



SUPPLY CHAIN SUSTAINABILITY AND RISK – A BEST PRACTICE ASSESSMENT TOOL

Authored by Professor Alan Braithwaite, Jeremy Hammant, Daniel Knivett and Paul Farrell - presented at the 14th Annual Logistics Research Network Conference, Cardiff Business School, Cardiff University, September 2009

SECTION 1 – Introduction

Over the last 40 years global supply chains have evolved to create and sustain growth and demand through their economic scale; delivering both lower costs and superior value. Without doubt this has contributed to global warming, pollution, environmental damage and longer term material shortages. It has also generated deep social concerns about the ethics of working conditions, child labour and economic exploitation. Finally, it has created systematic supply chain volatility and risk. The Brundtland Report (1987) recognised that economic development taking place today could no longer compromise the development needs of future generations. This concept of sustainable development aimed to encourage people to reflect on the harm economic development was having on both the environment and on society.

These issues have emerged because costs have been optimised along the supply chain for the short term, without recognition of the long term implications and cost to the environment, material availability and social welfare. The ethics of taking more out of our planet than can be replaced is now a profound concern to consumers and political leaders alike. There is a realisation that our patterns of production and consumption are causing irreversible damage to the globally linked social, economic and ecological systems. The full dynamics of these risks are difficult to understand and predict, but people have come to realise instinctively that humanity cannot sustain its current way of life. Failure to adapt and respond may lead eventually to dire consequences, including social division and conflict, an inability to maintain customary levels of supply and wealth, and the potential for environmental destruction.

A survey by Populus, published in the Times on the 26th December 2008 (Populus), found that 60% of respondents would try to buy the most ethical and environmentally friendly products that they could. The other 40% will look for the best value for money regardless of source. This balance had not shifted by a statistically significant amount from previous months, notwithstanding the economic conditions at the time which might have been expected to drive a search for better value.

The survey succinctly puts the core question behind the term 'sustainability' value today or long term regulation of our activities to leave a better legacy for our planetary heirs? While consumers are in a clear majority for the long

a thought leadership White Paper

term legacy choice, the dichotomy for political and business leaders is huge. They are wrestling with conflicting priorities including short term electability, continued office, annual bonuses and shareholder dividends versus an undefined meltdown - %ome time in the future+.

Faced with this conflict, it should not be surprising that progress has been rather slow in creating a combined regulatory and corporate response to the question of sustainability. The goals, measures and status for individuals are based on the historic values of every increasing disposable wealth and free market economics. The perceived risk of change is one of first mover disadvantage adopting the new rules and scoring system while the majority are still playing to the old ones. However, changes to the rules are becoming established in the form of public accountability through Corporate Social Responsibility (CSR) standards and government commitments and charges to arrest climate change. The new rules are being set and companies are having to learn how to respond to them.

The skills of supply chain management have a major role to play in both corporate and governmental adjustments to deliver a sustainable future. Supply chain management is built on the core concept of minimising the end-to-end cost of the chain and / or maximising its service performance by balancing the activities between the actors along the chain.

The mathematical concept of an objective function for the total system is embedded in supply chain thinking. In the past the end-to-end optimisation was often done with no recognition of the cost of returns, recoveries, replacement and environmental damage, inter alia. Because the company did not pay for such costs and they were not easy to value economically, they were out of the picture. The conclusion is therefore that if society elects to change the objective function by putting a cost on the creation of emissions, depletion of materials, recovery of waste, and fair treatment for developing nations then supply chains will be reconfigured to a new and more sustainable balance.

The tools that can support the achievement of this new balance are already defined, but not yet widely developed or applied. The right tools can create an end-to-end picture of time, cost, sustainability and risk. They can enable supply chain designers to look beyond their own organisation and test the impacts of alternative product design, sourcing, logistics and customer service. Looking beyond is the key term; our experience is that this process of understanding the extended chain always identifies substantial potential to redefine the chain and save cost and improve sustainability.

This paper describes a methodology and model for capturing and assessing the sustainability and risk profile of supply chains. The authors, working at LCP Consulting, have taken the experience from prior work and developed a computer based tool to support organisations in assessing the sustainability and risk of their supply chains and then identifying areas of opportunity and the requirement for resilience.

Section two provides a brief reminder of some key references in the literature. Section three provides observations on the identification of supply chain sustainability and risk issues. Section four describes the model and section five details the requirements for further work to establish this approach as a standard.

SECTION 2 - Literature Review

The literature is crowded with commentary on sustainability, with a particular focus on climate change and the need to reduce CO₂ emissions. In 2006 the British Government commissioned Stern (2006) to review the economic impact of climate change; he concluded that sustainability was still a practical goal. He reported that the choice between being rich and dirty or clean and green was avoidable; we can be green and rich enough. Later in the same year, the Department for Transport published an independent review (Eddington) of transport policy and has since published a discussion paper 'Towards a sustainable transport system' which outlines the options for change. In recent years many manufacturing, retail and logistics businesses have been working on initiatives to reduce CO₂ emissions.

However, the sustainability debate is far wider than this and its origins can be traced back to 1987 and the Brundtland Report. This recognised that economic development taking place today could no longer compromise the development needs of future generations. Building upon this, the Rio Earth Summit in 1992 represented a major step forward towards the goal of achieving sustainability, with international agreements made on climate change, forests and biodiversity. Out of the Earth Summit came the United Nations Agenda 21 (UN 1993), a blueprint for sustainability in the 21st century. By championing the concept of sustainable development, Agenda 21 provides a framework for tackling today's social and environmental problems, including air pollution, deforestation, biodiversity loss, health, overpopulation, poverty, energy consumption, waste production and transport issues. Agenda 21 requires each country to draw up a national strategy of sustainable development. The UK strategy follows Agenda 21 and sets out a vision of sustainable development based on social equality, environmental protection, conservation and preservation of natural resource and maintenance of high employment and economic growth.

This paper is not a review of the work already undertaken on sustainability but starts from the position that this is a pressing threat to 21st century way of life.

Similarly, much has been written in recent years about the need to identify and manage supply chain risks. Research conducted in the second half of 2001 by the Cranfield Centre for Logistics and Supply Chain Management (CCLSM) provided an exploratory insight into Supply Chain Vulnerabilities on behalf of the DTLR, DTI and Home Office (Cranfield School of Management 2002). It concluded: 'many organisations currently lack an awareness of the need to consider the resilience of their supply chains as part of their overall approach to risk and business continuity management'. Beyond that, the research concluded that 'a number of tools should be provided to assist organisations, large and small, in the identification and management of supply chain risks.'

One of the results of this research was the identification of the need to provide both large and small companies with a methodology to identify supply chain vulnerability. In essence the need is for a simple approach for companies to enable them to think about the key questions but without major overhead: to get risk and vulnerability onto the agenda. The Supply Chain Vulnerability Self Assessment Workbook (LCP Consulting 2003) was developed in order to address this requirement. The structure and methodology contained in the workbook were used as the starting point for the development of the assessment tool outlined in Section 4.

SECTION 3 – Identifying Supply Chain Sustainability and Risk Issues

The term 'sustainability' can mean different things to different people and is a term increasing prevalent in a company's vocabulary. In the context of this paper, it encompasses the three areas of environmental, economic and social sustainability (see Figure 1). Sustainable development can be seen as an attempt to achieve a balance between the environmental, the social and the economic.

Thus if we can achieve a balance between environmental and social priorities, we can have a healthier world; if we can balance economic needs with environmental limitations we become more efficient; if we address the imbalances between society and economics, we get a fairer world. If we can get all three in better balance and we become more sustainable.

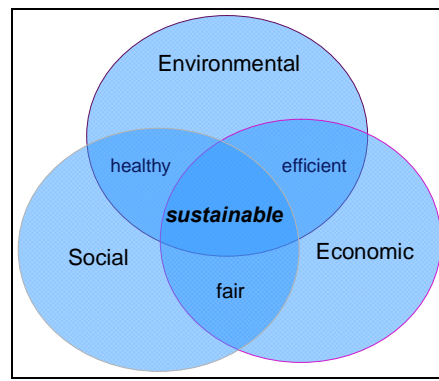


Figure 1: Sustainability model

The global sourcing of products and raw materials from the best supplier base around the world, and the capacity to reach into new markets to achieve business growth, create major new challenges; both in terms of sustainability and risk. Supply chains that comprise hundreds or possibly thousands of companies, extending over several tiers and across several continents, harbour innumerable risks. For each of the organisations that make up these global supply chains there are many types of risk that can threaten business continuity. A key challenge is the need to identify and address supply chain risks in a systematic way with a consideration of not only the economic impacts of the risk but also the wider sustainability implications.

This is a huge and complex problem, which starts with the intrinsic vulnerability of the supply chain (its exposure to risks) and its resilience to the various risks that it may encounter (ability to ride the shocks). Risk may be experienced as a result of risk drivers that are either internal or external to the company. This idea is illustrated in Figure 2.

a thought leadership White Paper

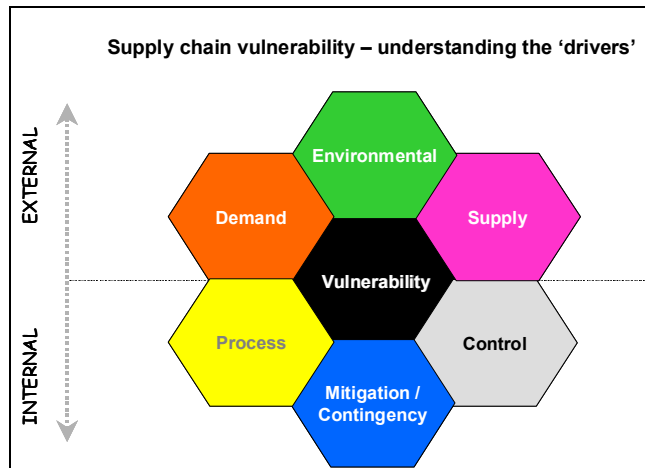


Figure 2: External and Internal Vulnerability Drivers

The external drivers are the risk areas that are most commonly thought of by managers. This is for exactly the reason that they are external and therefore may be perceived as unmanageable. The risks of unpredictable demand, unreliable supply and the effects of external shocks in the business, social and climatic environment are all the areas that we use as scapegoats for unexpected outcomes.

The internal drivers of process, control and mitigation / contingency are more tightly under the direction of the business itself and are therefore less obvious as being sources of vulnerability.

This paper will not describe the risk drivers illustrated in Figure 2; these are fully explored in the aforementioned Supply Chain Vulnerability Self Assessment Workbook.

There are many types of risk in the end-to-end supply chain and their characteristics, in terms of probability and severity, will vary greatly. Risk will be sensitive to the context of the business, its markets and its position in the chain. The permutations and combinations of risk are such that few generalisations will apply. However, directors and managers will need to make complex choices about the exposure to risk that they will tolerate as against the exposure they will buy-off. Different organisations will take different approaches and will have different levels of appetite for tolerating risk.

The traditional approach to thinking about supply chain risk has been to consider only the financial implications associated with the risk: the loss of revenue from availability failures; the additional costs of emergency shipments; the additional capital costs of holding extra inventory etc. However, as consumers increasingly focus on environmental and social sustainability then organisations must look beyond their traditional focus on economic sustainability. Businesses are beginning to respond to these consumer demands by developing a wider focus on:

Economic development. Promoting profits, creating jobs, attracting customers, reducing costs, anticipating and managing long-term risks, and fostering long-term competitiveness.

a thought leadership White Paper

Environmental stewardship. Conserving energy and resources, consuming more renewable and less-polluting energy, increasing recycling, minimizing packaging and reducing the carbon footprint.

Social well-being. Improving labor standards and conditions, enhancing communities and creating and delivering socially responsible products and services.

This means that the traditional approach to assessing risk, in terms of the financial impact on the business, must be widened to include an assessment of the wider environmental and social impacts. However, the starting point for supply chain risk assessment remains the same: the identification of all potential risks. A risk that is visible may be managed, minimised and even eliminated; an unseen risk is far more dangerous, only allowing itself to be tackled when having perhaps occurred to its full effect. Pinpointing all of the areas of risk that a firm may face is likely to be a difficult task. What is required is a methodology to help organisations identify supply chain risks as precursor for prioritising them in terms of both financial and sustainability impacts and then developing an appropriate response.

SECTION 4 - The Supply Chain Sustainability and Risk tool

In response to this requirement LCP Consulting have developed a computer-based tool based on the framework and qualitative scoring approach first used in the Supply Chain Vulnerability Self Assessment Workbook+. The workbook is focused on risks that cause disruption to the supply chain; the key development in the tool is the expansion to incorporate the consideration of the company's sustainable development. This includes considering a risk's impact on the company's environmental and social sustainability, and also identifying sustainable development risks. This ensures the full scope of sustainability is included in the review of the end-to-end supply chain.

A four stage approach is applied using the tool to guide the company through the identification and assessment of risks across the supply chain and their impact on the company's sustainable development.

The first stage in the process is to describe and map the supply chains. A company may operate multiple discrete supply chains and each of these can be identified in the mapping stage and each one should be assessed separately. A retail company, for example, may want to conduct a separate analysis for different food temperature bands or store types. The tool includes an automated mapping capability that allows the company to map the end-to-end supply chain(s). This provides a visual representation that allows each part of the business to understand how the whole supply chain interacts. This approach is adopted within two of LCP Consulting's proprietary tools, Cost-to-Serve® and Carbon-to-Serve®, to enable companies to consider the full end-to-end scope of the supply chain. Over the years, LCP Consulting has devoted considerable effort to creating a standard framework for supply chain visualization using mapping (Figure 3). This builds on the identification, by Hines (1999) and Christopher (2005), of mapping as a critical skill in the redesign of supply chains. The value in this approach has been proven through a wide range of supply chain management projects for its ability to create the discussion necessary to identify co-operative step changes in overall performance.

a thought leadership White Paper

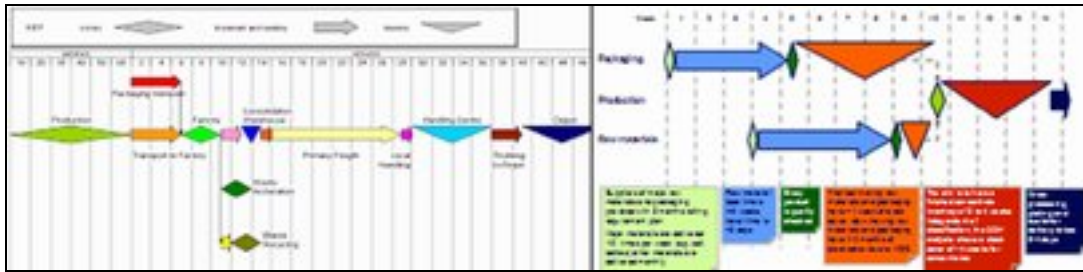


Figure 3: Examples of Supply Chain Mapping

Having mapped the supply chain the next stage in the process is to identify and assess risks. The tool classifies the risk drivers into the six different elements: three external drivers (demand, supply, environment); and three internal (process, control, mitigation/contingency). For each risk driver, there are a set of typical risks and assessment criteria built into the tool that the company should consider and test themselves against. There is the flexibility to add further risks as they are identified for the particular supply chain being analysed. To support the identification and assessment of risks there is a set of typical sustainability issues and potential implications built into the tool. The real challenge to companies in addressing the broad issue of sustainability is to understand how the less traditional areas of environmental and social sustainability relate to its business. This tool provides tangible paradigms to support the company in understanding and assessing sustainability in the context of supply chain management. It facilitates the questioning on issues like ethical sourcing, product carbon intensity and the use of the earth's natural resources.

The tool supports a structured process to identify where the business is most exposed to risk. This process is designed to both identify and calibrate the severity potential for the specific types of risk - internal and external. It does not attempt to elicit the probability of a risk happening. The nature of risks is that they are infrequent and to some extent unexpected. Our experience is that the challenge of quantifying the chance that a risk will happen is an impossible one.

Calibration is based on the potential exposure of the business to the risk, where appropriate offset by the existence of operational measures or market place conditions (if any) that will mitigate the risk. Calibration is based on a simple 0,1,2 format corresponding to: none, some, significant. The mitigation offset is based on the reverse format of 0,1,2 meaning: significant, some, none and this is used as a multiplier to enable the user to classify the relative risk. This means that a highly significant risk with no mitigation offset gets a value of 2 times 2 = 4. At the end of this process the most significant risks from each area of the supply chain can be assembled and ranked. Figure 4 illustrates an example of two risks identified by a company and ranked based on the severity of the risk and the level of mitigation offset.

a thought leadership White Paper

| Risk | Impact | Likelihood | Risk Rating | Mitigation Actions | Responsible Parties | Timeline | Status | Updated Rating |
|--|--------|------------|-------------|--|-------------------------|----------|-------------|----------------|
| Supply chain disruption due to natural disasters | High | Medium | High | Develop contingency plans, diversify suppliers | Operations, Procurement | Q3 2009 | Completed | Medium |
| Raw material price volatility | Medium | High | High | Long-term contracts, hedging | Finance, Procurement | Ongoing | In Progress | Medium |

Figure 4: Identify and assess the risks

For the list of significant risks, the third stage in the process is to evaluate the implications of these relatively high-risk ratings. This is a four-step process that places a value on the size of the risk, (in terms of its financial and wider sustainability impacts), its estimated duration before it is likely that it can be corrected, the recovery actions that will be needed and the indicative cost of that recovery. Completing these implication evaluations is the most judgemental part of the whole process as it relies on knowledge of the firm, its customers and suppliers. For many organisations this will be the first time that they have really considered the scope of the end-to-end supply chain.

The assessment of the implication of the risk is supported by the built-in list of sustainability implications that can raise the company's understanding of sustainability in a supply chain context. This enables the company to make an informed judgement of the potential impact of the risk on the sustainability issues identified. In addition, any risk that may impact on carbon emissions can be evaluated using LCP Consulting's Carbon-to-Serve® tool. The methodology behind Carbon-to-Serve® is covered in depth in a previous paper published by Braithwaite and Knivett (2008). The tool can be used to calculate the base case carbon emissions for a supply chain for comparison with various scenarios; thus informing the carbon scale of the risk to be evaluated. The process ensures that the risks are fully explored in terms of their potential sustainability impacts as well as more traditional cost and revenue implications.

At the end of this process it is possible to see the importance of the risk from Stage 2 in the workbook against the scale of the exposure and the cost to fix. A simple ranking of the most critical vulnerabilities in the chain for which there is no mitigation or contingency becomes available as a result of this analysis. Figure 5 shows the example from Figure 4, progressed to this point.

a thought leadership White Paper

The screenshot shows a software interface with a table. The title is 'Evaluating Implications'. The table has several columns, including 'Risk', 'Impact', 'Likelihood', 'Mitigation', and 'Contingency'. The rows contain data for various risks, with some cells highlighted in red or green.

Figure 5: Evaluate the implications

The ranked list of critical vulnerabilities becomes the input to the final stage, which is to identify potential actions to reduce risk: in terms of either contingency planning on resources or mitigation measures by design. By this time, the user can expect that the appropriate mitigation measures or contingency plans will be self evident; but there will be a need for informed debate on these measures and the extent to which the business can afford to invest in mitigation now or contingency planning and capabilities for the future. So the final step in the process is to prepare a list of actions and an estimate of the associated costs to mitigate or provide contingency. This is illustrated in Figure 6 below.

The screenshot shows a software interface with a table. The title is 'Identifying Actions'. The table has several columns, including 'Risk', 'Action', 'Cost', 'Impact', and 'Likelihood'. The rows contain data for various risks and actions, with some cells highlighted in red or green.

Figure 6: Identify potential actions to reduce risk

At the conclusion of this stage, the firm will have a documented and agreed list of supply chain risks that has been narrowed to areas for priority focus and appropriate actions flagged and estimated. This will allow the business to make some initial judgements on where to focus their risk management efforts and resources in the chain. It may be that the analysis exposes some uncertainties which the company should address further with more detailed analysis. But the conclusion should be a rapid and valuable first step to taking an end-to-end view of the risk and vulnerability and the potential implications for environmental and social sustainability as well as the financial impacts.

a thought leadership White Paper

SECTION 5 - Conclusions

Supply chains that comprise hundreds or possibly thousands of companies, extending over several tiers and across several continents, harbour innumerable risks. For each of the organisations that make up these global supply chains there are many types of risk that can threaten business continuity . both in financial terms and increasingly also from the social and environmental perspectives. While a company that has planned may be to some extent forewarned it may still have proved impossibly costly to become forearmed by putting in place contingency arrangements against very low probabilities. But at least this will have been a positive choice against a background of knowledge rather than the event coming as a complete surprise, if, or when, it does occur.

From our experience of using the tool we have noted some common questions that are raised by all organisations that have been through the process:

What opportunities exist to limit the exposure of our supply chains to social and environmental risks and to future supply-demand imbalances?

Will the opportunities affect our suppliers' operations, purchased inputs, internal operations, commodity production, commodities, packaging, distribution, or logistics?

In which sourcing categories do we need to prepare for major supply-demand imbalances in the future . especially given the impending peak oil production point?

What are the risks and implications of the eco-footprint left by our global suppliers and low-cost sources? Are there exploitable opportunities for the supply chain to help the firm meet existing market demand in new ways or to create and meet new demand?

Which business partner reliably offers access to innovations that foster sustainability?

What will be the implications on the organisation's carbon footprint of alternative supply sources and transportation modes?

Whilst the answers are different for every company it is true to say that for many organisations this is the first time that such issues will have been raised let alone addressed. However, increasingly the best companies view sustainability not only as a chance to contribute to social goals, but also as a powerful source of competitive advantage. Improving sustainability allows them to cut costs, create new products and demands, avoid long-term ills and give their firms an edge over less-sustainable companies. To move from a superficial gloss to a profound commitment, companies need to incorporate socially responsible values into their supply chains. Only then will sustainability drive decision making.

a thought leadership White Paper

References

- Bruntland, G. (ed.) (1987), *Our Common Future: Report of the World Commission on Environment and Development*, Oxford: Oxford University Press ISBN 0-19-282080-X. Available at <http://www.worldinbalance.net/agreements/1987-brundtland.php>
- Braithwaite, A and Knivett, D (2008), *Evaluating a supply chain's carbon footprint – a methodology and case example of Carbon-to-Serve*, LRN Conference 2008. Available at <http://www.lcpconsulting.com/thought-leadership/going-green/carbon-footprint>
- Populus Limited (2008), *Concerned Consumers Summary – December 2008*. Available at http://populuslimited.com/uploads/download_pdf-151208-Concerned-Consumer-Index.pdf
- Stern, N. (2006), *Stern Review on the Economics of Climate Change* Available at: http://www.hm-treasury.gov.uk/stern_review_report.htm
- Eddington, R (2006), *The Eddington Transport Study* Available at: www.dft.gov.uk/about/strategy/transportstrategy/eddingtontstudy/
- Agenda 21: Earth Summit - The United Nations Programme of Action from Rio (1993). ISBN 13: 9789211005097 Available at <http://www.unep.org/Documents.Multilingual/Default.asp?documentID=52> and <http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21toc.htm>
- LCP Consulting (2003), in conjunction with Cranfield Centre of Logistics and Supply Chain Management, sponsored by the Department of Transport, *Supply Chain Vulnerability Self Assessment Workbook* ISBN 1 861941 03 X
- Cranfield School of Management (2002), *Supply Chain Vulnerability* Final Report on behalf of DTLR, DTI and Home Office
- Braithwaite, A (2003), *The Supply Chain Risk of Global Sourcing* LCP Consulting White Paper
- Christopher, M (1985), *The Strategy of Distribution Management*, Gower: Aldershot
- Hines, P, (1999), *Value Stream Mapping*, Financial Times/Prentice Hall.
- Christopher, M (2005), *Logistics and Supply Chain Management*, 3rd edition, Financial Times/Prentice Hall.
- Braithwaite, A and Wilding, R (2006), *Untangling Sourcing and Transactions*, Financial Times
- Gattorna, J (2006), *Living Supply Chains*, Financial Times/Prentice Hall
- Hammant, J (2000), *From Vertical Integration to Virtual Integration*, Enterprise Integration (The Journal of the UK Council for Electronic Business) pp. 4-7
- Singhal, V and Hendricks, K (2005), *An Empirical Analysis of the Effect of Supply Chain Disruptions on Long-Run Stock Price Performance and Equity Risk of the Firm*, Production and Operations Management, Spring 2005

About LCP Consulting

LCP Consulting is a leading specialist in customer-driven supply chain management. With over 20 years experience in the field, we identify where supply chains make major contributions to how businesses operate profitably and compete effectively. We support businesses review, re-design and implement changes to their end-to-end operations. Our fact-based diagnostics pin point exactly where & how to cut costs, enhance operational efficiency and invest for the future.

LCP Consulting is a member of the Green Logistics Consultants Group, which is an international collaborative network of supply chain consultants who focus on improving the environmental performance of supply chains.

Head Office:
LCP Consulting
The Stables
Ashlyns Hall
Chesham Road
Berkhamsted
Hertfordshire
HP4 2ST
UK
Telephone: +44 (0) 1442 872298

info@lcpconsulting.com

For more information please visit

www.lcpconsulting.com

