

Manchester PBL Scenarios : In Detail

Appendix 3.5: The Exercises

WHEELS

Author: Helen Dobson

1. Aspects of Sustainable Development to be explored:

- Institutional/corporate attitudes to sustainable development
- Perspectives of different stakeholders (customers, employees, consultants)
- Sustainability definitions, tools and techniques

2. Professional Activities to be practised:

- Understand and challenge a project brief
- Research data sources to find information
- Apply critical thinking to analyse information, compare options and make decisions based on incomplete data
- Produce an output within a limited timescale

3. Ability/Skills to be developed:

- Planning a complex task
- Communication within a team
- Negotiation within a team

4. The role which the student group is to adopt:

Graduate engineers/scientists working in the SHE (Safety, Health and Environment) Department of a small European tyre manufacturing company.

5. The task to be addressed, on behalf of whom:

The output requested is an email response of up to 500 words, recommending sustainability initiatives for the company to pursue, on behalf of the SHE Department.

6. Outline information for the task:

The students will be given a consultants letter that includes keywords relating to specific sustainable development tools they may wish to investigate. Other material can be provided on demand from the Facilitator if the students can justify their need. The Facilitators will also be provided with a list of internet links.

7. **MEQ Question:** Sustainable development for a manufacturing company.

8. Place in the sequence of exercises

First

9. Location

Europe, Manufacturing Industry

10. Brief

Your team is employed by a tyre manufacturing company (Tyres'r'us) in the Safety, Health and Environment (SHE) Department. Your team leader has just received the following email from Site Manager, on behalf of the company Chairman, following the Annual General Meeting of shareholders.

Given that your role is to promote sustainability for your organisation, please provide a suitable response by the date stated in the email. Your response should be submitted by email to your group

Facilitator as a Word document attachment, along with a list of references your group has used in your research.

**Email Message to Safety, Health and Environment (SHE) Manager,
Tyres'r'us Company Ltd.**

From: alex.smith@trus.co.uk
To: chris.kahn@trus.co.uk
Subject: Sustainable Development
Date: 31st January 2007

Chris,

Sorry to spring this on you, but I have just returned from a meeting with the Company's shareholders. They are insisting we take action urgently regarding evaluating and reporting the sustainability of our site.

As SHE Manager, this is clearly part of your remit, but we can bring other Section Heads on board if you think necessary. Some money has been set aside in our 2007 budget to do this, but how much resource we should be spending on this exercise isn't yet clear, and as you know, any project requiring significant time or funding will have to be justified to senior management to gain approval prior to work being started.

There are several options we could pursue and please find enclosed a letter from a consultant suggesting some techniques. We do not have the budget to employ an external consultant, but would like your team to investigate these initiatives and recommend what we should carry out as an in-house project, bearing in mind we have limited time and resources to devote to this.

I will need an answer in time for a meeting first thing Monday morning, 12th February, so please email your response to me by then. Keep it concise - no more than one side of A4, and we can then discuss in more detail at our next team meeting.

Best Regards, Alex
TRUS Site Manager

SHELTER

Author: Grahame McDougall

1. Aspects of Sustainable Development to be explored:

- Impact of natural disasters on communities in short and long term
- Requirement for co-operation between stakeholders
- Requirement for infrastructure and logistic systems
- Cultural and other differences (e.g. between developed and developing world and between different World regions)
- Requirement for design to be appropriate to end user and maintainable and robust if it is to be sustainable.

2. Professional Activities to be practised:

- Understand a project brief
- Research data sources to find information
- Apply critical thinking to analyse information
- Develop a strategy
- Produce an output within a limited timescale

3. Ability/Skills to be developed:

- Planning a complex task
- Communication within a team
- Negotiation within a team
- Seeking relevant information from, and implementing information received from, key external sources.

4. The role which the student group is to adopt:

A team of facilitators, acting as a conduit between the design industry and the humanitarian world.

5. The task to be addressed, on behalf of whom:

The output requested is a written report of up to 1000 words, to be presented to representatives of UK aid agencies, industries and the United Nations.

6. Outline information for the task:

The students will be given brief and two maps. Other material including photographs and organisational structures can be provided on demand from the Facilitator. The facilitators will also be provided with a list of internet links.

7. MEQ Question: Island severe flooding

8. Place in the sequence of exercises

Second

9. Location

Overseas

10. Brief

On 8th October 2005, eleven-year-old Amina was sitting in school. "When I noticed my fountain pen rattling on the desk I quickly ran outside," recalls Amina. Twenty of her classmates were less fortunate and unable to save themselves. In the district where the girl lives, over 211 schools suddenly ceased to exist, destroying or seriously damaging a total of 6000 schools. Overall, 73,000 lives were lost due to the earthquake and around 3 million people were made homeless in the Kashmir areas of Pakistan and India. International aid was swift and generous, but made difficult by the rapid onset of winter. With logistics provided by the military, much was done to save lives by the simple provision of tents and

tarpaulins, but longer-term assistance is required to help the population rebuild their communities and infrastructure, whilst providing medium-term solid shelter (transitional accommodation) from the extreme sub-Himalayan weather.

You are a team of 'facilitators', working with international aid agency *Design for Humanity*, acting essentially as a conduit between the design industry and the humanitarian world. You are a multi-disciplinary team whose aim would be to assess the situation on the ground and, with the help of the following:

- Local community groups
- Local police and security forces
- Army and other military personnel
- Aid agencies and charities - both at organisational level and in the field
- Non-governmental organisations (UN, UNHCR, ICRC, etc.)
- Designers
- Manufacturers
- Other organisations (including health organisations and food charities)

....to develop a strategy to provide suitable transitional accommodation (housing, schools, clinics, etc).

It is vitally important that all issues of sustainability are taken into account, and a realistic balance is achieved between emerging technologies and the constructional methodologies traditional in the area. Take account of potential transport difficulties, severe shortages of skilled labour and building expertise, as well as the availability of potentially suitable building materials. It is worthy of note, at this point, that many of the collapsed buildings were of 'modern' in-situ concrete construction - unfortunately, often with inadequate reinforcement. Also, many of the surviving buildings were of locally traditional construction - namely, stone walls, with timber posts and beams built into the structures. This, it seems, provided adequate flexibility to withstand the seismic upheaval.

You are to analyse possible alternative approaches and propose an environmentally sound and sustainable strategy for the construction of buildings, listed above. Achieve a realistic and workable balance between international aid and local skills and manpower. Make a reasoned proposal for a technological strategy which, if employed, would facilitate the creation of sustainable and safe buildings, and act as the building blocks of a longer-term rebuilding of communities.

Note: This is not a physical design exercise. Do not attempt to design any buildings. Instead, design an appropriate and workable strategy based on best current knowledge. Any such strategy must be workable, sustainable, affordable in both the short and longer terms, and should propose appropriate activity networks for all potential participants (local and international). Present your analysis and proposals as a 1000 word A4 report. Your ideas will be presented in due course to representatives from UK aid agencies, industries and the United Nations.

RULES

Author: Carolyn Abbott

1. Aspects of Sustainable Development to be explored:

- Main impacts of high tech products at different stages of the life cycle (environmental, social and economic)
- Implementing change via legislation
- The process of implementation of EU Directives by Member States
 - Different forms of regulation
 - Impact and costs to small companies of changes to environmental regulations
- Impacts of change along the supply chain

2. Professional Activities to be practised:

- Understand a project brief
- Research data sources to find information
- Apply critical thinking to analyse information
- Produce written communication appropriate to specific audiences
- Produce an output within a limited timescale

3. Ability/Skills to be developed:

- Planning a task
- Communication within a team
- Written communication

4. The role which the student group is to adopt:

A group of employees of the Environment Agency (England and Wales)

5. The task to be addressed, on behalf of whom:

The outputs requested are:

- Task 1: Produce a briefing note for SMEs (Small and Medium sized Enterprises)
- Task 2: Produce a press release
- Task 3: Identify impact on other sectors in the supply chain

6. Outline information for the task:

The students will be given a briefing letter, with attached article from the Environmental Trade press, and a list of relevant links. The Facilitators will also have a small selection of additional press articles to give to the students, if the students can justify why they should receive this information.

7. MEQ Question: Batteries Directive

8. Place in the sequence of exercises

Third

9. Location

England

10. Brief

Your team is employed by the **Environment Agency** (England and Wales), and has been presented with the following project.

Please provide a suitable response by 9am Monday 12th March. Your response should be submitted by email to your group Facilitator as a Word document attachment, along with a list of references your group has used in your research on a separate page.

TASK 1: PRODUCE A BRIEFING NOTE FOR SMEs

As you are aware, one of the priorities of our organisation is to identify impacts of regulatory instruments on SMEs (small and medium sized enterprises).

We have been asked to provide a concise industry briefing on the impact of the recent European Directives affecting the electronics industry, for the benefit of SMEs in that sector. This is of particular importance given that the attached article has raised concerns over how these directives are being perceived.

Please produce a 500 word briefing note targeted at SMEs involved in the manufacturing of electronic equipment and components. Ensure you include the key actions SMEs may need to take to comply with new regulations and standards, and reference existing documents in the public domain where appropriate.

TASK 2: PRODUCE A PRESS RELEASE

In addition, please prepare a press release of up to two pages to send to media outlets to inform the trade press of the intended benefits of recent and impending changes.

Your press release should explain clearly (i) how the negative life cycle impacts of electronics manufacturing activities are being addressed by the combined impact of these directives, and (ii) why the particular forms of regulation that have been chosen are the most appropriate in each case.

TASK 3: IDENTIFY IMPACT ON OTHER SECTORS IN THE SUPPLY CHAIN

Other businesses may also be affected indirectly by these directives, for example, because they use electronic components in their manufacturing, are reliant on products that may change, or need to dispose of waste electrical or electronic goods. Please identify other key industrial sectors and stakeholders at risk of being impacted by these directives, who may need to be informed of likely changes.

Best Regards,

Environment Agency Team Leader

ENERGY

Author: Tony Sung

1. Aspects of Sustainable Development to be explored:

- Implementing change through introduction of new technology
- Barriers to new technologies, including social and economic factors
- Use of renewable energy generation: wind, solar and geothermal power
- Impact of legislation and standards on sustainability of housing design
- Assessing viability of novel technologies

Secondary Aspects to be explored

- Energy and heat conservation
- Conflict between urban dwellings as status symbols and environmental impact
- Appropriate housing design for local conditions
- Capture, storage and reuse of rainwater and water

2. Professional Activities to be practised:

- Understand a project brief
- Research data sources to find information
- Apply cost-benefit analysis to inform decision making
- Apply critical thinking to analyse information
- Apply creative ideas to develop alternative strategies
- Produce an output within a limited timescale

3. Ability/Skills to be developed:

- Communication within a team
- Negotiation within a team
- Carrying out detailed analysis
- Preparing a presentation

4. The role which the student group is to adopt:

A specialist environmental housing consultancy team

5. The task to be addressed, on behalf of whom:

A PowerPoint presentation including annotated notes.

6. Outline information for the task:

The students will be given the scenario and a schematic of a current Eco-house design; together with full installation costs and energy efficiency measures from CLG and email links. The Facilitators will be provided with a list of internet links and relevant factsheets.

7. MEQ Question: An evaluation of single-hose grey-water systems.

8. Place in the sequence of exercises

Fourth

9. Location

Manchester, England

10. Brief

You are a team of consultants for a specialist environmental housing consultancy "Perma". Perma has been contracted by a UK house builder to make recommendations on improving the sustainability of the house builder's next project. Perma's expertise is in innovative housing design based on sustainable ecological, permaculture, environmental and social principles.

Perma's client has been appointed to create a new community housing development in West Gorton, on a 128-acre area close to the city centre. The house builder will be working closely with New East Manchester Ltd and the New East Manchester Housing Regeneration local community to develop a masterplan for the regeneration of the area.

Dear Consultant Team,

In April 2007, the UK Government will publish a new "Code for a Sustainable Home" that will be implemented by house builders in the country on a voluntary basis. We want to be one step ahead of our competitors and so are considering introducing renewable energy micro-generation facilities and energy efficiency measures in our next phase of new built homes.

We are aware that several of our competitors have already been studying renewable energy technologies in a range of their new homes. (Please watch the promotional video which Barratt's have produced). However, we are unsure of the applicability, performance, costs, benefits and risks of incorporating these systems, and we believe there may be alternative options that would be more effective in the long term.

Please produce a PowerPoint presentation summarising the key factors we should be aware of to enable the company to make an informed decision about whether we should or should not incorporate microenergy generation technologies and alternative energy efficiency measures in our forthcoming community housing development in West Gorton. Please ensure you include environmental, economic and social aspects in your analysis. Any alternative suggestions you can provide for other means of improving our new build homes in line with the new Government Standards will also be of benefit to us as we are making our final decision on this development.

Your presentation could include a brief summary of

- any relevant government regulations, industry standards, and recommended codes of practice and best practice guidance documents,
- estimated cost of installing an optimum set of renewable technologies,
- information about technology viability,
- an analysis of the possible environmental, social and economic costs, benefits and risks in the short and long term (taking into account of the expectations of our customers),
- a table which ranks the order of the technologies showing key pros and cons in separate columns,
- any recommended alternative strategies we could apply to make our homes more sustainable.

We have a deadline approaching to submit our proposals to New East Manchester Ltd. I look forward to receiving your PowerPoint presentation with annotated notes for our Board of Director's meeting.

Yours truly,
Mrs Building Technical Director

Exercise 2

Eco-funerals: is there a greener way to go?

Dear Consultancy Team,

The Co-operative Group is a unique business democratically run by members to meet their common needs and aspirations. Instead of blindly chasing profits, as businesses controlled by shareholders are sometimes accused of doing, we aim to steer our business in a more responsible direction. We are also amongst the world's leading businesses tackling climate change. Co-operative Funeralcare has become one of the country's leading funeral directors because of the high quality of care we deliver. We have helped generations of families through difficult times, providing care, support and reassurance when it matters most.

Around 500,000 deaths are registered annually in England and Wales. We suspect that there may be growing consumer demand for funeral arrangements that are more environmentally friendly. On average, 70% of people who die in the UK are cremated and this results in a significant amount of green house gas emissions and accounts for 16% of the UK's mercury pollution. The Natural Death Centre "gives support on family-organised and environmentally-friendly funerals and runs the Association Natural Burial Grounds". Co-operative Funeralcare is considering what the environmental benefits would be of offering eco-funerals as a mainstream option to the bereaved, what format this service might take, and whether it would be financially viable for both our customers and investors.

Having first identified the major environmental impacts associated with traditional funeral procedures of cremation or burial, we would like you to produce a series of presentation slides that could be presented in about 30 minutes, fully referenced and with *brief* accompanying notes pages, outlining the different alternatives currently available for "greener" funerals in the UK and around the world. These can range from simply replacing wooden coffins with more biodegradable alternatives, to more unusual methods of disposal such as the "freeze drying with liquid nitrogen" process mentioned in the attached Guardian news article. Please summarise the social (ethical), environmental and economic implications of a shortlist of what you consider to be the most promising of these practices. Highlight any legal restrictions that we should be aware of and assess the long term sustainability of the practice and factors that would impact on the feasibility of extending this practice to other parts of the world.

Introducing changes to accepted funeral practices is likely to be difficult and the recently bereaved can be particularly sensitive and emotional clients. Research has shown that in their interaction with the bereaved, funeral directors may even become the recipients of anger, as part of the natural grieving process. Given that much of funeral practice is rooted in strong tradition, religious beliefs and culture, and respect is key to the service we offer, what would be your strategy to take account of differing cultural perspectives in offering your proposal as an alternative to a traditional funeral? How would you pilot the scheme? Which organisations or individuals would you aim to collaborate with as part of your process of gaining acceptance for a new funeral practice?

To make your proposals clear to our management team, we would like you to prepare a mock up of a leaflet that could be shown to the bereaved in order to inform them of the options that are available under your new arrangements.

Please submit an electronic copy and hard copy of your presentation slides (in Powerpoint format, with brief Powerpoint notes-pages suitable to be used as a handout for the audience) and leaflet by 10am on Wednesday 9th March. All references should be shown in full as footnotes on the slides, as well as being listed on a separate slide at the end of your presentation.

Useful Links (Tested November 2011)

The Economist "Green Funerals - Exit Strategies" <http://www.economist.com/node/17043348>

The Guardian, Tuesday 18 October 2005

Should I ... be buried or cremated?

Leo Hickman's guide to a good death

It's better to burn out than fade away. Kurt Cobain clearly thought so, quoting this famous Neil Young lyric in his suicide note, but then he obviously wasn't referring to the issue of greenhouse-gas emissions when it comes to the somewhat thorny cremation v burial debate.

For most environmentalists, it's actually better to fade away than burn out. Our lives, they say, already result in enough gratuitous combusting of fossil fuels. Much better, in death, to compost down as nature intended.

According to the Federation of British Cremation Authorities, there were 424,956 cremations held in the UK in 2004. This figure represents 70.8% of all deaths. Consider that a cremator needs to operate at 760-1150C for 75 minutes per cremation and it's easy to see how much energy is required. In fact, a cremator uses about 285 kiloWatt hours of gas and 15kWh of electricity on average per cremation - roughly the same domestic energy demands as a single person for an entire month.

Aside from the considerable amount of greenhouse gas emissions this creates, cremation is also responsible for 16% of the UK's mercury pollution (via our dental fillings), according to the Environment Agency. The industry has been told that all 650 crematoria must halve mercury emissions by 2012, but, ironically, one way to do this is to cremate at a higher temperature, thereby leading to more emissions.

Then there are the materials used to make a coffin. Wooden coffins are either made from solid oak or pine, or more likely (89%, in fact) from veneered chipboard, which is bonded with a formaldehyde resin. All of which, of course, will end up being burnt and entering the atmosphere.

But these materials also enter the ground if burial is the preferred option, as do embalming chemicals - also formaldehyde-based - which can, over time, enter the watercourse. So even in death we're not let off the hook when it comes to considering our environmental impact.

So what to do? Burial at sea might seem a logical eco option, but the authorities generally frown on us choosing to become fishfood: just 50 or so non-navy sea burials are granted each year for the UK's three licenced locations (Newhaven, Sussex; The Needles, Isle of Wight; and Tynemouth, Northumberland). However, woodland burials are becoming an increasingly popular option, as is the use of fully biodegradable coffins. There are now about 200 woodland burial sites in the UK (see www.naturaldeath.org.uk) which offer families an alternative to cemeteries or crematoria. Managed either privately (often by a farmer) or by a local authority, these burial sites are left unmarked or are marked by the planting of a tree or wild flowers. Any coffin used must be made from a fully biodegradable material such as cardboard or wicker, or a cloth or drape can be used instead.

While many find much comfort in this naturally-minded option, there is a question about just how sustainable it can be to offer everyone who can afford it their own piece of pristine woodland in perpetuity. One of the reasons cremation superseded burials in the UK was because available space had greatly diminished over the decades. After all, the post-war drive to get more people to consider cremation included the slogan "Save the land for the living". Recognising the continuing pressure for space, a House of Commons select committee inquiry into cemeteries in 2001 urged for multi-burials to take place in the same site. It seems this taboo will have to be broken before a truly sustainable burial option is found in this country.

Eco alternatives to burial and cremation are still being sought. Just last week, a Swedish town made headlines when it announced it was set to try freeze-drying its dead into brittle, compostable remains using liquid nitrogen. And solar-powered crematoria have been proposed to help save the millions of tonnes of wood burnt each year cremating India's dead. But while we wait to learn whether these are viable options, it seems that being buried in a modest, fully biodegradable coffin remains the option that is least harmful to the environment.

Manchester PBL Scenario

University of Manchester
Skills for Sustainability and Social Responsibility
Briefing date: 08/03/2011

Exercise 3

Your team of consultants has won a contract with the business development section of an international agriscience corporation and your group leader provides you with the following brief:

Dear Team,

Our consultancy contract is with a multinational agri-corporation which has a core business in providing seeds and crop protection products to support arable farming across the globe. As part of their market research with farmers and food retailers they have found that significant quantities of fresh fruits, vegetables and non-food arable produce are being wasted between the farm gate and the supermarket shelves.

In parallel they have been offered a number of technologies which could alleviate this waste and reduce the overall carbon footprint of the transport supply chain by providing real-time data on the stress suffered by perishable goods as they are shipped under chilled conditions. This stress can be down to many factors such as temperature excursions outside of the ideal 3-5°C temperature band, extremes of humidity, spoilage from ethylene vapours, fungal pathogens, physical bruising, etc. The business development group within the agri-corporation believes that by introducing appropriate information technologies these stresses can be dynamically managed as they occur and appropriate remedial treatments taken to recover the quality of the goods before they suffer premature decay. In extreme cases irrecoverably damaged produce could also be extracted early on in the shipping process so as to minimise the environmental impact and fuel costs associated with further transportation.

The financial and environmental value to the food and perishable crops sector in reducing the overall shipping costs and waste through this new information technology is seen as significant. However, the supply chain is presently complex and fragmented being made up of a number of independent companies which internationally transport, store, repackage and distribute the produce between a network of growers and retail outlets. The agri-corporation at presently provides post-harvest remedial treatments for the produce once early stage spoilage has been identified but it does not currently offer any in-package tracking of the stresses sustained.

Your task is to produce a report outlining possible strategies for how the agri-corporation could introduce this novel real-time tracking service to the food and perishable crops supply chain and extract a financial return from it. This service may have considerable overhead costs which would need to be covered, including; managing the activity, providing & servicing the equipment, training in its use, help-desk support and steerage of the on-going R&D development programme.

As the growers, retailers and logistics businesses along the chain have never had this service before they will be unlikely to pay for its introduction unless they can be persuaded of their particular financial and environmental returns. Because of this, your strategy should contain a top-level business model detailing which part(s) of the supply chain would pay for the service and how they would directly gain value within their specific business(es). It should also outline what methodology would be followed to secure early adoption of the new technology; this may include methods of lobbying appropriate public bodies (e.g. politicians, NGOs, regulatory authorities, academic institutions, popular press, etc).

Your report will be in the form of a short summary document for submission to the senior executive board of the agri-corporation. It must therefore be succinct, make appropriate use of references and diagrams as necessary and not exceed 6 sides of A4 using 12 point Time New Roman font. *In addition, you must submit a page of references you have used in this exercise, using standard academic referencing. A summary of your primary data collection should be included as an appendix.*

Please deliver this report **by 3pm MONDAY 4th April both electronically and as a hard copy submitted to the MBS PGT Office (Harold Hankins Office 5.22).**

Background Information

The existing economic structure of the perishable goods supply chain for arable produce (fruits, vegetables and non-food crops) between farmer and retailer is non conducive to the reduction of waste and carbon footprint. Though considerable expertise has been expended on removing systemic weaknesses in transportation from farm gate to supermarket shelves this has been founded upon a fragmented inter-linkage of supply chain businesses. This study is based upon the common scenario whereby a large, remotely located, farm facility is contracted to supply chilled high-value produce to one or more supermarket majors. At present the grower has limited control on the fate of the produce from the point where it leaves the farm's grading and chilling rooms to its arrival at the Quality Assurance (QA) testing station in the supermarket's import warehouse. The grower has a significant series of up-front costs prior to harvest (e.g. seeds purchase, glasshouse / farm facilities, labour, energy, packaging, chemical and nutrient inputs) and though the produce leaving the farm maybe of premium quality from then on it is handling is controlled by third parties. The resulting abiotic and biotic stresses (physical and biological damage) suffered by the goods in transit tend to be highly variable and dependant upon the internal and cross-company handling by a series of subcontract warehouse, shipping and distribution agents. The grower will again pay up-front for their services.

On arrival at the retailer if the produce has suffered unacceptable stressing then the supermarket can choose to reject it and charge the farmer for the additional costs of its local disposal and back-filling of their inventory with goods supplied from alternative sources. The effect is both a significant economic burden on the grower and a rise in the environmental impact. The latter includes the increased loading on landfill, or other disposal options, and a greater carbon footprint in wasted transportation fuel and farm inputs. It should be noted that fuel also contributes to over three quarters of the costs associated with manufacturing synthetic nitrifying fertilisers and that 21% of food stuffs are lost in the supply chain, predominantly before they ever reach a consumer. This is the single largest source of waste in western economies and costs £20 billion per annum in the UK alone (source: UK-DTI, 2006). This should then be considered versus the projection that the World's populace will grow from 6.5 to 9.3 billion by 2050 (source: US census bureau estimate, 2006).

Understandably, growers will attempt to mitigate their financial risks by tracking the stress suffered by goods as they transit through the supply chain. Such monitoring needs to be at the package level rather than just in the ambient atmosphere within a shipping container due to the physiology of crop senescence (ripening, ageing and decay) causing localised additional stressing, especially in the presence of pathogens. A common technique is to include data loggers in samples of produce so as to record any outages from the ideal conditions. These may then be used to identify where in the supply chain an unacceptable stress condition has occurred and allow costs to be recovered from the businesses responsible. This can lead to an acrimonious relationship between the various elements of the supply chain.

Through recent developments in microelectronics and biosensor technologies it is now feasible to implement appropriate real-time sensing (RTS) within the produce packaging and so make supply chain management decisions on a dynamic basis. Dependent upon the stress profiles, this information may be used to effect a remedial treatment on the produce at waypoints in its journey and so recover its quality. Alternatively, critically stressed goods may be removed at an early stage to limit any further carbon burden and possibilities of releasing unsafe levels of pathogens into the food chain.