consumption perspective.

A distinction is made in the figure between the tourism data that individual national statistical systems could elaborate based on TSA 2008 and the estimates of related environmental flows obtainable on the basis of data developed according to TSA 2008 and SEEA-CF, whose combination allows an integrated logic. Another distinction concerns statistical information that is relatively easier vs more complicated to obtain; the two labels below the bottom line of the figure – "estimation relatively more feasible" and "more complicated elaboration and further methodological development required" – may help identify the two types of data.

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Figure 1. **Economic and environmental flows of international air passenger transport in which the official statistics of individual countries would be interested – United Kingdom, United States of America, France**

The case of GHG emissions from a British Airways aircraft
traveling between New York and Paris
and carrying visitors that are residents of different countries

United Kingdom

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TSA 2008                          TSA 2008   (linking)   SEEA-CF

air transport service    ⇒    GHG emissions caused by the aircraft
provided by
British Airways               share of aircraft GHG emissions
                              attributable to UK outbound visitors

     Production perspective          Consumption perspective
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United States of America

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TSA 2008                          TSA 2008   (linking)   SEEA-CF

use of the a. tr. service by     share of aircraft GHG emissions
visitors residing in the USA     attributable to USA outbound visitors

          Consumption perspective
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France

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TSA 2008                          TSA 2008   (linking)   SEEA-CF

use of the serv. by outb.        share of aircraft GHG emissions
visitors returning to France     attributable to France outb visitors

          Consumption perspective
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| estimation relatively more feasible | more complicated elaboration and need of further methodological development |

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The United Kingdom, the United States of America and France – respectively the country of residence of the enterprise providing the service, the country of departure of the flight and that of arrival – are differently characterized in terms of economic and environmental phenomena which in their respective national statistical systems would be dealt with based on either the production or the consumption perspectives. This translates into data coverage that varies from one country to another, in particular as regards – important for the purposes of the discussion – the environmental information of interest according to the consumption perspective.

For all three countries, for one reason or another, estimating the share of aircraft GHG emissions attributable to outbound visitors would require the implementation of rather complicated elaborations and perhaps ad hoc methodological guidance in order for such information to become actually available

Figure 2. **Economic and environmental flows of international air passenger transport in which the official statistics of individual countries would be interested – all countries other than United Kingdom, United States of America, France**

The case of GHG emissions from a British Airways aircraft
traveling between New York and Paris
and carrying visitors that are residents of different countries

any Country X other than UK, USA, France

| TSA 2008 | **(linking)** | SEEA-CF |

share of aircraft GHG emissions attributable to Country X outbound visitors

Consumption perspective
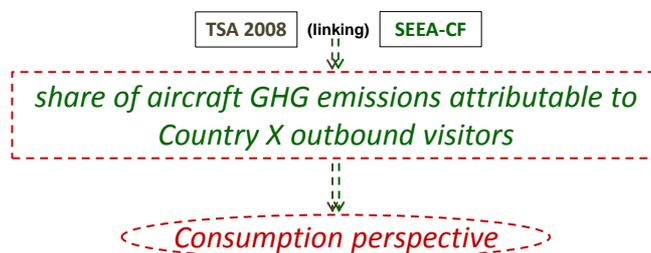
As to other countries of which other potential visitors among the users of the flight from New York to Paris could be residents, obviously the production perspective would not be applied in the respective national statistical systems, because in no case the center of predominant economic interest of the enterprise operating the flight would be located in the country of reference of official statistics. Turning to the consumption perspective, since neither the departure nor the arrival of the flight would occur in the country, the use of the air service by the resident visitors would be ignored in tourism satellite accounts, because – similarly to the case of official statistics of the United Kingdom – the trip would not be from nor towards the country itself. That can noticed in Figure 2, which illustrates the case of all countries other than those in Figure 1[9].

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[9] The observation made earlier on what has been noted as a peculiarity of the United Kingdom case applies also to all the countries at issue. In fact, visitors using the aircraft between New York and Paris who are residents of a given country among those mentioned above could be accounted for within official statistics in estimating the GHG emissions attributable to them, but these visitors would be ignored in the estimation of tourism consumption according to TSA 2008.

4. The importance of best use of existing data in individual national statistical systems and the crucial role of a supranational statistical perspective

4.1 Limitations linked to TSA 2008 constraints and international statistical standards' recommended breakdowns of data

As it appears from the discussion in the previous section, associating a share of GHG emissions to resident visitors that use an international air passenger transport service could encounter limitations in a given national statistical system, as illustrated through the example above, if the allocation of environmental flows to those visitors were based on the linking of economic and environmental statistical information only in terms of data from TSA 2008 and SEEA-CF standard tables.

Instead of only using TSA 2008 data as concerns visitor activity, other sources of tourism statistics could be linked to air emissions accounts in order to estimate the share of GHG emissions attributable to visitors. In principle, the available statistics developed according to the International Recommendations for Tourism Statistics 2008 (IRTS 2008) might be suitable for this purpose. In practice, however, even considering this opportunity, probably it cannot be taken for granted that the limitations outlined above could be definitely overcome.

For example, referring again to national cases such as those previously exemplified, for the United Kingdom (Figure 1) – which would be neither the country of departure nor the country of arrival of the international flight – and for all other countries in a similar situation (Figure 2), the breakdown of available data on outbound tourism with regard to expenditure would not necessarily be such as to enable the identification of suitable indicators which, starting from air emissions accounts' data, would allow to apportion the GHG emissions to resident visitors who could use the plane between New York and Paris.

Another important point concerns the fact that a gap in the statistical information available within a given national statistical system could in principle be filled by data that could be available, instead, in another national statistical system.

Referring again to Figure 1, in fact, it is noted that – with a view to estimate the share of aircraft GHG emissions attributable to the outbound visitors of the United Kingdom traveling between New York and Paris – the first step should be to identify this particular sub-set of outbound visitors from all those registered in the official statistics of the United Kingdom for the same reference period as that of their initial departures from the country of residence. Not necessarily, however, the statistical information available in the national statistical system of the United Kingdom could be sufficient to identify these particular outbound visitors, as there would not be a strong recommendation from IRTS 2008 to that effect.
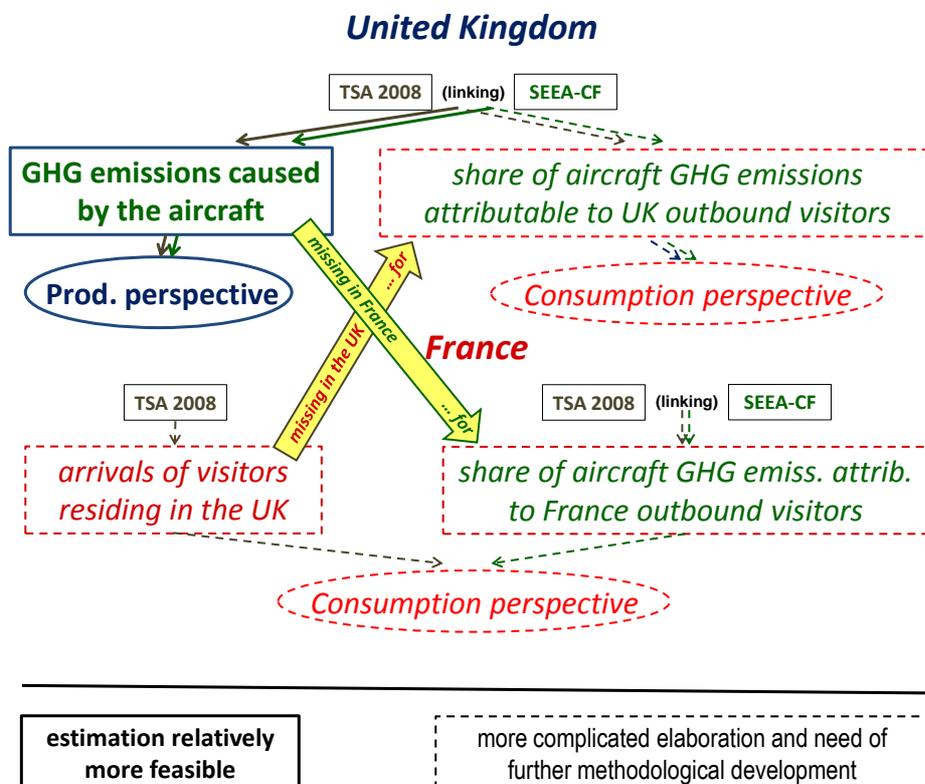
It might be less difficult, instead, for the information at issue to be available perhaps in the national statistical system of the country of arrival of the flight, France in the example. In reality, according to the IRTS 2008 Compilation Guide, the recommended breakdown for

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statistics on inbound tourism with regard to arrivals is by regions of the world from which the trip originates, but this would not prevent France to collect data on the residence of visitors arriving via international air passenger transport services.

Another example concerns the case of the French national statistical system, illustrated in Figure 3 together with that of the national statistical system of the United Kingdom. For France a systematic gap in the available statistical information concerns the aircraft overall GHG emissions from which the share attributable to outbound visitors would be calculated. Three aspects are worth noting: a) this data would be missing in the French official statistics becasue France would not be the country of residence of the enterprise providing the service between New York and Paris; b) at the time of the statistical processing in the French national statistical system, the data on the overall aircraft emissions would not have already been calculated in the national statistical system of the United Kingdom; c) this would happen regardless of whether the calculations in the UK were based on the use of data from tourism satellite accounts or whatever.

Figure 3.   **Connections between data on economic and environmental flows potentially produced by different national statistical systems – United Kingdom, France**

The case of GHG emissions from a British Airways aircraft
traveling between New York and Paris
and carrying visitors that are residents of the UK and of France

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Without continuing with other examples, it appears that the possibility of developing useful specific methods on how to account for the ecological sustainability of international air passenger transport based on the consumption perspective is limited by some constraints deriving from the use of data from tourism satellite accounts and by the fact that no international recommendation calls for national statistical systems to include the country of residence among the characteristics taken into account for data on inbound visitors.

4.2   Exploring further how to make best use of existing data

All the above may suggest that, if there are any margins for the development of further guidelines useful for overcoming the difficulties induced by the complexity of the issue discussed here, such additional methodological guidance could be in terms of details and further specification concerning the basic data to be used. The residence of the visitor would be crucial in this respect.

For the time being it might be appropriate for national statistical systems to explore how best to use basic data that would be available in their respective countries on a regular basis. They could try to improve as much as possible the availability and use of data on visitor activity, possibly extending the scope and breakdowns of their statistics on the use of international air passenger transport services.

Possible achievements in this direction would be useful for the development of sound and relevant statistical estimates of the environmental flows attributable to visitors in relation to their international travel with the airlines.

Each new result should in any case be aligned with IRTS 2008 guidelines. Obviously, in the dissemination or delivery of new statistics, for example to UNWTO, it would be particularly useful to provide the normal metadata and any appropriate description of the methods used, as this new data would be at the forefront of statistical production.

4.3   Statistical processing on a global scale

Several aspects discussed so far highlight the need for a clear transnational statistical perspective and also suggest considering the role that a supranational statistical system can play.

Among initiatives that are linked to the Second International Conference on Climate Change and Tourism (Davos, 1-3 October 2007), a study was commissioned by the World Tourism Organization and the United Nations Environment Programme to address the challenges of climate change for tourism, on the basis for the first time of a global assessment of GHG emissions from tourism related activities[10].

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[10] World Tourism Organization and United Nations Environment Programme (2008): "Climate Change and Tourism - Responding to Global Challenges", Madrid.

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Given limited coverage of the necessary data in the official statistics of individual countries available at that time, a set of tables was prepared – with 2005 as the reference year – for the above evaluation, based on data on tourism volumes worldwide from the UNWTO database and information on air transport provided by the International Civil Aviation Organisation and the International Air transport Association.

The mentioned tables included statistical information on international and domestic visitor trips, in terms of both hard data and estimations and approximations. Together with scientific data[11], this was the information base for measuring the GHG emissions of global tourism, including those from international air transport.

Regarding data quality, a general conclusion was that international comparability was not yet optimal at that time, mainly due to differences in definitions and methods of data collection; furthermore, results were based on a series of hypotheses formulated by the experts. Despite this, one of the strenghts of the study – apart from the great usefulness it actually has had for the debate on climate change and tourism – is the demonstration of the unique role that UNWTO can play for the purposes of a global assessment of GHG emissions from tourism related activities.

In relation to the specific issue concerning the attribution to visitors of GHG emissions associated with international air passenger transport in cases such as those discussed in previous sections, a study published in 2018[12] seems to demonstrate that a global statistical perspective can provide a response to the lack of data at the origin of the problem.

Within the mentioned work an assessment was made, based on the consumption perspective, of the carbon global footprint of visitors for the 2009-2013 period[13]. The use of statistical information based on UNWTO data was crucial, in particular to obtain tourism satellite accounts for more than one hundred and fifty countries[14]. Other essential elements which seem to be of particular interest were the following: the use of UNWTO data on "arrivals of non-resident visitors at national borders by country of residence"; the integration of tourism data into a global multi-region input-output (MRIO) database; the use of a database of GHG emissions; the use of a standard Leontief model; the combination of tourism and GHG emissions data for country pairs.

In the light of the above, it is interesting to focus the role that UNWTO can play in particular to attribute to visitors the GHG emissions associated with international air passenger transport in specific cases such as those object of the discussion in the present document.

In this regard, it is worth noting that SF-MST can be seen as responding to two convergent needs. It aims to promote an adequate organization of statistics suitable for assessments of the sustainability of tourism on a global scale, as would be the case for assessments

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[11] For example, emission factors. Those used to estimate GHG emissions from aviation were based on the figures and a method published by Peeters, P. et al. (2007): "Air Transport Greenhouse Gas Emissions", in Peeters, P. (ed.), *Tourism and Climate Mitigation - Methods, Greenhouse Gas Reductions and Policies* (pp. 29–50), NHTV Academics Studies, No. 6, NHTV, Breda University, Breda.

[12] Lenzen, M. et al. (2018): "The carbon footprint of global tourism". The work referred to in this study was financially supported by the Australian Research Council.

[13] Also the supply chain underpinning tourism was taken into account.

[14] Countries with individual satellite accounts were 55; for the rest, data from UNWTO was used.

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similar e.g. to the studies mentioned above. At the same time, SF-MST should provide guidance for national statistical systems for the organization of data to be used to measure the sustainability of tourism from the perspectives of individual countries.

As concerns countries, although many of them may in the long run become able to make improvements as regards the availability of data necessary for filling gaps such as those illustrated in Figure 3, for the time being the point is that appropriate statistical methods for calculating the GHG emissions at issue based on available basic data might actually not easily be within the reach of individual national statistical systems.

Regardless of possible future improvements[15], a remarkable point is that in principle UNWTO is in a position to consider simmetrically both the origin and the destination of a particular tourist flow that involves a particular pair of countries. In practice, origins and destinations of trips can probably be more easily linked to each other on the basis of data collected through UNWTO international questionnaires once these are filled out by member countries.

A question is then whether or not to try to provide countries with more detailed and stringent directions in SF-MST regarding the allocation of GHG emissions for cases such as those illustrated in Figures 1 to 3, including a recommendation for the collection of information about the residence of the visitor. With such additional recommendations, one would aim to increasingly rely on every single national statistical system as regards the coverage of this particular allocation of GHG emissions.

In this regard, it might be worthwhile to question whether this would be the best solution from an economic point of view for the overall statistical system, in other words whether this option would be preferable, on the basis of considerations of the costs and benefits of a new commitment for member countries that would result from further statistical work that they should develop, compared to the alternative option of relying on centralized work at UNWTO.

5. Concluding remarks

The allocation to visitors of GHG emissions from international air passenger transport is a delicate point to be further clarified before SF-MST is completed with a view to be submitted to the UNSC for adoption as an international statistical standard. The cases where the visitor and the airline do not reside either in the country of departure or in that of arrival of the flight deserve particular attention.

For one reason or another, depending on different cases, relying on statistical information obtained just by linking TSA 2008 and SEEA-CF data would cause limitations to the calculation of the shares of GHG emissions attributable to the resident visitors who use an airline international service. Similar shortcomings may be encountered even where tourism official statistics are based only on IRTS 2008.

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[15] Further developments may also take place in due course with regard to international statistical standards.

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The situation varies depending on countries. The visitor residence is a key aspect in this respect, since it determines whether the visitor is an inbound or an outbound visitor for the country of reference of statistics. Three possible situations can be distinguished for the national statistical system of a given country, depending on whether this is: the country of departure of the international flight; the country of arrival; all other countries. The key point is that in the different national statistical systems the coverage of data that would be necessary for the purposes of estimating the shares of the GHG emissions attributable to resident visitors who use the international air service varies from one country to another.

During past discussions it has been considered, with specific reference to visitors whose country of residence is neither the country of departure nor that of arrival of the international flight on which they are embarked, with the airline residing in the same country of residence of such travelers, that the visitors at issue should be taken into account in the national statistical system of their country of residence. In relation to this point, in the present document it is presumed that there is a general convincement that for the allocation of GHG emissions based on the consumption perspective SF-MST could go beyond the conceptual limitations of TSA 2008. Accordingly, also the resident visitors traveling by air without any contact with the economic territory of reference should be taken into account, notwithstanding the fact that these visitors would be ignored in the estimate of tourism consumption.

A possible approach, therefore, would be that all visitors traveling on international routes, regardless of particular circumstances, should be taken into account in SF-MST and shares of aircraft GHG emissions should be attributed to them as appropriate, based on the consumption perspective. The only relevant circumstance would be the residence of the visitor, in the sense that this territorial reference would determine the national statistical system involved: each national statistical system would account for those visitors that would be residents in the country which is the territorial reference for the statistics produced.

In the light of the possible cases, for which the statistical treatment would vary depending on the country involved, it seems reasonable to consider two main orientations. Further methodological developments could be based on: a) possible improvements at the level of the implementation in member countries of methodologies already defined in the current version SF-MST, with the aim of finding statistical solutions in the different countries for complicated cases of international air passenger transport such as those discussed above; b) preparation by UNWTO of new ad hoc methods for inclusion in SF-MST. In other words, the point would be whether to leave the national statistical institutes with the task of focusing on possible improvements in the use of the available basic statistics concerning tourism flows that may be useful for allocating GHG emissions to visitors or try to complement the current version of SF-MST with further more specific guidance for this purpose.

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