Institution: Heriot-Watt University

Unit of Assessment: C19: Business and Management Studies

Title of case study: Decarbonisation Of Freight Transport

1. Summary of the impact (indicative maximum 100 words)

Research undertaken by the LRC on 'low carbon logistics' has informed UK government policy on the environmental impact of freight transport, altered the official method used in the UK to carbon audit road freight transport operations, provided guidance to industry on the measurement and management of freight-related CO_2 emissions and resulted in the establishment of the first industry and government-endorsed target for cutting the carbon intensity of road freight transport.

2. Underpinning research (indicative maximum 500 words)

The research team comprised Professor McKinnon (in post throughout the period) and Dr Piecyk who joined the team in 2006.

Heriot-Watt University has been undertaking research on the environmental impacts of logistics (i.e. all the activities associated with the movement, storage and handling of goods) since the early 1990s initially supported by an EPSRC grant. One of the early outputs of this research was an analytical framework for assessing the extent to which, at a country level, logistics-related externalities could be decoupled from economic output. This framework was subsequently adopted and refined by two large EU-funded projects in which HWU participated (REDEFINE and SULOGTRA) and applied in reports prepared for the UK Commission for Integrated Transport, set up to provide independent advice to the UK government, and the International Transport Forum (part of the OECD with around 30 countries affiliated). It was further developed, over the period 2007-2009, into a 'freight decarbonisation model' during the EPSRC-funded Green Logistics project and operationalised as a forecasting tool. This model is based on a series of eight key parameters: average length of haul, handling factor, modal split, proportion of empty running, load factor, fuel efficiency and carbon intensity of the energy consumed. This tool was used, with empirical data collected from focus groups and a large online questionnaire survey, to predict the level of CO2 emissions from UK road freight transport in 2020 (Piecyk and McKinnon, 2010) and to construct a series of road freight – CO2 scenarios for 2050 (McKinnon and Piecyk, 2009b).

In the course of the Green Logistics project, related research was conducted on the measurement of CO2 emissions from road haulage operations at both macro- and micro-levels. This reviewed the various approaches and methodologies that had been applied and discovered significant discrepancies in macro-level estimates quoted by different UK government departments and agencies (McKinnon and Piecyk, 2009a). The research examined the causes of these discrepancies and recommended the adoption of a new approach. Research conducted at the micro-level examined the ways in which individual companies could measure carbon emissions from their logistics operations and the feasibility of carbon foot printing individual products on an end-to-end supply chain basis. This involved writing case studies with particular companies and discussions with organisations that have developed carbon measurement methodologies and reporting standards (McKinnon and Piecyk, 2010). This research revealed wide differences in the methods and carbon intensity values that companies were using for logistical activities and cast serious doubt on the practicality and benefit of product-level carbon auditing (McKinnon, 2010). The Green Logistics project also included a comparative carbon audit of the online and conventional retail channels for books. This work was conducted by Dr. Julia Edwards, Dr. Sharon Cullinane and Professor McKinnon. This showed that, on the basis of mid-range estimates, the carbon intensity of online retailing / home delivery was significantly lower than that of conventional store-based retailing (Edwards, McKinnon and Cullinane, 2010).

3. References to the research (indicative maximum of six references)

[1] McKinnon, A.C. and Piecyk, M. (2009a) 'Measurement of CO2 Emissions from Road Freight Transport: A Review of UK Experience.' Energy Policy, 37 DOI: 10.1016/j.enpol.2009.07.007

[2] McKinnon, A.C. and Piecyk, M. (2009b) 'Logistics 2050: Moving Goods by Road in a Very Low Carbon World' in Sweeney, E. (ed.) 'Supply Chain Management in a Volatile World' Blackrock Publishing, Dublin. Available on request.

[3] McKinnon, A.C. (2010) 'Product-level Carbon Auditing of Supply Chains: Environmental Imperative or Wasteful Distraction?' International Journal of Physical Distribution and Logistics Management, 40 DOI: 10.1108/09600031011018037

[4] Edwards, J.B., McKinnon, A.C. and Cullinane, S. (2010) 'Comparative Analysis of the Carbon Footprints of Conventional and Online Retailing: A 'Last Mile' Perspective' International Journal of Physical Distribution and Logistics Management, 40, 1 DOI: 10.1108/09600031011018055

[5] Piecyk, M.I. and McKinnon, A.C. (2010) 'Forecasting the Carbon Footprint of Road Freight Transport in 2020' International Journal of Production Economics, 128, 1, 31-42 DOI: 10.1016/j.ijpe.2009.08.027

[6] McKinnon, A.C. and Piecyk, M. (2010) 'Measuring and Managing CO2 Emissions in European Chemical Transport' Cefic, Brussels. http://www.cefic.org/Documents/IndustrySupport/Transport-and-Logistics/Sustainable%20Logistics/McKinnon%20Report%20Transport%20GHG%20emissions%2024.01.11.pdf

Research grants:
[G1] EPSRC EP/D043328/1 £2,115,625 (PI Dr Whiteing at Leeds University, £465,754 share to HWU) 'Green Logistics' 2006 -2010)
[G2] EPSRC EP/C10R00003 £21,650, 'Pathways to Impact award (PIA)' 2010-2011. (supplemented by payment from FTA))

4. Details of the impact (indicative maximum 750 words)

Our research on CO_2 emissions from freight transport has impacted on government policy and industrial practices in three ways:

1. Measurement of CO_2 emissions from freight transport:

1.1 Macro-level:

The underpinning research formed the basis of a report written by Prof McKinnon in 2007 for the Commission for Integrated Transport (CfIT) on 'CO_2 emissions from freight transport in the UK'. This was the first study to carbon footprint the UK freight transport system and construct decarbonisation scenarios for the freight sector. In the course of this work, it was discovered that the figures quoted for CO_2 emissions from road freight transport in several government publications were much higher those calculated using data from the government's own 'Continuing Survey of Road Goods Transport' (CSRGT). This was acknowledged in CfIT's summary report on Transport and Climate Change: 'trend emission figures for lorries and vans can vary by a factor of 3' (p.24). As part of the EPSRC-funded Green Logistics project, McKinnon and Piecyk (2009a) then reviewed the various data sets, approaches and methodologies in an effort to explain why the discrepancies has arisen. They recommended that in future empirical data derived from the CSRGT, rather than laboratory test data, be used to carbon footprint road freight operations. The method used by AEA Technology to compile CO_2 data for road freight transport for the National Atmospheric Emissions Inventory (http://naei.defra.gov.uk/) was subsequently changed to incorporate CSRGT data and the CO_2 estimates for road freight revised downwards by a factor of three. This indicated that the decarbonisation of the road freight sector would be less difficult than originally thought and not require the introduction of stringent policy measures.

1.2 Micro-level:

Our research on the comparison of the carbon footprints of online and conventional retailing is quoted by Amazon.com

http://www.amazon.com/b/ref=gw_m_b_corpres?ie=UTF8&node=13786321 and the UK online retailer Scotts of Stow as evidence that online retailing is better for the environment. The results of our research on the practicality and benefit of product-level carbon auditing of supply chains has been used internally by companies such as Procter and Gamble [S2] and Diageo to support their argument that they should not be compelled by retailers or legislators to put carbon labels on all their products. We were also invited by the European Council for the Chemical Industry (Cefic) [S2] to provide their member companies with guidance on how to measure CO_2 emissions from their transport operations. http://www.cefic.org/Industry-support/Transport--logistics/Best-Practice-Guidelines1/General-Guidelines-/ The report that we prepared for them (McKinnon and Piecyk, 2010) included industry-specific carbon intensity values for all the main freight transport modes and these are now widely used by chemical companies. Our report also formed the basis of a manual that Cefic prepared giving member companies guidance on how to calculate their freight-related CO_2 emissions (Cefic, 2010). These guidelines are now applied by many large European chemical companies.

2. Forecasting future trends in CO_2 emissions from road freight transport

The 'freight decarbonisation' framework and model have been used by the Dept for Transport (DfT), Dept of Energy and Climate Change (DECC) and the Committee on Climate Change (CCC) to forecast future trends in CO_2 emissions from freight transport and map pathways for their reduction. In its 2008 policy document on 'Delivering a Sustainable Transport System: A Logistics Perspective' the DfT outlined the results of a Delphi survey which we conducted to forecast business-as-usual freight-related CO_2 trends up to 2020 (p.36). These results were subsequently reported in Piecyk and McKinnon (2010). We also used the freight decarbonisation model to determine how the UK road freight system would have to change to meet the CO_2 reduction target enshrined in the 2008 Climate Change Act (80% reduction by 2050 against a 1990 base line) (McKinnon and Piecyk, 2009b). This study became an integral part of DECC's '2050 Pathways Analysis' as acknowledged its July 2010 report: 'For domestic freight transport activity the levels have been based on DfT baseline projections, rolled out to future years, combined with similar work undertaken by Heriot-Watt University' (p.69). Both our 2020 forecasts and 2050 scenario analysis were used by the CCC in the derivation of its Fourth Carbon Budget as acknowledged on page 188 of its 2010 report[S10] Committee on Climate Change (2010) http://www.theccc.org.uk/reports/fourth-carbon-budget 'Fourth Carbon Budget Report.' This built on an earlier paper that Prof McKinnon prepared for the CCC on the future trend in CO_2 emissions from freight transport. http://www.theccc.org.uk/publication/building-a-low-carbon-economy-the-uks-contribution-to-tackling-climate-change-2/ This advice was incorporated into the CCC's first report entitled 'Building a Low Carbon Economy' (2008).

3. Reducing CO_2 Emissions from Freight Transport

In 2010 the Freight Transport Association (FTA) (representing 12,000 users and providers of logistics services in the UK) established a Logistics Carbon Reduction Scheme (LCRS) to help and encourage member companies to cut their freight-related CO_2 emissions. With the support of an EPSRC 'Pathways to Impact Award (PIA)', we have closely worked with the FTA to adapt our freight decarbonisation model to the needs of the LCRS. A version of the model was used to derive a target for reducing the carbon intensity of freight transport between 2010 and 2015. This target was declared in the 1st annual report of the LCRS and subsequently endorsed by the UK government. To the best of our knowledge this is the world's first industry-government target for cutting the carbon intensity of freight transport. Scheme members collectively committed to an 8 per cent reduction in the carbon intensity of freight operations by 2015 compared to 2010. We have also converted our original spread sheet model into a software tool that companies can use to determine how they can meet this target. This 'carbon intervention modelling tool', which was developed in association with the FTA [S5] and DfT, can be downloaded free-of-charge from the FTA website and is being widely used by LCRS and over 85 companies to assess the potential savings in CO_2 emissions from applying a range of 38 measures to their freight transport operations covering 61,000 commercial vehicles. Most of these measures reduce the distance travelled and / or fuel consumed, thereby cutting costs as well as carbon emissions.

5. Sources to corroborate the impact (indicative maximum of 10 references)

[S1] Head of Logistics in Cefic will confirm that the research provided the basis of a manual that Cefic prepared giving member companies guidance on how to calculate their freight-related CO2 emissions (Cefic, 2010).

[S2] Head of Supply Network Innovation Centre, Brussels, Procter and Gamble will corroborate the application of the guidelines based on the report that prepared for Cefic in 2010, which included industry-specific carbon intensity values for all the main freight transport modes and that these are now widely used by chemical companies

[S3] Economic Adviser at the Department of Transport will confirm the adoption and endorsement of the freight decarbonisation model and that version of the model was used to derive a target for reducing the carbon intensity of freight transport between 2010 and 2015. This target was declared in the 1st annual report of the LCRS and subsequently endorsed by the UK government.

[S4] Analyst at the Committee on Climate Change the 'freight decarbonisation' framework and model have been used by the Dept for Transport (DfT), Dept of Energy and Climate Change (DECC) and the Committee on Climate Change (CCC) to forecast future trends in CO_2 emissions from freight transport and map pathways for their reduction.

[S5] MD for Policy and Communications, Freight Transport Association will confirm that we have closely worked with the FTA to adapt our freight decarbonisation model to the needs of the LCRS. A version of the model was used to derive a target for reducing the carbon intensity of freight transport between 2010 and 2015 and will be able to report progress against target.

[S6] Commission for Integrated Transport (2007) 'Transport and Climate Change' http://webarchive.nationalarchives.gov.uk/20110304132839/http://cfit.independent.gov.uk/pubs/2007/climatechange/index.htm

[S7] Cefic (2010) 'Guidelines for Measuring and Managing CO_2 Emission from Freight Transport Operations' http://www.cefic.org/Industry-support/Transport--logistics/Best-Practice-Guidelines1/General-Guidelines-/

[S8] Dept for Energy and Climate Change (2010) '2050 Carbon Pathway Analysis' http://www.decc.gov.uk/assets/decc/what%20we%20do/a%20low%20carbon%20uk/2050/216-2050-pathways-analysis-report.pdf

[S9] Freight Transport Association (2011) 'Logistics Carbon Reduction Scheme: first annual report' http://www.fta.co.uk/export/sites/fta/galleries/downloads/logistics_carbon_reduction_scheme/lcrs_annual_report.pdf