WM3:
Data management and data collection techniques
for sustainable distribution

Data needs and data review for Green Logistics research

Report

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Green Logistics WM3: Data management and data collection techniques for sustainable distribution

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1. **Introduction**

There is a need for an improved data quality, and a constant improvement in data management, not only from the 'applied' point of view of transport policy makers, shippers, logisticians and carriers, but also from the 'fundamental' point of view of research and technology development. Due to its diversity and the fundamental approaches chosen, most of the general problems and difficulties related to data quality and data management in freight transport principally apply for the Green Logistics (GL) project.

For the Green Logistics (GL) project, "A consistent, systematic and comprehensive approach to data collection across the different work modules in the overall work programme is important due to the following issues regarding information on freight and distribution:

1) Data is often incomplete and inconsistent
2) Differences often occur in the units of measurement used
3) Data is often held by many different organisations
4) There is a shortage of data necessary for freight" (GL homepage 2008)

Here some examples to illustrate these four types of difficulties:

1) Looking at the international freight transport, for example, shows that it is difficult to separate the high sea container hinterland transport from and to ports, and the maritime transport of the same container, because the shipment is not the basic unit of the statistics survey, it is the vehicle. Ship and truck move the same container, and the tonnage transported is the same, but the tonnage counts for both trips. There are many examples where the data is either incomplete or inconsistent and there is a need for clarification here.

2) If we consider the carbon footprint problem and its implications for freight transport, it appears that electricity use induce different carbon footprints, depending on the grid, time of the year, and country. Therefore, the transport of import products is not leading to the same carbon footprint per kilometre or per tonne, and there is a great need for harmonisation of transport emissions factors for freight. Like for emissions, standard units are rather clear for UK, but Defra published again 2008 a new set of factors, and a handbook, but these valuable factors are not valid outside of UK. Other units problems needs to be further investigated and workable, transparent solutions will be proposed.

3) Recent studies show that transport CO2 and fuel use data were collected by different organisations, that were applying different survey methods, and leading to big differences in the numbers. Solutions to this problem will be suggested.

4) Looking at original data collection efforts in UK or in Europe, there is little survey work, besides the central statistics looking at a set of about 10-20 indicators, but then, these additional surveys were collecting much more detailed information with up to 1000 indicators. Despite many suggestions in the past, in order to diversify the sources of information and improve the quality of the data collection efforts, most of the freight data available is rather limited in variety, scope, time and space.

The objectives of the Workmodule 3 are therefore:
Consider the opportunity to harmonise the data, indicators, survey design and survey methods for internal use in the green logistics consortium.

Review the available literature and statistics for:
- units
- sources
- existing datasets

Final objective of this work module is to propose some harmonisation solutions for data, units and main sources for future research on green logistics.

The purpose of this intermediate study is to review a first set of harmonisation solutions with the help of a literature collection among GL consortium members, an identification of key problems and potentials, and a proposition to overcome some possible barriers and difficulties on green logistics data use.

2. **Method of this Work Module 3 study**

In order to fulfil these objectives, this study
- works with literature and primary sources
- develops a structure for analysis
- collects among partners the approaches, survey design and survey methods used, in order to:
  - establish common points and differences in a comparative analysis, and finally
  - deduce the solutions.

**Figure 1: Data harmonisation process outline**

```
Analysis of common points & differences
Suggestions for solution

Focus of data collection in green logistics

data of partner 1:
- sources
- main focus
- main outputs
- etc.

data of partner 2

data of partner 3

data of partner 4

data of partner 5

data of partner 6
```
2.1 Reviewed published literature of the 'Green Logistics' consortium members


(bibliography as of 10 Oct. 2008)

* LRN 2008: A. Lyons (Eds) Logistics Research Network 2008 - Conference proceedings, Univ of Liverpool
3. For whom? the actors needs different data

The first problem appears to be the diversity of green logistics and sustainable freight transport solutions. Not only diversity of solutions, but also complexity of approaches, contradictory environmental north-south debates, ubiquity of the carbon and energy problems, multiplicity of actors and intervention levels, all adds to contribute to an overall intransparency of the situation. Therefore, there is a need for a clear structure, when analysing the data needs.

At the OECD/ITF global forum on globalisation, transport and environment, a consensus appears on the fact that sustainable transport, as the most pressing transport policy challenge, has to be developed by multiple solutions paths, even if the establishment of a global carbon trade market is regarded as the most efficient solution.

Since one of the purposes of the green logistics project is to provide adequate data and helpful data management solutions for decision makers, it seems that an orientation towards policy needs is providing a solid structure (chapter 3.1). But, this first structure is not enough, because there is a high diversity of business needs (chapter 3.2: data for businesses) and research approaches that also require a high amount of 'data for research' (chapter 3.2).

3.1 Data for policy makers

Each of the diverse paths for sustainable transport policies have different data needs:

Economic and fiscal policies

Taxes, carbon trade (European carbon Trading System), verification and compliance etc., all the Kyoto related instruments and economic tools need accurate data on fuel use and transport performance. However, the instruments are under development and the freight transport sector is included only in national reporting on total emissions under the Kyoto process. First attempts to include aviation and maritime emissions in the Kyoto reporting system are under way. The needs for data in this field is high. Most of the countries of the world have established special statistics divisions and are reporting to the Climate Convention Secretariat (UNFCCC). Those data include freight emissions at a very aggregated level. The discussion on how to include road freight transport into this reporting system and into a freight transport sector emission reduction commitment is ongoing.

For this type of policy, data sources are well known and generally widely available. More details on economic and policy data are in:

- chapter 4.1 sources for methodologies and data management
- chapter 4.2 energy
- chapter 4.5 international
- chapter 4.6 national.
Laws and regulations

New laws and regulations relevant for freight transport and logistics were developed and applied in recent years. Many discussions are ongoing in order to create and prepare decisions for new rules, in accordance to market needs, standards, or international agreements.

These new rules, laws or regulation principles are either

- promoted and implemented (London congestion charge)
- already implemented but still the subject of some discussion (Euro-Standard for emissions)
- just decided but not implemented (e.g. inclusion of the aviation sector in the EU Emission Trading Scheme)
- politically controversial (Low emission zone, market rules for biofuels etc.)
- or under development (accountability rules and allocation for carbon market caps for transport under Kyoto protocol etc.).

Many opportunities are still open for international, national or local legislation.

For regulatory policy, the quality of data sources is fundamental for the compliance system, but far less central for the part of the work dealing with the development of new rules and regulations. Following sources are relevant:

- Chapter 4.2 energy and CO2
- Chapter 4.3 urban
- Chapter 4.5 international
- Chapter 4.6 national

Local policy

The local authorities needs both economic instruments and regulations, mainly at a practical level, and they also need spatial disaggregated data that applies to their territorial area of influence.

At the city level, all types of Green Logistics data are relevant (Chapters 4.1 to 4.8), except international data that might be less important (Chapter 4.5).

Planning and infrastructure management

Actors like intermodal terminals managers, new rail and port infrastructure developers, congestion and traffic management experts, planning, transport and land use manager needs to have instant access to accurate and up to date data in their daily work. During decision making processes, long term data and prospective trends are used.

Following sources are mostly needed

- Chapter 4.2 energy and CO2
- Chapter 4.3 urban
- Chapter 4.6 national
3.2 Data for businesses

Business data needs are almost exclusively focussed on costs and operational efficiency. Transport performance indicators and fuel use indicators are also widely used (Chapter 4.2), as are data from telematics systems.

One field that develops increasing interest is the carbon footprint analysis (Chapter 4.4). Two main problems for business data is confidentiality and the overwhelming quantity of relevant information and datasets, due to the use of ITC. Both problems determine the need for data management solutions.

For businesses in general, all types of green logistics data sources are potentially relevant (Chapters 4.1 to 4.8). Since most of the companies produces their own datasets, they are interested in exchange and benchmarking.

However, in the field of 'green logistics', benchmarking studies comparing cost and benefits of different solution are quickly facing the dilemma of confidentiality.

Nonetheless, some resources are available to provide benchmarking data. Sources include:

- Academic publications
- The FreightBestPractice programme funded by the DfT
- Reports produced by trade associations such as the Institute of Grocery Distribution, Efficient Consumer Response, Freight Transport Association etc.
- Research and directories by other organisations such as eyefortransport
- The SCOR Model – this now includes a return element and is therefore of relevance to reverse logistics. However, it is not clear if environmental performance measures are included.

One of the challenges for businesses using such data is degree of comparability with the practitioner’s own situation. While broad surveys do enable the company to position themselves, case studies can often be dismissed as not being relevant because of differences in the logistics network to which they are applied.

Obtaining more comparative business studies, including comparable, transparent datasets, is one of the most pressing need for the 'green logistics' field, as it could help to identify and spread beneficial solutions more easily.

It is important to focus on the transferability of these datasets to maintain their usefulness for industry.

3.3 Data for research

Data is needed for answering research questions

Within the ‘green logistics’ community many questions have to be answered with the help of original data, that needs to be produced in the course of the research. This leads to the problem that each study aiming at obtaining a quantitative result may have to produce different datasets, and this increases the problem of diversity.
Do we have a 'green logistics' research community consensus about data management?

Looking at the different publications and sources, there is no contradiction or major opposition between scientists in the way they are dealing with data. It is obvious that differences are to be found in the questions and the methods, but this is not leading - as far as can be observed in the publications mentioned chapter 2.1 - to any fundamental contradiction. Some debate between 'models oriented' and 'experiments oriented' research, or between 'market' and 'regulatory' approaches, might have been suggesting in the past, that some fundamental problems could be thought likely to result in significant problems in data use and applications. Within the Green Logistics project, the different approaches explored so far do not appear to result in major problems.

On the contrary, it seems that the consensus on the main objectives of 'green logistics' research is leading to a recognition of common principles for 'good quality' research methods, such as surveys methods, models, experiments, evaluation etc., and to a core set of key topics, such as fuel use, distance, mode choice, vehicle type, load factor, time windows, delivery patterns, telematics use etc.

Data for models

Models are essential, and quantitative work needs data. Transport model studies were developed since many years, using a very high amount of existing data, like for example governmental statistics or specific surveys, but also leading to very high amount of new available data. All types of sources are in principle relevant for models (Chapters 4.1 - 4.8)

Data for consultancy

Policy makers need consultancy for their decision making processes on transport and environmental fields. All types of sources could become relevant for a policy oriented study (Chapters 4.1 - 4.8)

Data for evaluations

Tests and experimentations needs also to be independently evaluated. Relevant here are following sources:

- Chapter 4.1 data management and methods
- Chapter 4.2 energy and CO₂
- Chapter 4.3 ITS
- Chapter 4.5 international
- Chapter 4.6 national
4. Main data sources for Green Logistics research

The central question of this step is:

- What do we use as the main data sources within the Green Logistics project?

The identified following sources are providing quantitative data, guidance on data management, advice on data collection and surveys, and are all related to green logistics. They are used by the partners in past and present studies. Some of the partners developed original data, documented in the following structured list of data sources. New data management techniques and methods were also developed or commented in previous studies.

The main data sources identified are now on the homepage of the 'greenlogistics.org' site, under WM3 data.

The following structure was developed:

4.1 Data collection methods: research papers and reviews
4.2 National UK transport, energy and CO₂ statistics
4.3 Freight, energy, CO₂, and sustainability
4.4 ITS - Intelligent Transport Systems
4.5 Urban freight and reverse logistics
4.6 Supply chains, energy and freight transport efficiency
4.7 European countries and international transport statistics
4.8 Conversion factors for energy and CO₂

These 'main data sources for Green Logistics research' will be updated on a regular basis.
4.1 **Data collection methods: research papers and reviews**

- J. Allen and M. Browne (2008) *Review of survey techniques used in urban freight studies*
- BESTUFS 2008: *BESTUFS Best Practice in data collection, modelling approaches and application fields for urban commercial transport models*
- A. S. Fowkes and D. H. Johnson (2008), What impact will the economic and social climate have on the growth of rail freight, Presentation at the Adam Smith Institute and Marketforce’s 4th Annual Conference, Brussels, November 2008.
- ISCTSC Working group on urban freight
    Resource paper
  - O recommendations of the workshop (Meyburg, Rooda 2008)
- ISCTSC Working group on long distance freight
  - O McKinnon, Leonardi (2008) *The Collection of Long Distance Road Freight Data in Europe*; Resource paper
  - O recommendations of the workshop (Kochelmann et al 2008)
- *Uncertainties related to freight transport costs and modelling (A literature review)* (2007) GL Literature review reports
4.2 National UK transport, energy and CO2 statistics

- Civil Aviation Authority (2008): UK Airport Statistics
- DfT - Department for Transport (2008): Statistics (data, tables and publications)
- DfT - Department for Transport (2008): Road freight statistics (CSRGT)
- DfT - Department for Transport (2008): Railways; National Rail Travel Survey (NRTS)
4.3 Freight, energy, CO₂, environment and sustainability: surveys, reports and datasets

Heriot-Watt University Logistics Research Centre papers, reports and data collections

- Analysis of Transport Efficiency in UK Supply Chains;
- Analysis of CO₂ from Freight Transport in the UK;
- Key Performance Indicators of Distribution in the Automotive Industry;
- Longer and Heavier Vehicle Project;
- McKinnon: Synchronised Auditing of Truck Utilisation and Energy Efficiency - A Review of the British Government's Transport KPI Programme

Faber Maunsell 2008: Freight best practices programme
http://www.freightbestpractice.org.uk/

- Key Performance Indicators for the Pallet Sector;
- KPIs for Food and Drink Supply Chains;
- KPIs for Non-food Retail Distribution;
- KPIs for the Builders Merchant Sector;
- KPIs for the Food Supply Chain;
- KPIs for the Next-day Parcel Delivery Sector;

EU-projects

- COST 355 WG1 Freight and Energy,
  - vehicle and fleet approach;
  - supply chain approach;
  - transport modeling approach;
  - last mile approach;
  - Final report (2008)
4.4 ITS - Intelligent Transport Systems

Lancaster University Management School


Cardiff University IMRC

- ITeLS project: Integrating Transport and e-Commerce in Logistics Supply Chains
- McCLOSOM project: Mass-customized Collaborative Logistics for Sustainable Manufacture
- Working Papers - Logistics & Operations Management

Faber Maunsell 2008: Freight best practices programme
http://www.freightbestpractice.org.uk/

- IT systems at Marshalls pave the way for operational efficiency
- Operational Efficiency Brings Savings for Yearsley
- The Benefits of Central Supply Chain Management: Corus and TDG
- Wayfinding Research: Using satellite navigation to improve efficiency in the road freight industry
4.5 Urban freight and reverse logistics

University of Westminster (UoW) Transport Studies Group (TSG) selected publications, reports and datasets on urban logistics

- BESTUFS - Best Urban Freight Solutions; European project; http://www.bestufs.net/
  - BESTUFS II (2008): BESTUFS Best Practice in data collection, modelling approaches and application fields for urban commercial transport models;
  - BESTUFS II (2008): Good practice guide on urban freight transport;
  - BESTUFS I (2000): Best urban freight solutions handbook; Statistical data, data acquisition and data analysis regarding urban freight transport;

Recent UoW TSG articles and papers

University of Southampton Transportation Research Group publications, reports and datasets on reverse logistics

- Triantafyllou, M., Cherrett, T (2009) Developing business establishment surveys to understand Reverse logistics processes within a multi-retailer shopping environment. Transportation Research Board Annual Conference, Paper 09-2483, To be presented as part of the Travel Survey Methods Committee (ABJ40) special session on Freight Survey Methodologies.
4.6 Supply chains, energy and freight transport efficiency

- ITeLS project: Integrating Transport and e-Commerce in Logistics Supply Chains

Faber Maunsell 2008: Freight best practices programme
http://www.freightbestpractice.org.uk/
- Consolidate and Save
- Focus on Double Decks
- Heathrow Airport Retail Consolidation Centre
- Jaguar Sprints Forward
- London Construction Consolidation Centre
- Operational Efficiency Brings Savings for Yearsley
- Reducing the environmental impact of distribution: Transco National Logistics
Other organizations

- **Efficient Consumer Response Europe** – includes a project on Sustainable Transport that has a number of very short case studies.
- Eyefortransport – Green Transportation & Logistics Report published in December each year. Includes a directory of providers of ‘Green Logistics’ services.
- Institute of Grocery Distribution – various supply chain reports plus supply chain analysis (Some parts open to subscribers only).
- Road Haulage Association - Carbon Footprint Explained - how to reduce emissions and save money
- **Supply Chain Council** – for more information on the SCOR Model.
4.7 European countries and international transport statistics

European Union and data from European countries

- EEA - European Environmental Agency 2008: Transport - Indicators. Statistics on Freight transport energy, pollutants and CO2; data until 2006
- Eurostat 2008: Transport.
- OECD/ITF - Organisation of Economic Cooperation and Development / International Transport Forum (2008): statistics and data on Europe of 27 and other countries including USA, Canada, Australia, Japan and South Korea
- VTT (2008): LIPASTO Calculation system for traffic emissions and energy consumption; Finland system on traffic and freight emission data collection

United Nations and sub-organizations


International maritime transport


International aviation

4.8 Conversion factors for energy and CO$_2$

The documents below provide data essential for all other sectors.


5. **Data, indicators and units: collection among consortium partners**

Data and Indicators were extracted from the 2 main publications of the partners (list in Chapter 2.1). In many cases, own quantitative data were presented as result of the investigation. Authors are presenting original data values on these following indicators.

**Table 1: Structured list of data, indicators and units, represented in partners publications** (10 Oct 2008)

<table>
<thead>
<tr>
<th>1) KPI</th>
<th>Unit/ definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle fill</td>
<td>degree of loading against actual capacity by weight by volume or by unit loads carried.</td>
</tr>
<tr>
<td>Empty running</td>
<td>in absolute terms the relocation of empty vehicles, but including legs where returns and packaging were carried.</td>
</tr>
<tr>
<td>Time utilisation</td>
<td>measured by seven categories of use, including being loaded or running on the road</td>
</tr>
<tr>
<td>Deviations from schedule</td>
<td>covering any delay deemed to be significant, with causes such as congestion en route or waiting at delivery point</td>
</tr>
<tr>
<td>Fuel consumption</td>
<td>actual fuel used, correlated to factors such as loading and airflow management equipment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2) Transport and logistics</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic data</td>
<td></td>
</tr>
<tr>
<td>Tonnage</td>
<td>tonnes</td>
</tr>
<tr>
<td>Vehicle-km</td>
<td>km</td>
</tr>
<tr>
<td>Tonne-kilometres</td>
<td>tkm</td>
</tr>
<tr>
<td>Mean load (tkm/km)</td>
<td>t</td>
</tr>
<tr>
<td>Distance travelled, length of haul</td>
<td>km/delivery</td>
</tr>
<tr>
<td>Detailed data</td>
<td></td>
</tr>
<tr>
<td>Distance</td>
<td></td>
</tr>
<tr>
<td>Km/HGV</td>
<td>km</td>
</tr>
<tr>
<td>Km/car</td>
<td>km</td>
</tr>
<tr>
<td>Vehicle miles involving a drop or delivery</td>
<td>miles</td>
</tr>
<tr>
<td>Changes in the number of vehicle kilometres</td>
<td>%</td>
</tr>
<tr>
<td>Load</td>
<td></td>
</tr>
<tr>
<td>Tonnes distributed</td>
<td>t</td>
</tr>
<tr>
<td>Tonnage by road</td>
<td>t</td>
</tr>
<tr>
<td>Volume of delivery/consignment of trip</td>
<td>m³, nb of pallets, cages, parcels</td>
</tr>
<tr>
<td>Delivered tonnage daily</td>
<td>t</td>
</tr>
<tr>
<td>Total weight</td>
<td>t</td>
</tr>
<tr>
<td>Carrying capacity, payload</td>
<td>t</td>
</tr>
<tr>
<td>% of km run empty</td>
<td>%</td>
</tr>
<tr>
<td>Vehicle load factor</td>
<td>% by weight or by volume</td>
</tr>
<tr>
<td>Deliveries characteristics</td>
<td></td>
</tr>
<tr>
<td>Goods delivered per delivery point</td>
<td>N° of pallets, cages, parcels</td>
</tr>
<tr>
<td><strong>Handling factor (nb of load/unload per shipment)</strong></td>
<td>N°(N° = number)</td>
</tr>
<tr>
<td>----------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td><strong>Number of vehicle trips/ deliveries/ collections</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Number of stops</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Number of deliveries</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Number of delivery rounds</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Number of deliveries per round</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Vehicle trips made loaded</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Number of deliveries daily</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Vehicle numbers</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Number of lorries/year</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Number of HGVs/hour</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Changes in the number of vehicle trips</strong></td>
<td>%</td>
</tr>
<tr>
<td><strong>Changes in the number of vehicles</strong></td>
<td>%</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Vehicle hours</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Loading/unloading time</strong></td>
<td>hours, hours/day, % of trip time</td>
</tr>
<tr>
<td><strong>Travel time</strong></td>
<td>hours, hours/day, % of trip time</td>
</tr>
<tr>
<td><strong>Delay time</strong></td>
<td>hours, % or total trip time</td>
</tr>
<tr>
<td><strong>Time window for delivery</strong></td>
<td>hours, minutes</td>
</tr>
<tr>
<td><strong>Changes in parking time and frequency</strong></td>
<td>%</td>
</tr>
<tr>
<td><strong>Changes in travel time</strong></td>
<td>%</td>
</tr>
<tr>
<td><strong>Average speed of vehicles</strong></td>
<td>km/h</td>
</tr>
<tr>
<td><strong>Road freight per head of population</strong></td>
<td>t</td>
</tr>
<tr>
<td><strong>Modes/Fleet</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Artics</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Rigid lorry</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Van</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Car</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Motorcycle</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Bicycle</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Pedestrian</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Shipping</strong></td>
<td>N°</td>
</tr>
<tr>
<td><strong>Rail</strong></td>
<td>N°</td>
</tr>
</tbody>
</table>

3) **Supply chain, consumer trip and carbon footprint**

| **Type of product, goods**                         | Units |
| **Type of production/ storage / transport / shop** |      |
| **Tonnage of production/ storage / transport / shop** | tonnes |
| **Energy used per tonne of product**               | MJ/t  |
| **Consumer buying trip load**                      | kg    |
| **Consumer buying trip distance**                  | km    |
| **% of shopping trips made by car**                | %     |
| **% of trips where shopping is the single purpose** | %     |
| **Energy used per kg of product**                  | goe/kg |
| **CO₂ emission per kg product**                    | gCO₂eq/kg |
### 4) Economy

#### Business types

<table>
<thead>
<tr>
<th>Business type</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food retail</td>
<td>Nb</td>
</tr>
<tr>
<td>Clothing retail</td>
<td>Nb</td>
</tr>
<tr>
<td>Other retail</td>
<td>Nb</td>
</tr>
<tr>
<td>Restaurant</td>
<td>Nb</td>
</tr>
<tr>
<td>Public House</td>
<td>Nb</td>
</tr>
<tr>
<td>Hotel</td>
<td>Nb</td>
</tr>
<tr>
<td>Banks</td>
<td>Nb</td>
</tr>
<tr>
<td>Other Services</td>
<td>Nb</td>
</tr>
<tr>
<td>Warehousing</td>
<td>Nb</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Nb</td>
</tr>
<tr>
<td>Personal Services</td>
<td>Nb</td>
</tr>
</tbody>
</table>

#### Business characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees</td>
<td>Nb</td>
</tr>
<tr>
<td>Hire and reward</td>
<td>Nb or %</td>
</tr>
<tr>
<td>Own account</td>
<td>Nb or %</td>
</tr>
</tbody>
</table>

#### Costs

<table>
<thead>
<tr>
<th>Cost</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total logistics costs</td>
<td>£</td>
</tr>
<tr>
<td>Logistics costs per item/kg</td>
<td>£/kg</td>
</tr>
<tr>
<td>Changes in logistics costs</td>
<td>%/a</td>
</tr>
<tr>
<td>Transport costs</td>
<td>£</td>
</tr>
<tr>
<td>Changes in transport costs</td>
<td>%</td>
</tr>
<tr>
<td>Vehicle operating costs</td>
<td>£</td>
</tr>
<tr>
<td>Changes in operating costs</td>
<td>%</td>
</tr>
<tr>
<td>Costs of fuel</td>
<td>£/l; £/gal.</td>
</tr>
<tr>
<td>Costs of one tonne CO₂</td>
<td>£/t or €/t or $/t</td>
</tr>
</tbody>
</table>

### 5) Policy

#### Units

<table>
<thead>
<tr>
<th>Unit</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restriction zones</td>
<td>Scale</td>
</tr>
<tr>
<td>Clean vehicles</td>
<td>Emission class</td>
</tr>
<tr>
<td>Coordinated transport: Consolidation etc.</td>
<td>T.B.A., Vehicles per day</td>
</tr>
<tr>
<td>Congestion mitigation</td>
<td>Vehicle per hours, total hours</td>
</tr>
<tr>
<td>Charging</td>
<td>£, Vehicles per day</td>
</tr>
<tr>
<td>Information systems</td>
<td>T.B.A. (to be agreed)</td>
</tr>
<tr>
<td>Public private partnership</td>
<td>T.B.A. Progress reports</td>
</tr>
</tbody>
</table>

### 6) Impacts: Pollutants

#### Units

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₂</td>
<td>kg</td>
</tr>
<tr>
<td>CO₂</td>
<td>t</td>
</tr>
<tr>
<td>CO</td>
<td>kg</td>
</tr>
<tr>
<td>HC</td>
<td>kg</td>
</tr>
<tr>
<td>NOₓ</td>
<td>kg</td>
</tr>
<tr>
<td>PM</td>
<td>ppm</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>ppm</td>
</tr>
<tr>
<td>7) Energy and CO₂</td>
<td>Units</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Total fuel use (litres or gallons)</td>
<td>litre, gallon</td>
</tr>
<tr>
<td>Changes in the total fuel use</td>
<td>%</td>
</tr>
<tr>
<td>Energy use</td>
<td>GJ, kWh</td>
</tr>
<tr>
<td>Fuel consumption efficiency</td>
<td>mpg, l/100km</td>
</tr>
<tr>
<td>Fuel intensity of transport</td>
<td>l/tkm</td>
</tr>
<tr>
<td>Total CO₂ emissions</td>
<td>kg CO₂</td>
</tr>
<tr>
<td>CO₂ intensity</td>
<td>gCO₂/tkm</td>
</tr>
<tr>
<td>Changes in vehicle emissions</td>
<td>%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8) Networks/traffic</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road arcs</td>
<td>Nb</td>
</tr>
<tr>
<td>Road nodes</td>
<td>Nb</td>
</tr>
<tr>
<td>Distances</td>
<td>km</td>
</tr>
<tr>
<td>Travel time</td>
<td>h / mn</td>
</tr>
<tr>
<td>Time windows for delivery</td>
<td>hh:mn - hh:mn</td>
</tr>
</tbody>
</table>
6. **Intermediate conclusion**

**Differences and possible inconsistency in the methods?**

Of course, major difference are prevailing in the approaches and survey methods. One partner focuses on calculations and use existing datasets, another prefers direct data collection through interview and company questionnaires to produce its own 'primary' dataset, and the next study is mainly consisting in comparative data analysis. All are equally valid, depending on their objectives.

**No major problems detected in existing approaches**

Looking at the different publications and sources, there is no contradiction or major opposition between scientists in the way they are dealing with data. It is obvious that differences are to be found in the questions and the methods, but this is not leading - as far as can be observed in the publications mentioned chapter 2.1 - to any fundamental contradiction. Some debate between 'models oriented' and 'experiments oriented' research, or between 'market' and 'regulatory' approaches, might have been suggesting in the past, that some fundamental problems could be thought likely to result in significant problems in data use and applications. Within the Green Logistics project, the different approaches explored so far do not appear to result in major problems.

**Common principles and key topics for data collection and management**

On the contrary, it seems that the consensus on the main objectives of 'green logistics' research is leading to a recognition of common principles for 'good quality' research methods, such as surveys methods, models, experiments, evaluation etc., and to a core set of key topics, such as fuel use, distance, mode choice, vehicle type, load factor, time windows, delivery patterns, telematics use etc.
ANNEXE:

Reminder on the purpose of Green Logistics WM3

'Data management and data collection techniques for sustainable distribution'

Objective

This is a cross-project work module concerned with surveys and other data collection techniques required within the project. The objective of this module is to ensure that data collection techniques applied in the programme are compatible and closely coordinated. This will permit pooling of data across the consortium and minimise the data collection burden on companies participating in the surveys.

A consistent, systematic and comprehensive approach to data collection across the different work modules in the overall work programme is important due to the following issues regarding information on freight and distribution:

* Data is often incomplete and inconsistent
* Differences often occur in the units of measurement used
* Data is often held by many different organisations
* There is a shortage of data necessary for freight