CHAPTER 8

BUSINESS SECTOR DOMAINS

LIKELY IMPACTS & POSSIBLE ADAPTATION RESPONSES

Introduction

This section considers those domains in the South West which fit broadly under the heading of 'the business sector'. Such headings are necessarily arbitrary but have proved useful in progressing and reporting on the study. Because of the wide range of commercial and industrial activity in the region the decision was made to limit the study to certain key sectors. Therefore this section focuses explicitly on the priority sectors which the SWRDA has identified as the main vehicle for economic development in the region. So, the section explores the following impact domains:

1. Advanced engineering
2. Biotechnology
3. Environmental technology
4. Financial services
5. Food and drink
6. Information Communication Technology (ICT)
7. Leisure and tourism
8. Marine engineering
9. Tele-marketing

(For details of the methodology adopted for researching and reporting on these domains please see Annex 2.)

This introductory section precedes the detailed consideration of each domain and considers some of the general issues relating to the entire business community. It is followed by a table of recommendations for the business sector and individual domains.

Business activity will be significantly affected by climate change, whether through direct impacts of future climate, such as increased flooding, or through new market opportunities presented in areas such as tourism or environmental technologies. In addition, activities within the business community by their very nature have an effect on all of society. Therefore, it is important that impacts and adaptation options for businesses are at the forefront of any climate change studies or policies. It is also evident however, that despite the potential for businesses to drive forward the climate change debate and both stimulate and develop solutions to the issue, there are very few business sectors, and even fewer individual businesses, for whom climate change adaptation is considered a serious issue.

Mitigating climate change, on the other hand, has become increasingly focussed on businesses through the fight to reduce greenhouse gas emissions and in particular through the introduction of the Climate Change Levy in April 2001 which levies a tax on the use of commercial, non-renewable energy. Unfortunately, many businesses view the imposition of these financial costs as simply an additional burden and do not appreciate the issues behind the legislation and the incentive to reduce greenhouse gas emissions.

More awareness raising is needed to ensure that businesses are at the forefront of climate change adaptation in the South West.

Business Profile of the South West

The business environment within the South West consists of 203,900 business establishments with the majority (85.4%) employing less than 10 people. (This is slightly higher than the national figure of 84.%). Just 1.3% of workplaces employ over 100 people in the South West, slightly less than nationally. Although medium and large workplaces (employing 25 or more people) are heavily outnumbered by small workplaces, the former provide the bulk of employment in the South West. Over three quarters of jobs in the South West are provided by medium and large workplaces.

Reflecting the small scale of many businesses, the region has one of the highest rates of business failure in the UK, with 4,514 businesses failing in 1997, equivalent to 2.5% of all business in the region. This is far in excess of the national average of 1.8%, despite the actual number of failures falling by almost 16% on the previous year. This suggests that there may be a need to improve business support and information services within the region on many issues, of which climate change may be one.

The region has a similar rate of new business formation, 40 registrations per ten thousand people in 1998, to that experienced across the U.K. as a whole. New businesses in the South West fare slightly better than average in terms of their longer term survival with 63.8% of businesses registered in 1995 surviving for three years compared with 61% nationally.

Due to its rural nature the South West has a particularly large concentration of businesses in the agriculture, forestry and fishing sector, accounting for almost 13% of all business establishments in the region.

The region also has a higher than average share of establishments in the mining, quarrying and energy sector reflecting the industrial strengths of the region. Other key sectors in the region include tourism, with the South West attracting more than

21m visitors each year, and information and communication technologies.

Those organisations and businesses directly involved in the protection and enhancement of the natural environment also play an important role with at least 1,376 jobs directly employed in this sector in the region contributing an estimated £26m to regional GDP (Source: RSPB Study). This reflects the growing importance being placed on enhanced environmental quality in creating conditions for inward investment and business growth, particularly for tourism but also in areas of film and media, and quality of life for residents.

The environment plays a significant part in the quality of life in the South West, in turn attracting people to live and work in the region. In a recent survey of company executives, 57% stated that overall quality of life was the most important personal factor for relocation to another city.

Research and Development (R&D) by businesses is greater in the region than the national average - but trails business R&D spending in the east and south east. Government R&D in the South West is slightly higher than the UK average, while R&D activity by higher education is slightly lower.

The South West has been successful in attracting inward investors, particularly in the east of the region, including Bristol and Swindon. These firms are concentrated in hi-tech, research, automotive, plastics and food processing clusters, and employ large numbers of people. Over 1,200 overseas-owned companies have located in the region, constituting 25% of the region's hi-tech manufacturing cluster which employs 50,000 people, and with a major presence in a number of other sectors including automotives, plastics, ICT and food processing.

Climate Change:

The Challenges and Opportunities for Businesses

Weather conditions already have significant impacts upon business activities, including disruption to supply lines, over- or under-stocking of goods, loss of work days for outdoor activities, infrastructure damage, overtime costs, financial penalties for late projects and health effects on staff.

A recent survey suggests that British businesses lose on average 11.54 days trading each year as a result of the climate (Met Office, 2001). The cumulative costs of these impacts are around £7.6 billion per year, or up to 10% of company profits. Despite the fact that 75% of businesses recognised the impacts of climate, 47% thought their business wasn't sensitive to the weather, and only 17% take climate into account when planning business activities.

A major barrier for the business sector generally is the difficulty in perceiving climate change as a current matter for attention, rather than a distant concern for beyond the 2020's. Businesses tend to plan only a few years ahead, and rarely recognise situations occurring today – e.g. reduced winter heating bills, higher insurance costs, increased flood risk etc. as being a symptom of climate change to which they are already exposed.

Future climate change scenarios suggest that significant business impacts will take place as a result of a number of climatic variables. Throughout all sectors generic impacts will include:

- Direct infrastructure impacts as a result of increased flooding, subsidence during dry weather, coastal erosion, windstorm impacts and water intrusion.
- Changes to resource usage, in particular increased energy demands for cooling in summer months, and reduction in winter heating demands.
- Changes to internal conditions within facilities, primarily hotter in both summer and winter, impacting upon production processes and worker health.
- Changes to external conditions for outdoor workers, primarily hotter summers and wetter winters.
- Health impacts as a result of higher internal and external temperatures, increased winter survival of diseases and other risks.
- Impacts upon supply lines, staff availability and business activities as a result of flooding, subsidence, and storm impacts on transport and communications facilities.
- Climate change impacts upon markets and customers on a regional, national and international scale.
- Changes to planning and building regulations as a result of perceived climate impacts and related government legislation.
- Changes to insurance costs and coverage, in particular in vulnerable geographic areas or economic sectors, such as operations within floodplains. Financial implications related to this may include changes to mergers and acquisitions, a lack of inward investment and an inability to develop or sell facilities.
- The potential for litigation against companies who provide services which are subsequently impacted upon by climate change. As a result businesses may become susceptible to legal challenges if their products and services do not allow for climate changes. This is an area that needs further investigation, and may well prove to be a driving force behind many businesses accommodating climate change in future projects.

Despite the potential risks and costs of these impacts, significant market opportunities exist for many business sectors to develop climate-proof products and services which reduce climate impacts and increase adaptability. In addition, opportunities exist within specific sectors such as flood defence technologies, tourism and environmental services to capitalise on both the positive and negative impacts of climate change. The expanding market for cleaner technologies and low carbon products means that many new opportunities exist within this field and many businesses may choose to diversify into these areas.

Despite these significant new market opportunities, both in the South West and globally, many businesses will be slow to react on their own. It is likely that government legislation, including changes to planning regulations, and financial penalties or incentives will be a major driving force behind business changes. It is likely that many forms of legislation will be in response to a demand to mitigate climate change and a recognised need to prevent catastrophic losses in vulnerable areas, such as along coastal regions.

However, the potential savings for business of considering the climate today and accommodating future changes means that corporate growth could be increased by considering climate and climate change as soon as possible.

Proposed actions for all businesses to accommodate climate change include the following:

1	Investigate potential climate change impacts on their business.
2	Create a management position with responsibility for climate change.
3	Report risks in annual reports.
4	Provide funding for climate change related activities in future budgets.
5	Appoint a climate change task force.
6	Develop and implement a climate change action plan.
7	Assess the effectiveness of the action plan and make further improvements.
8	Quantify greenhouse gas emissions and set reduction targets.
9	Communicate actions and findings to the public and shareholders.
10	Maintain links with stakeholders, researchers and the media.

Table 8.1

Proposed Actions for all Businesses

(Salt, 2001)

Recommendations for Business Domains

- Identify managerial responsibility within individual companies for addressing the impacts of climate change.
- Carry out simple risk assessment appropriate to scope of business based upon climate change scenarios.
- Risk assessment should include: health; supply lines; infrastructure; insurance; litigation, customer demand, etc.
- Specifically investigate the challenges and opportunities presented by climate change with regard to the market for goods and services provided by the company.
- Recognise that markets will be influenced by climate change impacts at a regional, national and global scale.
- In reviewing market threats and opportunities consider potential changes in lifestyle brought about by climate change.
- Monitor greenhouse emissions at company or site level and take steps to reduce them in order to reduce the potential for global warming.
- Identify appropriate policy frameworks within which to nest adaptation strategies.
- Co-ordinate the development of climate change strategies within each business sector in the region, possibly through Trade Associations, Professional Institutes, etc
- Explore commercial opportunities for **advanced engineering** in the development of 'flood-proof' infrastructure to accommodate higher storm surges and tides.
- Explore commercial opportunities for the development of new technologies in **renewable energy**.
- Undertake further research on climate change impacts on agriculture (e.g. drought conditions) and potential for **biotechnology** in adapting to new climatic conditions.
- Increase awareness of potential impacts of climate change in order to increase market opportunities for **environmental technology** sector.
- Encourage **insurance industry** to be more open in its deliberations on emerging policy with regard to climate change impacts.
- Encourage the **finance sector** to identify investment opportunities with regard to climate change mitigation including low-carbon technologies.
- Explore the potential for new local crops and produce as part of regional and sub-regional strategies for marketing local f**ood and drink** specialities. Use SWRDA sector development project as one vehicle for this work.
- Explore and monitor implications of global impacts on regional **tourism and leisure** activity.
- Provide co-ordinated strategy and support for disparate and often small businesses in the **tourism and leisure** industry. Use SWRDA sector development project as one vehicle for this work, in conjunction with Tourism South West and relevant trade associations.
- Try to spread visitor numbers throughout the year by extending tourist season to avoid further stresses on already stretched **infrastructure**

ADVANCED ENGINEERING AND AERONAUTICAL INDUSTRY DOMAIN

Scope

Commercial activities associated with advanced engineering, including aerospace engineering, medical devices and automotive vehicles and components.

See Also

Biotechnology, ICT, Environmental Technology, Coastal Erosion and Flood Defences, Built Environment, Utilities and Transport.

Background

This business sector is comprised of large multi-national companies who are major employers within specific geographic areas, as well as smaller regionally based components suppliers, expert consultants, and sales and distribution companies.

Businesses within this sector are clustered together in a number of pockets throughout the region, including; aeronautical engineering in Bristol, car production in Swindon, Helicopter production in Taunton, marine engineering in and around Plymouth, and medical related engineering throughout many areas.

As a result advanced engineering is an important employer and contributor to the regional economy, and in some areas has replaced more generalised engineering, in particular traditional defence based industries.

In addition this sector has attracted a large volume of inward investment into the region and developed the South West prestige overseas. As a result Advanced Engineering is a sector in which investment is being made by the SWRDA to further enhance the region's economic prowess and to ensure that new technologies and advances are competitive.

Key Issues

- Changes to manufacturing processes may be required to accommodate increased internal and external heat.
- Opportunities to develop engineering solutions to climate change impacts in many economic sectors and geographic regions.
- Changes to health risks as a result of climate change providing new opportunities for medical technologies.
- Impacts upon infrastructure, supply lines and customers.
- Increased costs as a result of restricted water supplies and changes to energy costs.
- Increased levels of down time as a result of loss of energy supplies and telecommunications during periods of extreme climate impacts.
- The introduction of global climate change mitigation legislation is likely to provide both challenges and opportunities to this sector through the development of low carbon technologies.
- Opportunities exist to develop on-site "climate proof" energy supplies using renewable energy technologies.

General Concerns for the Industry

This sector will incur similar infrastructure and transportation impacts as other business sectors. The result is an increased disruption to manufacturing processes through flooding of sites, rain intrusion into buildings, storm impacts, increased levels of subsidence during hot, dry, summers and impacts along coastal regions. Furthermore, transport links, particularly coastal installations such as ports and railway lines may be disrupted, as would electricity and telecommunications connections. Some impacts should, however, be offset by a reduction in cold weather effects, in particular a decline frost related impacts.

Repair and insurance costs are likely overall to increase and changes to planning guidelines to take account of climate change will affect plant expansion and other developments. Furthermore, the high dependency of this sector upon suppliers nationally, as well as the global markets it is involved in, results in it being very susceptible to climate impacts in other regions.

Components within manufacturing/engineering processes may be affected by changes in heating conditions and related requirements for increased coolants. Potential reductions in water supplies during dry summer periods may exacerbate this problem further. In addition increased heating moderation in offices and factories have related health impacts and affect worker productivity, thus requiring changes to building design and heating/ventilation processes.

The Way Forward

Despite the potential for considerable impacts in many operational areas, this sector has the potential to contribute significant engineering solutions to many of the climate impacts on a global scale. This may include the development of "flood proof" infrastructure, including engineered flood defences, and installations similar to the Thames Barrier to accommodate higher storm surges and tides.

In addition the development and increased use of renewable energy products within this sector and others will result in increased demand for technologies such as solar power, heat exchange technologies and tidal power installations. The use of on-site renewable energy will also reduce dependency upon vulnerable energy distribution infrastructure, and reduce energy costs related to fossil fuel combustion. The development of resource efficient products for global markets will provide a substantial opportunity for engineering companies, including such things as energy efficient vehicles.

New markets are likely to result from changes in demand for products related to climatic conditions on a global scale, such as increased demand for soft top cars and changes to health risks and related technology demands. Furthermore, demands for technologies which control or reduce greenhouse gas emissions within transportation and manufacturing process present a considerable short to medium term opportunity for businesses within this sector. This may include carbon dioxide fixing and disposal technologies.

Mitigating climate change is an important issue for this sector, as it remains dependent upon large-scale energy use and may produce high levels of greenhouse gases. As a result this sector may susceptible to government legislation, and may benefit from activities such as emissions trading schemes.

Mechanisms for Change

As with many economic sectors, advanced engineering will respond to a combination of customer demand, risk avoidance, costs, and government legislation. There is likely to be limited activities within many businesses to accommodate climate change impacts on a large scale. Drivers will include demands for technologies which have lower levels of greenhouse gas emissions. In addition increasing demands for flood defences and related engineering activities will be a significant driver on the product side of the business.

On the production side the primary drivers to consider climate change will be direct and perceived costs, in particular costs as a result of impacts such as flooding over a sustained period, and insurance costs. Linked into this will be changes in building and planning regulations which will dictate where and how facilities can be expanded.

The introduction of further government legislation and incentives to both mitigate and accommodate climate change will also act as one of the primary drivers for change in this business sector.

Barriers to Change

Traditional engineering and manufacturing has often been slow to respond to changes within environmental parameters. However, the new generation of engineering firms covered within this sector have developed into more flexible organisations than in the past. This is a consequence of the fluctuations within global business markets, but may prove to make them responsive to climate change.

Uncertainties within climate predictions coupled with the difficulties for businesses to accommodate climate change impacts pose a considerable barrier to change. In addition the cost of making changes to engineering plants and other facilities are considerable and unlikely to take place until higher knowledge levels are developed within the sector.

Perception of Adaptation Issues

There is little evidence to suggest that adaptation to climate change has been considered within this sector. However, the consideration of flood risks and planning changes is evident and this may prompt future adaptation considerations as the issue becomes more integrated within the business sector.

Challenges and Opportunities of Key Climate Impacts in Advanced Engineering and Aeronautical Industry Domain

Climate Impact		Challenge and Opportunity
Summertime Temperature Increased	C	Increased coolant costs for offices and manufacturing processes.
	C	Health effects upon staff working in offices and factories.
	C	Health effects on staff working outdoors.
	O	Change in market demand for products, e.g. Soft top cars.
	O	Increased use of solar power and heat exchange technology within the manufacturing process.
Wintertime Temperature Increased	C	The need to change current heating and ventilation systems within buildings to meet new building guidelines.
	O	Positive impacts upon energy costs and staff health.
	O	A reduction in cold weather impacts on supplies, manufacturing processes and infrastructure.
Flooding Increased	C	Direct infrastructure damage, and indirect impacts upon supplies and markets.
	C	Increased insurance costs and changes to planning regulations affecting infrastructure development.
	O	New products/markets for engineered flood defences and “flood proof” infrastructure.
Reduced Summer Rainfall	C	Restricted water supplies with association cost implications.
	C	Risk of subsidence in vulnerable areas.
	O	Increased use of solar power technologies in manufacturing.
	O	Opportunities for expanded work outside of buildings.
Increased Winter Rainfall	C	Impacts on infrastructure, in particular buildings and installations.
	C	Increased down-time and delays as a result of water intrusion.
	O	On-site water collection and storage operations.
	O	Increased water supplies during winter months.
Sea Levels and Tides Increased	C	Direct and indirect impacts on infrastructure, markets and supplies, in particular impacts on port facilities, and coastal installations.
	O	Engineering solutions to storm surges and tidal inundation.
	O	New engineering requirements for coastal infrastructure and ship design.
	O	The possibility to develop products for tidal power generation
Longer Growing Season and Reduced Frosts	C	None identified.
	O	A reduction in frost impacts.
Potentially Increased Winds and Storms	C	Increased direct and indirect impacts on infrastructure and supplies/ markets.
	C	Increased repair costs and insurance costs.
	C	Increased down-time through loss of energy supplies.
	O	The opportunity to develop on-site energy sources, such as wind turbines and other renewable energies.

BIOTECHNOLOGY DOMAIN

Scope

Commercial activities operating within the realm of biotechnologies; including medical techniques and equipment development, technologies derived from or responding to natural/ biological processes, and monitoring of biological indicators.

See Also

Agriculture; Health; Built Environment

Background

The SWRDA has identified over 100 companies within the region which fit into this description of the developing biotechnology sector. However, connected business sectors, including environmental technologies and agriculture which are well established in the region, are likely to be impacted in a similar way to this sector. In addition impacts within the ICT sector and other technology developers will have considerable impact upon what is in essence a very technologically dependent economic sector.

Many biotechnology companies are of a small scale and in some cases are recently established. The need for considerable resources and contact with leading scientific research has resulted in many spin-out companies from research establishments in the region. This is particularly true for a number of businesses operating out of the Tamar Science Park in Plymouth which have been set-up in conjunction with the University of Plymouth.

Biotechnology is one of the key sectors within the SWRDA development strategy for the region and has its own co-ordinator position.

Key Issues

Context

Recent issues surrounding the genetic modification of foods and other biotechnological developments have highlighted the challenges this sector faces. However, potential climate change impacts on a global scale will again highlight the need for drought or flood resistant crops and other biotechnological advances, thus providing opportunities for companies in the South West. The conflicting demands of public opinion and resource needs is an issue that is likely to expand further in the future as climate change becomes more of an established concern.

Main Issues

- Demand for climate resistant crops and biological processes will increase opportunities for market development.
- Health considerations, including increased solar radiation, heat effects and dehydration will provide potential market opportunities.
- Direct impacts upon business activities include dust and heat stress on operatives and equipment damage.
- Financial costs of insurance, resource use and investments will be affected by operations in this sector and beyond.
- The provision of advice and consultancy services to other business sectors will increase as climate change becomes a more substantive issue across the business world.

Impacts upon other business sectors and natural domains will present the biotechnology sector with considerable challenges and opportunities as more emphasis is put on resources to adapt to climate change impacts.

A primary example is the development of resistant crops to overcome increased drought and damp conditions. Species which resist increased pest numbers will increase in importance as well other modified natural processes.

The debate for GM work will re-open and many more people may see the benefits and moderate their opposition.

Biotechnology Company Adviser

Climate impacts upon health will be another priority area for development, including enhanced sun screening, such as sun blocks, and products to maintain hydration of humans during particularly hot periods.

Direct impacts upon operations within biotechnology companies will include health effects on staff working indoors and outdoors.

In our biotech work, opportunities would come from the physical effects such as flooding.

Biotechnology Company Manager

Instruments used in the field and in laboratories may require increased protection from higher temperatures and dustier conditions.

Other impacts include increased costs of natural resources and insurance costs, as well as global influences upon biotechnology activities as a result of climate change impacts in other areas.

The Way Forward

This sector has the potential to be at the forefront in developing solutions to climate change impacts. Therefore, the phenomenon itself will be a considerable driver as impacts become more apparent and research clarifies potential challenges. However, it will be the requirements of other business sectors for specialist advice and resources which will be the main drivers in developing climate change related activities in this sector.

> **Climate change is probably going to be a lot quicker than useful evolutionary changes. Biotechnology deals with living things, hence there will be a definable need to artificially adapt living things (foodstuffs, beneficial predators, livestock etc) to cope with any change. Society will reject most of these ideas due to the media's portrayal of any genetic modification as the stuff of science fiction.**
>
> Biotechnology Company.

Potential Barriers

The primary barriers to change are likely to be the challenges faced in developing genetically modified material and promoting acceptance of these throughout society, in particular within the U.K.

Scientific uncertainties within the field of climate change research will also pose a barrier to some companies who require this information, but do not have the resources to develop it themselves.

Therefore, this sector will be amongst the most responsive to climate change knowledge as it becomes more available.

Perceptions within the sector

Biotechnology businesses recognise the need to consider the environment as a vital resource and therefore acknowledge the need to adapt to climate change. However, the nature of the sector means that opportunities for modification of the environment to accommodate climate change exist.

Concern within the sector is on the acceptance of all adaptation strategies by the public. Opportunity will be provided but the solutions require significant funding which takes time and resources, even with public and government support.

Knowledge and information base

To date there has been little specific research or information dissemination on climate change within this sector specifically. Research into climate change impacts on agriculture with particular reference to drought conditions and other climatic phenomenon is relatively well developed and many of the issues raised there will be pertinent to businesses in this sector. In addition consideration of the health implications of climate change and response strategies which may include biotechnology will also benefit this sector - work on this is relatively advanced in many areas.

Challenges and Opportunities of Key Climate Impacts in Biotechnology Domain

Climate Impact		Challenges and Opportunities
Summer Temperature Increased	C	More focus on plants' genetic ability to resist extremes and possibly increased predator-attack, especially food-crops.
	C	Outside work; exposure to sun, dust, extreme heat and the subsequent unreliability of scientific instruments.
	C	Changes away from normal cooling methods towards air conditioning and other cooling methods, with associated increases in costs.
	O	The development of products and services to meet market needs (below)
	O	Develop new food supplements to cope with changes to peoples daily lives such as possible short-term dehydration.
	O	Develop crops and potentially livestock to resist heat stress
		Develop superior sun-block systems
	O	Develop preventative measures to deal with stronger sun and related enhanced ageing effects and skin cancers
Summer Rainfall	C	A restriction on water intensive activities.
Reduced	C	Changes to the cost of water and water abstraction.
	O	Develop drought- resistant crops.
	O	Opportunities for genetic modification of crops (e.g. Effects upon insects required for pollination)
Winter Temperature Increased	C	Change current heating and ventilation systems within buildings to accommodate warmer winters and to meet new building guidelines.
	O	A reduction in cold weather impacts on supplies, manufacturing processes and infrastructure.
	O	Positive impact upon energy costs and staff health.
	O	Opportunities for crops to be made more resistant to damp-related problems and resistant to certain pests which may proliferate under damper conditions.
Winter Rainfall Increased	C	Increased risk of flooding.
	C	Impacts on infrastructure, particularly buildings.
	C	Development of crops resistant to wet weather and related pests.
Sea Level and Tides Increased	C	Direct and indirect impacts on infrastructure, markets and supplies, in particular impacts on port facilities.
Longer Growing	C	Changes in demand for frost resistant crops.
Longer Growing Seasons and Reduced Frosts	C	Changes in demand for frost resistant crops
	O	The potential for multiple-cropping and the development of new species to accommodate the new growing conditions.
	O	Increased demand for consultative advice.
Flooding Increased	C	Direct infrastructure damage, and indirect impacts upon supplies and markets.
	C	Increased insurance costs and changes to planning regulations affecting infrastructure development.
	C	Impacts upon crops and monitoring equipment.
	O	Provision of specialist advice and research into causes and effects of crop damage and biological control of flooding.
Potentially Increased Winds and Storms	C	Increased direct and indirect impacts on infrastructure and supplies/ markets.
	C	Increased repair costs and insurance costs.

ENVIRONMENTAL TECHNOLOGIES DOMAIN

Scope

Commercial activities associated with environmental technologies, including environmental engineering, resource efficient products, renewable energy products, environmental monitoring equipment, low carbon technologies and related consultancies.

See Also

Water Resources, Built Environment, Biotechnology, ICT, Marine Engineering and Activities.

Background

The South West has a considerable, and growing, reputation for developing technologies that conserve and monitor the environment. The idea of the region as the "Green Peninsula" is often referred to and is well founded in its development of renewable energy in particular as well as many other specialist techniques and technologies.

The level of renewable energy development has grown considerably with over 70 companies in Cornwall alone involved directly with renewable energy development, such as wind power, wave power and thermal power.

In addition recent initiatives by the SWRDA to promote the development of environmental technologies have included the EnviroSkills SW project which aims to "provide an overall focus to support innovation in the Environmental Technology sector in the South West region, and as part of this, to help facilitate the SWRDA's engagement with the sector businesses". This project has included training needs analysis within the sector and a conference held in March 2002 which drew together businesses, training providers, policy makers and organisations to further develop the profile and training needs of this sector.

Subsequent initiatives to identify requirements within this sector and to further develop its resources are ongoing at present. The opportunities for this sector to develop over the short to medium term have been identified and are being developed as issues surrounding environmental protection and monitoring become more prevalent. The potential for the South West to be a leading force within this sector on a national and international scale is substantial.

Key Issues

This business sector will incur the same direct and indirect impacts upon its activities as other sectors, including flooding of premises, health effects on staff, and disruption to supply lines.

There are however, several issues specific to the environmental technologies sector, including:

- Significant opportunities exist for companies to develop techniques and technologies to monitor and mitigate the risks that climate change may bring - "climate proof" products and services.
- Renewable energy technologies provide opportunities for providing localised sustainable power generation options, reducing energy costs and the vulnerability of transporting power.
- Increased demand from other business sectors and organisations for consultancy services related to managing climate impacts.
- Increased sales of resource efficient technologies, pollution monitoring and other related equipment.
- Direct and indirect impacts upon infrastructure, business activities and supply lines.
- Increased resource costs, including fossil fuel based materials, and increased business costs.
- Increased need for climate impact and climate change consultancy.
- There is potential for expansion in the renewable energy, environmental consultant and related services sector as a result of the impacts of climate changes on other businesses and activities

"The mitigation option is where our business growth is!"

Renewable Energy Consultant.

"We have already had to move our server room to the second floor because of the flood risk. Our insurance company would only provide cover if we moved our servers."

Casella Cel Ltd.

The Way Forward

The need to continually monitor and attempt to manage the impacts of human activities on the environment has lead to a boom within the environmental technologies sector. The view that mankind can develop solutions to climate change in the form of "climate proof" and "clean" technologies has the potential to be a major driving force behind the development of environmental technologies.

The occurrence of the second "Earth Summit" in 2002 further highlighted environmental technology development issues as a response to climate change and more generalised sustainable development issues.

The importance of the natural environment within the South West region as a resource for tourism, energy generation and general economic development has long been recognised. Maintaining this natural environment is of vital importance to the socio-economic development of the region and in many cases this job will fall to businesses within the environmental technologies sector.

This sector is in a position to benefit from the need requirements of other businesses in terms of developing technologies and techniques to both mitigate and adapt to climate change. These include the ongoing development of renewable energies and low carbon technologies, as well as flood risk assessment tools, pollution monitoring technologies, and water supply management products.

Many of the products and services that the environmental technologies sector may develop to manage climate change are already being developed and applied in locations which are susceptible to climate extremes today, such as coastal areas susceptible to flooding. As a result these susceptible areas can be used as test beds for much of the products and services which may be required on a larger scale as a result of climate change.

When new products and services are being developed to manage, mitigate and monitor climate change, it is important that the impacts of climate change on these products and services themselves be considered. Impacts such as higher temperatures, wetter weather, and increased dust production may have significant detrimental effects on equipment and operators.

Potential increases in storminess and higher sea levels may also pose considerable problems to the development of shoreline or off-shore projects, such as off-shore wind farms or tidal barrages. As a result climate proofing of future products and services is essential.

Increases in business and insurance costs may affect future development of renewable energy projects and other infrastructure. However, the potential for this sector to develop climate proofing technologies, monitoring techniques and consultancy expertise related to climate change should result in it being at the forefront of producing low-risk developments.

Mechanisms for change

Many of the businesses involved in this sector within the region are conscious of climate change as an important issue and an important opportunity.

This being said, environmental technologies must react to customer demand. In terms of low-carbon technologies and resource efficient products this is already well established, and government initiatives to encourage their use are growing the sector further.

Climate change adaptation products and services are much less developed. However, existing monitoring and management techniques for flood defences and subsidence have created demands for products and services which can be applied to wider climatic impacts as and when these become more prevalent.

Barriers to change

The underlying barrier to climate change related development is the slow up-take in products and services by many business outside of this sector, i.e. the customers.

The size and financial status of many businesses in this sector mean that ideas may not be fully developed to the delivery point without outside financial input and an established market.

A significant barrier may therefore be the limited ability of smaller companies, which dominate this sector, to attract substantial investment from banks which have yet to consider climate change, or are reluctant to lend to smaller companies.

"We have adapted and are launching a range of low energy, long life ventilation products which go from domestic toilet ventilators right through to industrial roof fans. The company sees this as a market opportunity which local authorities, the education sector and the hospitality industry are keen to take up in response to Agenda 21, under the Government climate change programme. Despite this positive move towards sustainability the company has not had any encouragement from Government"

Vent Axia Company

Key Drivers

The primary driver within the sector will be demands from consumers who want products,

services and facilities that both mitigate and accommodate climate change.

Environmental management and sustainable development practices are becoming, and will continue to become, more important within all business sectors. This is a result of both public demand for sustainable services and government or European legislation to move towards more sustainable processes. In addition many business have seen environment consideration as a marketable product and therefore have altered their activities accordingly.

Smaller and newer businesses can be more responsive to the environment and within this sector they often have a personal desire to tackle climate change and environmental issues. With the number of smaller businesses found in the region, this bodes well for the future of this business sector in the South West.

Knowledge level within the sector

In addition to the recognised potential market opportunities in developing techniques and technologies to assist clients to adapt to climate change, environmental technologies companies themselves are frequently at the forefront of considering their role within the natural environment and potential impacts of climate on their practices. As a result they are advanced in developing sustainable business practices which will accommodate climate impacts.

The importance of the environment within the activities of this sector is paramount. As a result many of those working in this sector are highly knowledgeable about the issues involved and have contributed considerably to the development of knowledge on climate change related issues within the region.

However, as with many other sectors specific knowledge of climate change impacts and adaptation varies across the sector. The dissemination of climate change predictions and related knowledge in a relevant manner is an important factor in developing this knowledge base further. In addition the development of the most up to date and certain predictions of future climate is of importance to those businesses seeking to develop products and services to meet potential increases in demand and to assist in the financing of such developments.

In some cases businesses within this sector will actually be developing knowledge relevant to climate change impacts and adaptations. This knowledge is likely to be disseminated to other businesses through consultancy services.

Challenges and Opportunities of Key Climate Impacts in Environmental Technologies Domain

Climate Impact		Challenges and Opportunities
Summer Temperature Increased	C	Changes away from normal cooling methods towards air conditioning and other cooling methods, with associated increases in costs.
	C	Operational difficulties for equipment under higher temperatures.
	C	Health impacts on staff of higher temperatures and increased pollution, particularly in urban areas and within offices.
	O	The development of energy efficient cooling methods to prevent increased greenhouse gases as a result of air conditioning increases.
	O	The development of detection equipment for changes in pollutants and disease monitoring.
Summer Rainfall Reduced	C	Changes to supply and quality of water will impose restrictions on water intensive activities, and changes to the cost and abstraction of water.
	C	An increased demand for new water efficient technologies such as cistern dams, urinal controls, tap restrictors and monitoring equipment. Especially for intensive water users such as the agricultural, food and drink and manufacturing sectors.
	O	Increased demand for water treatment and "grey water" technologies to: a) maximise the use of reduced precipitation levels b) reduce loss through polluted water. c) combat increased levels of water pollution in higher temperatures.
Winter Temperature Increased	C	Change heating and ventilation systems within existing buildings to accommodate warmer winters and to meet new building guidelines.
	C	Reduced market for frost monitoring equipment.
	O	The opportunity to meet market needs for changes in heating and ventilation systems including heat recovery products.
	O	Positive impact upon energy costs and staff health.
Winter Rainfall Increased	C	Impacts on infrastructure, in particular buildings.
	C	Impacts on health through damp conditions, mould and disease.
	O	The potential for new products to accommodate more humid conditions.
	O	New markets in consultancy and monitoring equipment for processes susceptible to wet weather.
Sea Level and Tides Increased	C	Direct and indirect impacts on infrastructure, markets and supplies.
	O	Increased demand for services and equipment to monitor, mitigate and adapt to sea-level rise, coastal erosion and related impacts, including geo-engineering opportunities.
Longer Growing Seasons and Reduced Frosts	C	Impacts on energy crops and related products/ markets.
	O	New equipment / technologies in a more productive agricultural market.
	O	A reduction in frost damage to building, supply lines and other activities.
Flooding Increased	C	Increased insurance costs and changes to planning regulations affecting infrastructure development.
	C	Direct infrastructure damage, and indirect impacts upon supplies/markets.
	O	An increased need for environmental engineers and consultants to monitor flood risks and products to monitor and warn of flood risks.
	O	Expanding markets for post-flood recovery, such as de-humidifiers.
Potentially Increased Winds and Storms	C	Increased direct and indirect impacts on infrastructure and supplies/ markets leading to increased maintenance, repair and insurance costs.
	O	New markets related to “climate-proofing” buildings and infrastructure.

FINANCIAL SERVICES DOMAIN

Scope

Commercial activities operating within the financial services sector, including; banking, building societies and insurance providers.

See Also

Business, Public Health, Built Environment, Coastal Erosion and Flood Defence, Heritage, Transport, Utilities, and Leisure & Tourism.

Background

Financial services within the South West are primarily focused upon small to medium scale customer delivery points, be that through banks, building societies or insurance brokers. A relatively small number of banking and insurance institutions have larger offices in the region, and are predominantly based in Bristol, Gloucester, Swindon, and Exeter.

Financial services are one of the ten priority sectors of the SWRDA, and consequently are likely to be developed further in the future.

Leading financial organisations originating in the region include Bristol and West, Cheltenham and Gloucester (now part of Lloyds TSB Group) and Stroud & Swindon Building Society.

The influence of the City of London and global financial and insurance markets on this sector is substantial. This reflects the fact that financial services are substantially influenced by market forces far beyond regional boundaries.

Specialist financial services exist within the region, in particular ethical investments services and ethical/ green insurance services. This reflects the growing demand for these types of products in the region and beyond, as well as the importance that the environment plays within the economy of the region. Examples of this include NatureSave Policies Ltd. and The Ethical Investors Group.

When considering financial services it is important to consider the interrelationship between organisations and their customers. As financial companies are service providers, their liabilities and market opportunities will come about directly as a result of changes in the position of their customers, competitors and regulators. Therefore, within this sector direct impacts on financial services will be considered as well as indirect impacts upon customers and the market place.

Key Issues

- Global impacts of climate change, including floods and tropical cyclones, will have an impact on financial companies in the region, and subsequently upon their customers.
- Insurance companies are highly vulnerable to large losses as a result of changes in climatic variables, in particular changes to the severity and spatial or temporal distribution of windstorms, drought conditions, and coastal/ fluvial floods.
- Climate change introduces increased uncertainty into a market place which already has uncertainties attached.
- Warmer winters will result in a reduction in cold-weather related insurance claims.
- Banks and building societies will lose income as customers incur loses through climate impacts, such as disruption to supply chains.
- Properties in high risk areas, primarily flood plains and along unstable coasts, could lose value, become uninsurable or become un-saleable resulting in loses for lending institutions.
- Increased investment opportunities exist in climate change mitigation activities, including emissions trading activities, Renewable Obligations Certificates and low carbon technologies.
- There is likely to be declining investment in traditional fossil fuel based industries.
- Health impacts upon staff and those insured under health insurance schemes is significant.
- The full range of climate change impacts on all sectors will be felt by the banks, in particular short term impacts of extreme events.

The financial sector will be faced with a number of challenges and opportunities which primarily reflect the impacts of climate change on their customers and new markets for products and services.

> **"Recent history has shown that weather related losses can stress insurance companies to the point of impaired profitability, consumer price increases, withdrawal of coverage, and elevated demand for publicly funded compensation and relief."**
>
> IPCC, 2001

Insurance companies are likely to incur increased losses primarily as a result of the following impacts:

- Subsidence as a result of shrinkage of clay soils due to drying. This will primarily occur in the west and South West of the region

where Tertiary, Cretaceous and Jurassic clays are prevalent.

Currently £450 million is paid out annually in subsidence claims in the U.K. alone.

ERM, 2000

- Windstorms which damage infrastructure, particularly when accompanied by heavy rainfall, as may be the case for winters in the future.
- Flooding, both fluvial and coastal, has resulted in substantial losses in the past. Developments in floodplains exacerbates this issue. Currently, approximately 7 million people across the UK are at risk from river flooding alone, and this level is likely to increase as new developments take place (CII, 2001).
- Existing levels of claims for burst water pipes and other infrastructure damage resulting from freezing conditions may well decline as a result of warmer winters. However, if more winter holidays are taken and house are left unheated then pipe bursts may well occur (Palutikof, 1998).

Additional impacts upon insurance companies will include changes to claims for health and life insurance as a consequence of changing climatic conditions. In addition vehicle and travel insurance will be an increasing market, but losses in these categories may occur as a result of climate change, including increased car accidents in fine weather and outdoor activity accidents.

It is important to note that whilst for domestic insurance, claims reflect simply direct damage and loss, for commercial activities claims may also be made for lost income and business. This secondary factor means that businesses can make insurance claims for impacts upon their supply lines and other factors, as well as direct impacts upon the facilities they operate.

Recent insurance policies have allowed for payments to be made if non-physical impacts take place, such as events disrupted as a result of the climate (CII, 2001). This is both a response to businesses needs to avoid large losses, and an opportunity for insurance companies to expand their natural hazards service portfolio. Any increases in extreme events as a result of climate change may reduce companies' ability to maintain some of these services across the board, and/or increase premiums for businesses, which have a consequent effect on other financial services.

There is a significant correlation between summer rainfall and subsidence claims.

Palutikof, 1999

Financial services are very dependent upon levels of business activity in the region and as a result increased insurance losses and costs to businesses will affect the wider financial services sector through decreased loans and other services. In addition perceived risks of climate impacts in certain geographical areas or economic sectors may result in reduced investment in those areas. This is a particular concern for agricultural activities and in coastal regions (UKCCIRG, 1996). Therefore, financial services companies will incur differing levels of impact dependent upon their investment portfolio. The issue will also affect mergers and acquisitions policies as some companies are seen as winners and others losers. (ERM, 2000).

Lending risks as a result of climate change can be categorised as:

- Regulatory risks, including the introduction of legislation and financial instruments by governments or agencies.
- Short term risks as a result of rapid events such as storms.
- Long term risks as a result of long-term changes such as sea level rise.
- Reputational risks with banks making decisions and taking actions on investments.

It is likely that banking institutions will pass these risks on to insurers and re-insurers to minimise negative impacts.

Of particular concern is the level of inward investment into the region which plays a vital role in the region's economy. Any changes to investment levels will have consequences for all sectors in the South West. It is important to note that risk assessments and investment decisions will be influenced by global market conditions made by international companies.

Direct impacts upon business activities will be felt by the financial sector through impacts on working conditions, including office heating, health effects, and disruption to activities, particularly breakdown in communications which play a leading role in the fast moving financial markets (UKCCIRG, 1996).

Developments within the field of climate change mitigation and adaptation tools will result in changes in investments for financial institutions. Low carbon technologies and renewable energies will be an expanding market. In addition carbon trading schemes to reduce greenhouse gas levels are coming on stream and are becoming an important financial opportunity. In comparison, perceived "losers" in the low-carbon revolution will become less attractive as investment

opportunities, including fossil fuel based energy supplies, as new legislation and costs come on stream. However, the development and implementation of financial regulations and legislation will provide further opportunities for financial organisations specialising in such services.

The Way Forward

Recent extreme climatic events in the South West region, in particular the large-scale flooding in the winter of 2000 and the storms of the late 1980's and early 1990's, have resulted in increased insurance claims for natural hazards. Globally insured losses have increased over ten fold since the 1950's to approximately $40 billion per year in the 1990's (IPCC, 2001).

This reflects two principles evident within the insurance sector, and with consequent impacts upon all financial transactions. Insurance losses result primarily from extreme events affecting insured properties, and unlike most developed nations the U.K. currently offers insurance for flood risk as standard as well as other insured risks, such as subsidence and storm damage.

However, recent steps by insurance companies to reduce their risks in flood prone areas mean that some properties may soon become difficult to insure and therefore to sell. This will ultimately impact upon other financial services such as mortgage lending as well as influence planning considerations and government policy. In many European countries flood insurance is supported by the state, and this may need to be the case in the South West in the future.

Insured losses and impacts upon financial investments are influenced by wealth, property prices and other economic indicators within the region and beyond. Domestic Insurance claims are very dependent upon house prices and costs of contents as much as the level of impact themselves. Consequently, loss comparisons over medium to long time-scale involve more than just climate as a variable (Palutikof, 1999). In addition adverse market conditions and other non-climatic factors will influence insurance losses and financial investments, including economic down turns and international terrorism (IPCC, 2001).

However, standardised historical tends in insurance claims have shown increases during drought periods, related to subsidence, such as in 1989, and related to windstorms, flooding and cold weather (Palutikof, 1999). This historical data can be used as an indication of future impacts, although other factors need to be considered.

The financial sector in general focuses on short term changes and discounts long-term future costs, whilst remaining relatively quick to react to market changes.

Risk avoidance on investments and insurance decisions are the main drivers behind accommodating climate change. The potential for unsustainable loses is large and must be countered by either:

1. Changes to pricing, which is difficult to implement, may be uncompetitive and requires definitive information about future risks.
2. Risk transfer through such things as weather derivatives are a developing area to spread insurance risks.
3. Limiting the availability of insurance would reduce risks, but have considerable consequences for consumers.
4. Loss control activities through the utilisation of the industry's extensive resources.

(Parry, 2000)

Due to the global nature of the industry, drivers may well come from other parts of the globe who are more susceptible to climate change related losses. Therefore, drivers affecting climate change policies in the South West may originate from well beyond the region.

"This sector is a key agent of adaptation (e.g. through support of building codes, and to a lesser extent, land use planning) and financial services represent risk spreading mechanisms through which the costs of weather related events are distributed among other sectors and throughout society"

IPCC, 2001

Regulatory decisions by governments or international bodies will be drivers behind issues such as floodplain insurance, which in many countries is unavailable or provided by the state. In addition, changes to financial, and other related regulations associated with climate change will have consequent impacts upon financial services. These changes may take place on a national or international scale.

Potential barriers

Risk assessment models within the financial services sector are highly developed and require advanced data input. Of particular importance is a need for further information on extreme events and wind storms and models to track the interrelationships between climatic conditions and flooding/drought conditions.

Perception of Adaptation Issues

Adapting to climate impacts and avoiding risks is inherent to this sector. Therefore, accommodating climate change risks will become

a part of all investment and insurance considerations.

This sector is the driving force behind decisions made in many other sectors, in particular businesses, and due to the long term nature of investments in projects, such as dams and reservoirs, climate change adaptation is a major consideration. In effect this sector will substantially influence all other climate change adaptation policies on a global scale.

This sector, largely through insurance company activity, is responsible for promoting and funding a large amount of climate change related research. Dissemination of this knowledge has been facilitated through trade organisations such as the Chartered Insurance Institute, and interaction with risk assessment modellers. A survey by the CII found that 40% of insurers believed the home market would be influenced by climate change over the next 10 years. This shows an unprecedented level of concern for climate change impacts, with 89% of insurers questioned having at least a working knowledge of the issue (CII, 2001).

However, knowledge levels within smaller and South West based businesses in the field of adapting to climate change may need further development as the science develops further.

Further investigations into the impacts of climatic and other parameters as well as the vulnerability of certain activities and investments are required within this sector.

The large potential costs involved in climate change impacts means that this knowledge development work will be a focus of future climate impact studies and a driving force behind information development.

Challenges and Opportunities of Key Climate Impacts in Financial Services Domain

Climate Impacts		Challenges and Opportunities
Summer Temperature Increased	C	Increased disruption of businesses activities, such as crop losses, and related insurance claims.
	C	Increased health and life insurance claims due to strokes, heart attacks, food poisoning and heat stress.
	C	Direct impacts upon offices and working conditions.
	C	Increased leisure activities resulting in greater levels of accident claims.
	O	Greater opportunities for investment in solar based renewable energies.
	O	Increased demands for mortgages on holiday properties and tourism businesses in the region.
	O	Increased economic activity in the region due to increased tourism and businesses opportunities
Summer Rainfall Reduced	C	Increased insurance claims due to increased subsidence and land slides.
	C	Increased costs of fires, including wild fires, and related insurance claims.
	C	Agricultural losses and increased costs due to drought conditions and related insurance costs.
	C	Increased water costs for businesses, and related impacts upon financial performance and investments.
	O	Investment opportunities in "subsidence proofing" buildings.
	O	Investment opportunities and growth in water efficient technologies.
Increased Winter Temperature	C	Lower sales for energy companies affecting investments.
	O	A decline in claims for freezing pipes and related cold weather impacts.
	O	Expansion of winter tourism industry resulting in increased demand for financial services.
Increased Winter Rainfall	C	Increased business disruption and insurance claims, including building and property/stock damage.
Increased Sea Level and tides	C	Impacts upon coastal infrastructure resulting in investment losses and insurance claims.
	C	Increased marine and off-shore impacts and related investment / insurance losses.
	O	Investment opportunities in coastal defence technologies.
Longer Growing Seasons and Reduced Frosts	O	Reduced frost related insurance claims, eg crop losses, traffic accidents
	O	Increased economic activity and investment opportunities in agriculture
Increased Flooding	C	Higher costs of insurance claims and related impacts upon economic activity and investments, through damage and disruptions.
	C	Perceived risks of flooding in certain areas.
	C	Changes to flood risk cover for at risk properties.
	C	Impacts upon mortgages and property investments for at risk properties, and new developments on flood plains.
	O	Potential for development of flood specific insurance business.
Potentially Increased Winds and Storms	C	Increased insurance costs of windstorms, such as in the 1987 storm, impacts on transport, infrastructure and business activities.
	C	Investment impacts as a result of storm impacts upon businesses.
	O	New market investment opportunities in weather prediction, risk

assessment and impact protection markets.

FOOD AND DRINK DOMAIN

Scope

Commercial activities associated with the production, distribution and sale of food and drink.

See Also

Marine Fisheries, Agriculture, Health, Water Resources

Background

The comparatively high levels of agricultural and fishing activity within the South West has led to the establishment of a significant food and drink processing and packaging industry within the region. In addition the large number of visitors to the region and the global reputation of local produce, such as Cornish Pasties, has resulted in companies trading in food and drinks within the region and exporting further afield.

This sector is one of the SWRDA's priority sectors with a dedicated sector co-ordinator. A recent survey of companies involved in food and drink report on over 3000 different establishments in the region. Activities undertaken included mail order, farm shops, hamper providers, delicatessens and farmers' markets as well as packagers and producers of a range of food and drink.

Key Issues

- Cooling methods need to be enhanced to avoid damage to produce and reduce bacterial build-up.
- Potential increases in food poisoning need to be accommodated to avoid increased legal challenges and business losses.
- Changes to food and drink consumption patterns, including ice creams and cold drinks.
- Increased visitor numbers will result in a larger regional market for food and drink, in particular local specialities.
- Changes to crop and animal production as a result of changed climatic parameters, including changes to fish spawning and heat stress on animals.
- New product opportunities as a result of changes to traditional crops and species, such as increased wine production.
- Marketing opportunities exist for locally produced food and drink which is seen as safer and more environmentally friendly as it limits transportation - "food miles".

Context

Recent issues surrounding food safety and animal health have lead to local demand for sustainable food production on a local scale. As a result niche markets have developed, most prominent among these being organic produce.

Changes to consumer tastes and the availability of fresh produce from all around the globe have resulted in changes to markets for food and drink. Warmer weather is likely to enhance this situation within the region and encourage a move away from some traditional produce.

It is important to note that issues such as over-fishing and other non-climatic variables could be more influential in affecting supplies of produce than climate change itself, although climate change will place an additional burden on many stretched resources.

The cultural changes which will take place as a result of warmer summers and winters may have the greatest influence upon customer demands, which underpin this industrial sector. New and expanding products like ice cream and wine will offset changes away from some traditional produce. Furthermore, the increased influx of visitors to the region, in particular those from overseas who may be looking for a warmer region which is not as hot as other areas, will result in changes to food and drink demands. However, visitor demand for local specialities may also see a rise in this area of the sector.

Changes to the supply of natural ingredients for products, such as changes to fish species and crops, will fundamentally alter the costs involved in their production and ultimately availability of raw materials. New species will lead to new market opportunities in some produce.

Processing techniques and manufacturing processes will be affected by increases temperatures in particular which result in increased coolant demands. Reductions in summer water supply will place strain on drink producers in particular.

Health risks to workers within the sector as well as consumers are a significant challenge to this sector. In particular is the need to prevent increased food poisoning as a result of higher temperatures and related bacterial growth. Potential legal consequences of this could be considerable.

The Way Forward

Changes in consumer demands towards new and/or sustainable, locally produced products will be a considerable driver. In addition concern about specific species and production processes by consumers will result in moves away from some products and encourage changes to new products.

Policies and activities to accommodate climate change are unlikely to be developed on their own,

but will be accommodated within the need to develop sustainable activities and reduce greenhouse gas emissions.

The provision of locally produced and/or organic foods will result in changes towards more sustainable manufacturing processes which may be a driving force to adapt to climate change. In addition locally produced produce will reduce transport related greenhouse gas emissions.

Best Practice in the Industry

The Bath Breakfast where all the food on your plate is produced within a short distance of Bath, has acted as a considerably successful marketing tool and highlighted locally produced initiatives.

Initiatives to increase environmental protection and encourage sustainable farming and fishing practices will also have consequences for food and drink manufacture and reduce the vulnerability of suppliers to climate change.

A significant driver towards adapting to climate change will be financial and insurance costs which will impact upon business expansion and site development. Additional regulatory and financial instruments as a result of government action will influence this business sector.

Potential Barriers

Few, if any, businesses within this sector have considered this issue to a great degree. This lack of knowledge and the long-term uncertain nature of the issue which could act as major barrier to change.

In addition the small scale of many businesses involved in food and drink production and distribution means that resources and planning horizons do not accommodate issues such as climate change.

Perception of Adaptation Issues

Businesses in this sector recognise the need to consider the environment as a vital resource. In addition they recognise the value of increased visitor numbers and the restrictions of an over-stretched transport infrastructure on their business activities.

However, policies to adapt to climate change specifically are seen as the primary responsibility of government and regional agencies, and are often considered to be beyond the resources of businesses themselves.

To date there has been little research or information dissemination within this sector. Research into climate change impacts on agriculture and fisheries is comparatively well developed and many of the issues raised there will be pertinent to businesses in this sector.

Challenges and Opportunities of Key Climate Impacts in Food and Drink Domain

Climate Impacts		Challenges and Opportunities
Increased Summer Temperature	C	Changes away from normal cooling methods towards air conditioning and other cooling methods, with associated increases in costs.
	C	Increased bacterial build-up in foods leading to higher rates of food poisoning and related litigation matters.
	C	Health impacts upon staff who work both inside and outside.
	C	Transport of fresh produce may become difficult or more costly due to extra refrigeration requirements.
	C	Loss of traditional species of animal and crops.
	C	Some traditional food types may become less popular in warmer weather (e.g. Cornish pasties).
	O	The potential to develop tourist market as visitors to the region increase.
	O	New techniques and processes in response to changes in conditions and markets.
	O	The availability of new crops and species within the region, thus reducing import costs and developing new products, eg wine production.
	O	Increased consumption of warm weather food and drinks, such as ice cream, leading to new markets.
Reduced Summer Rainfall	C	Changes to the cost of water and supply levels, particularly important in drink manufacturing.
	C	Difficulty in storage of short shelf life fish in higher ambient temperature resulting in increased operating costs.
	O	Increased levels of tourism and so expanding markets within the region.
	O	Dietary changes to lighter meal consumption such as fish.
Increased Winter Temperature	C	The need to change current heating and ventilation systems in buildings to accommodate warmer winters and meet new building guidelines.
	O	Changes in food consumption patterns resulting in changes to demand for certain products and new/ expanding markets for other products.
	O	A reduction in cold weather impacts on supplies, manufacturing processes and infrastructure.
	O	Positive impact upon energy costs and staff health.
Increased Winter Rainfall	C	Impacts on infrastructure, in particular buildings, and transportation.
	O	Increased visitor numbers to indoor based food and drink attractions.
Increased Sea Level and tides	C	Direct and indirect impacts on infrastructure, markets and supplies, in particular impacts on port facilities.
Longer Growing Seasons and Reduced Frosts	C	Greater input into longer crop production cycle, offset by higher returns.
	O	Potential for more crops to be supplied and less crop loss in the winter.
	O	Potential for new crops and associated industries – e.g. wine production could become a large South West concern.
Flooding Increased	C	Direct infrastructure damage, and indirect impacts upon supplies and markets.
	C	Increased insurance costs and changes to planning regulations affecting infrastructure development.
Potentially Increased Winds and Storms	C	Increased direct and indirect impacts on infrastructure and supplies/markets a major factor in continuity of supply during winter months when most successful fishing opportunities are available.
	C	Increased repair costs and insurance costs.

INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT) DOMAIN

Scope

Commercial activities with the design, manufacture, distribution and support for hardware and software aspects of computers, telephones and related peripheral equipment.

See Also

Advanced Engineering, Environmental Technology, Built Environment, Utilities and Transport.

Baseline

This sector has seen massive expansion in recent years and has developed into a significant new area of economic development within the South West. Large international companies, such as Telewest Broadband, have located within the region and have lead to further development of smaller companies dealing with such things as web design, software development and equipment production.

Despite recent changes within this sector with the end of the dot.com and mobile phone boom, the skills and facilities which have developed within the region means that this sector remains an important contributor to the region's economy, and will further expand as technologies develop.

Key Issues

- Changes to health risks to workers inside, in particular those using electronic equipment.
- Impacts upon infrastructure, in particular communications masts and overhead cables.
- Potential increased energy costs due to carbon taxation methods and infrastructure damage.
- Increased levels of down time as a result of loss of energy supplies and telecommunications during periods of extreme climate impacts.
-
- Technologies associated with mitigating and adapting to climate change, for example monitoring building temperatures and flood risks, will be an increased market.
- On-line technologies will reduce the vulnerability of activities to climate impacts upon transportation links, such as coastal railways.
- Global climate modelling and risk modelling requires ongoing development in software and computer technologies.

The ICT sector has the potential to provide many of the technologies and solutions which will help to predict, accommodate and develop under a changing climate. This includes the software and technologies needed to run the global circulation models which produce the UKCIP02 scenarios as well as communication systems which reduce reliability upon transportation links which may be at risk from climate impacts. In addition there is scope for software and technologies to monitor flood levels, manage crops, and control temperatures in buildings.

The sector will be vulnerable to climate impacts through infrastructure damage. In particular threats to communications masts and overhead wires as well as other facilities such as manufacturing plants in coastal regions.

Changes to working and leisure time activities, including increased home working, and developments of on-line working and leisure facilities, will result from changes to the climate as well as other pressures. A proposal for an interactive website which provides tourist attraction details dependent upon weather conditions has been put forward, and signifies the importance of this sector in providing solutions to changes in other sectors.

A further important role for this sector, which may also be a niche market for some companies, is in the education and delivery of information to the public and other businesses on climate change. This could be in the form of visualised climate change scenarios and risk assessments for individual business activities.

The Way Forward

As with many economic sectors, ICT will respond to a combination of customer demand, risk avoidance, increasing costs, and government legislation. However, ICT is a very innovative sector of the economy and is in a position to benefit from impacts in other sectors.

Threats to infrastructure, and in particular planning regulations and insurance costs for structures such as telecom masts will force businesses to consider future climatic conditions when planning new developments. However, other planning issues such as the health effects of communication infrastructure will continue to play a large role in planning considerations.

Key drivers will include demands for technologies which predict and monitor climate impacts, and risk assessments in many sectors from agriculture to flood controls.

Changes in energy supply costs, and possible disruption to supplies as a result of climate impacts, will be of significant importance to this energy dependent sector. Government legislation and incentives to reduce dependency upon fossil fuel energy supplies may result in opportunities for on-site renewable energy supplies and energy efficient practices and technologies.

Potential Barriers

While uncertainties within the climate change debate pose a considerable barrier to change, it is the inertia within other industrial sectors who are the customers of ICT businesses that pose the largest barrier. The ICT sector itself is relatively responsive to new markets and economic changes and as a result will change when a market becomes significantly developed. Current economic conditions within the sector and other influences on this sector may result in limited change in the short term.

Knowledge Base

Little research has been done within this sector, and as a result knowledge levels and engagement with businesses has been limited. It is unlikely that adaptation strategies have begun or that the issue is seen to be of importance to many of the businesses in this sector. Considerations of economic stability and future expansion are priorities in the short–term. Climate change does not figure within the timeframes used or in the long-term planning for the majority of businesses.

Challenges and Opportunities from Key Climate Impacts in Information and Communication Technologies Domain

Climate Impacts		Challenges and Opportunities
Summer Temperature Increased	C	Increased need for cooling equipment and buildings with consequent increases in costs.
	C	Health impacts upon staff who work inside and with electronic equipment.
	O	The development of technology and software to monitor building temperature and other software needs.
Winter Temperature Increased	C	The need to change current heating and ventilation systems within buildings to accommodate warmer winters and to meet new building guidelines.
	O	Beneficial impacts on supplies, manufacturing processes and infrastructure.
	O	Positive impact upon energy costs and staff health.
Flooding Increased	C	Infrastructure damage, and impacts upon supplies and markets.
	C	Increased insurance costs and changes to planning regulations affecting infrastructure development.
	O	New technologies/ software to monitor and manage flood risk areas.
Summer Rainfall Reduced	C	Non-identified.
	O	Potential for on-line data on water management.
	O	New technologies/ software to regulate water supply.
Increased Winter Rainfall	C	Impacts on infrastructure, in particular buildings and cabling.
	O	Non-identified.
Increased Sea Levels and Tides	C	Direct and indirect impacts on infrastructure, markets and supplies, in particular impacts on port facilities.
	O	New technologies/ software and on-line data to monitor sea-level rise
	O	Impacts on transport infrastructure could result in more activities being undertaken interactively and to avoid excessive travel.
Longer Growing Season and Reduced Frosts	C	Non-identified.
	O	New technologies/ software in crop monitoring and management.
Potentially Increased Winds and Storms	C	Increased direct/indirect impacts on infrastructure and supplies/ markets.
	C	Impacts upon overhead cables and communication infrastructure.
	C	Increased repair costs and insurance costs.
	O	A reduction in travel resulting in more electronic communications.

TOURISM AND LEISURE DOMAIN

Scope

The provision of tourism accommodation, attractions, activities, food and drink retail outlets (including urban, rural and coastal) and recreational, leisure and sports facilities.

See Also

Rivers, Forestry, Agriculture, Fisheries, Coastal, Heritage, Transport, Built Environment, Health, Food and Drink.

Background

Tourism plays a vital role within the South West's economy, with over 20 million visitors in 2000, spending over £3.6 billion within the region. In addition a total of 131.5 million day trips were taken to the region in 1998. The value to the economy of the South West can be estimated to be in the region of £5,000 per household in Devon and Cornwall. Tourism supports about 225,000 jobs within 11,000 businesses in the South West. Within the region there is approximately 10,000 establishments with accommodation for over 600,000 visitors, 80% of whom travel to the region by car.

Climate is a primary motivating factor that is taken into account, particularly in relation to longer holidays, when deciding location and timing.

Acacia Report, 2000.

This level of visitors makes the South West the most popular destination for domestic tourists, with 16% of domestic tourist trips in England being to the South West. The region attracts a lower number of international visitors, accommodating 8% of the visitors to England.

Within the region there are five specific experiences which visitors come to enjoy:

- Cities and Spa Towns
- Coasts
- Resorts
- The Countryside
- National Parks and Open Spaces

Of these 75% of visitors are attracted by the culture and environment of the region. There is also a series of niche markets, which include health tourism and spiritual tourism.

Environment based tourist attractions are becoming increasingly popular within the region and include the very successful Eden Project and attractions such as the Gaia Energy Centre. The managed use of the environment as a tourist attraction highlights its value to the region.

69% of links golf clubs say their course is facing serious threat from erosion and/or flooding in the next 50 years.

CII, 2001

Key Issues

- Any increase in tourism must be managed to avoid damage to the South West's most valuable asset – the environment.
- Sea level rise and flooding threatening coastal and riverside installations.
- Health implications of increased heat stress, food poisoning and UV exposure.
- Increased pressures on services and utilities due to greater visitor numbers and climate impacts on infrastructure.
- Increased visitor and climate related pressures on natural environment attractions.
- Potential to exacerbate current peaks in demand in an industry already heavily influenced by seasonality.
- Opportunities for diversification, new markets and job creation.
- A longer, more reliable summer season and a warmer winter, thus extending the tourist season.
- Increased opportunities for outdoor recreation and warm weather services.

The region needs to develop the infrastructure to allow for greater outdoor activities... everything from cafe terraces to showers on beaches.

SW Tourism

- Opportunities for increased prestige and marketing based upon "green" tourism.
- An increase in extreme weather, including increased heat-waves, in other tourism markets, such as the Mediterranean, resulting in less overseas travel and an increase in domestic tourism.

An opportunity to market "storm tourism" - short breaks to experience nature at the extreme.

Malcolm Bell, SW Tourism

We see the greatest issue to be the lack of public engagement in the theme of adaptation. This fails to provide the right climate of support that would give politicians the will to address the necessary changes to e.g. investments in infrastructure, overseas aid etc.

Eden Project

- Increased travel costs as airline fuel is incorporated within a carbon taxation scheme could increase visitors from within the UK, whilst also discourage overseas visitors. Additional increases in domestic travel costs could similarly reduce long distance travel within the UK.

Climate change impacts and adaptation strategies within the tourism and leisure sector need to be built into the existing primary issues which exist in this sector, in particular:

- The wider debate on sustainable development and how tourism can be developed in a sustainable nature.
- Increased efficient use of resources and environmental considerations - therefore developing "green tourism".
- Increasing public transport services and reducing the dependency of visitors on the car.
- Developing tourist and leisure services to provide a higher level of service for customers.
- Undergoing a cultural change to develop more Mediterranean style services and facilities to attract overseas visitors and meet the higher expectations of domestic visitors.
- Overall a desire to increase quality and value for money throughout the sector in the region.
- The recent crises in the farming industry and declines in traditional rural activities mean that tourism now underpins many rural economies in the region. However, the increased purchase of holiday homes in rural areas has lead to higher property prices and associated problems for residents.
- Taxation on fuel and energy is an issue which affects both the development of leisure facilities and the costs incurred by visitors for travel.

Managing Development

Tourism and the use of leisure facilities is set to benefit from climate change as the climate becomes warmer and drier in the summer and warmer in the winter. Consequently, the tourist season should extend beyond its traditional boundaries and develop further in the winter months.

In addition the use of outdoor leisure facilities, including sports grounds, gardens and natural parks, and beaches will increase as temperatures become warmer. This provides an expanding market for leisure based holidays, which already account for 25% of U.K. holiday expenditure (CII, 2001), such as golfing and fishing holidays in the region which will provide higher income from visitors.

Since 1974 there has been a clear relationship between July temperatures and the number of domestic holiday trips.

Agnew,1999

Whilst this increase in visitor numbers has the potential to rapidly develop the sector, it is essential that this is done in a managed way. The region's facilities are currently very stretched during the tourist season, in particular the transport infrastructure and popular visitor destinations. It is therefore essential to manage adaptation to climate change by trying to increase the quality of the service provided to customers and thus increase visitor spend rather than just the numbers of visitors.

Benefits and disadvantages of growth

Increasing visitor numbers during the winter months and in particular the "shoulder months" is a substantial opportunity as the climate becomes warmer. This effectively allows visitor facilities to remain open for a longer season, and in some cases year round. This will have an additional benefit to the region as it will secure jobs in the sector and also mean that tourist specific services remain in operation for longer periods thus benefiting local residents who are often left with limited services during the "off season".

Visitor numbers to the region are likely to increase from both within the U.K. and overseas as tourist destinations in other areas become less desirable as a result of uncomfortable temperatures and other climate change impacts in the region.

Higher visitor numbers will have a positive effect on local economies, in particular in rural areas. Tourism will increasingly become the primary income stream for many in rural regions.

A likely increase in holiday homes will continue to push up house prices in rural areas and may affect living standards for local residents who cannot afford higher prices.

Accommodating climate impacts on infrastructure and facilities is viewed as being essential to ensure that costs are kept down and that the

opportunity for all year round tourism is not reduced by storm impacts.

Adaptation is of particular importance to ensure that the buying and selling of properties, which could be greatly influenced by insurance, financial costs, and planning regulations, does not hinder economic development.

The Way Forward

The need for sustainability

Policies and activities to accommodate climate change are unlikely to be developed on their own, but will be accommodated within the need to develop sustainable tourism activities and enhance the region's environmental resources.

The recognised need to manage the region's infrastructure to accommodate increasing visitor numbers will also act as a mechanisms for change. The SWRDA and South West Tourism are both committed to developing sustainable practices within the tourism industry.

The development of outdoor activities and leisure services is a response to public demand for activity based holidays and the "cafe culture" experienced overseas. New developments such as the Falmouth Marina and increased activities like beach volleyball in Weymouth will move the industry towards developing outdoor services and consequently accommodating new opportunities which climate change may present.

Additional drivers to change will be developing "Eco-tourism" activities which market the natural environment and "green" practices to attract visitors. In Scotland environmental tourism activities have increased occupancy rates by 20%, and the South West is aiming for a similar increase.

Similarly the recognised value of the region's environment to its tourist industry will be a driver in protecting areas against climate change impacts, where economically possible. The National Trust predicts that 75% of visitors come to the region because of its conserved landscapes, and are advanced in assessing responses to climate change. Similarly the recently created World Heritage Coastline further emphasises the unique attraction of the environment and ensures that its protection is at the forefront of future policies. Indeed the English Tourism Council report that 75% of visitors would be prepared to pay more to protect the environment.

The ability to market the region as a warmer sunnier place will be the main climate related mechanism for change. It was the Victorians who first discovered the mild winters on the English Riviera and who subsequently developed many of the region's tourist centres. By promoting outdoor activities and regionally distinctive attractions there is great potential to develop a further revolution in visitors and services in the region. Marketing new quality facilities will help to attract visitors who may otherwise go overseas and who want breaks outside of the summer season.

Potential barriers

The tourism sector is at the forefront in considering climate change within its future, as a direct result of the potential benefits that a warmer, sunnier season would provide. South West Tourism are very active in issues related to sustainable development under which climate change is of significant importance. However, individual practitioners themselves are limited in their understanding and ability to consider climate change.

This is a result of a lack of understanding of the issue, uncertainties surrounding the science of climate change, and the lack of clear messages from the media and policy makers on adapting to the opportunities and impacts. This reflects to a degree the unbalanced nature of many media stories regarding the issue which fail to put across the coherent message being developed by national and international bodies, such as IPCC and UKCIP, and gives excessive credence to contradictory, often unsupported, claims.

The underlying barrier to climate change related development is the financial status of many of the businesses. This is a result of the fact that most businesses involved in tourism in the region are small or even micro businesses with limited resources. It is very difficult to engage with a disparate industry such as tourism, when many businesses are of a size where they might not consider their own impacts and contributions to be significant on a regional level.

In addition the influence of other issues upon the market place means that the tourism sector is vulnerable to many changes and is in a limited position to address climate change. This was highlighted by the recent Foot and Mouth Disease epidemic which severely damaged the industry in the region.

Knowledge levels

Businesses and organisations in the region recognise the need to consider the environment as a vital resource for tourism and leisure. Over 80% of businesses in southeast Cornwall were concerned about the state of the environment and its relationship on their business, yet only 29.4% of these businesses considered their own impact on the environment (Vernon, 2001).

The belief that climate change, and the environment in general, is an issue beyond individual's or business's scope had been reflected in discussions with service providers. Consequently, adaptation to climate change is likely to be re-active rather than proactive. This is also a result of the financial considerations of the industry and the fact that in common with other sectors, many tourism businesses plan on 2 to 5

year time horizons which do not fit with projected climate change scenarios.

The impacts on tourism (both global and domestic) will be wide ranging, diverse and interrelated. To date there has not been much research on tourism (at a global and local scale) and climate change. The effects, therefore, of these changes are hard to quantify.

Dr David Viner, Climatic Research Unit

A difficulty in securing funds to finance adaptation initiatives as a result of the uncertainties in the projections has also been identified as a major issue for those who wish to be pro-active.

Where adaptation has been considered, issues identified have focused primarily on reducing direct climate impacts and accommodating increased visitor numbers and related stresses, as well as developing higher quality facilities for outdoor activities.

To date there has been little research or information dissemination on the links between tourism (on a global or local scale) and climate change. Furthermore, there is no evidence that climate scenarios have been used by individual organisations. This reflects the fact that very few leisure and tourism businesses or organisations have considered climate change beyond the implementation of the Climate Change Levy, which has not had as substantial an impact as in other business sectors.

The knowledge base on environmental and sustainable development issues is more extensive and understood within the sector, but consideration of the issues by businesses needs further consideration. Effective sustainable practices need to be put in place to prevent superficial "green" activities being marketed. Transportation and energy efficiency are of particular importance, with many tourists visiting attractions by car, and these are dependent upon regional changes as well as individual business practices.

Example of Best Practice

In South Hams there is a "Green Tourism Business Scheme Award" for businesses improving the efficient use of natural resources and protecting the environment.

C-CLIF held a workshop on climate change and Tourism on the 30th October 2001. This was attended by over 40 businesses and organisations. Information from the presentation and discussions at this workshop have been used in this section.

Principal Drivers

The primary driver within the sector will be demands from consumers who want services and facilities that accommodate changes in the climate as well as increased expectations of quality services and environmental preservation.

Environmentally friendly and sustainable activities will become increasingly important within the region to satisfy customer demand, as will be the development of a "cafe society" that allows for similar activities as in overseas resorts.

The fact that so many businesses have limited resources means that direct economic benefits of considering climate change will act as a key driver for adaptation. This could be in the form of government incentives, and established, low-risk, business practices to benefit from climate change.

There is likely to be a small group of businesses who will make the first steps in this issue, and a trickle-down effect once benefits have been recognised. There is a need here for trade organisations to provide assistance in reducing risks on financial investments.

A further driver will be individual consideration of the climate change issue and the environment as a whole. Studies suggest that newer businesses as well as individuals with personal experiences of sustainable practices and overseas cultures will make some businesses adapt quicker.

Personal desire to tackle climate change and environmental issues will also make businesses more innovative and willing to consider adaptation (Vernon,2001). This indicates that getting the climate change message across in a forceful and coherent manner will be a further key driver, and therefore places the onus on scientists, agencies, the media and NGO's to do this.

The South West should unlock its unrealised potential by developing its infrastructure to accommodate more visitors and marketing its regional distinctiveness and natural environment... the region needs to be proactive not re-active and market its green credentials.

The English Riviera Tourist Board.

Challenges and Opportunities of Key Climate Impacts in Tourism and Leisure Domain

Climate Impacts		Challenges and Opportunities
Increased Summer Temperature	C	Need to adapt to increased heat in visitor facilities e.g. hotels.
	C	Visitor health impacts, including heat stress, heart attacks and strokes.
	C	Requirement for more outdoor activities and facilities, including water parks, with associated increases in resource demands, including water resources.
	C	Higher temperatures resulting in lower urban air quality.
	C	Effects on coastal water quality, including increases in algal blooms, jelly fish numbers and beach management.
	C	An increase in warm water algal blooms resulting in water discolouration, thus affecting water based activities.
	C	Possible increased cases of food poisoning as higher temperatures result in higher levels of bacteria.
	C	Increased demand for water supplies and irrigation with drought conditions becoming more frequent.
	O	Increased visitor numbers as summers become more reliable.
	O	Increased use of sporting facilities and visitors to sports events, in particular water sports.
	O	Market opportunities as Mediterranean destinations become too hot.
	O	Greater demand for outdoor facilities, sporting facilities and warm weather goods and services e.g. Beach volleyball in Weymouth.
	O	Higher sea surface temperatures could extend the sea and inland water bathing and recreation season and range of activities e.g. more surfers at Newquay.
Reduced Summer Rainfall	C	Potential limitation of water supplies and related costs.
	C	Drought effects on natural tourist attractions such as gardens.
	C	Lower flow levels in rivers may increase pollutant levels and thus reduce their attractiveness to visitors and creating potential health problems.
	O	Less rainy days increasing outdoor and water based activities.
	O	Less rain for outdoor events e.g. Glastonbury Festival, sports events.
	O	Summers perceived to be more reliable, thus attracting more visitors.
Increased Winter Temperature	C	The need to change heating and ventilation systems to accommodate warmer winters.
	C	Increased pests and vermin who survive the winters, having a negative impact on tourist perceptions as well as health.
	O	Increased winter visitor numbers and spend leading to a more year round tourist season and "winter sun" holidays.
	O	Increased use of outdoor recreation and sporting facilities.
	O	Lower energy costs for facilities as a result of lower heating demands.
	O	Positive health effects on visitors and staff.
	O	Marketing opportunities of warmer winters.
Increased Winter Rainfall	C	Infrastructure damage through increased intense precipitation.
	C	The saturation of grounds (e.g. sports facilities) resulting in increased

		drainage impacts, management costs, and reduced usage.
	C	Reduction in visitors to outdoor attractions on rainy days e.g. football matches.
Climate Impacts		**Challenges and Opportunities**
Increased Sea Level and Tides	C	Infrastructure damage, in particular coastal attractions, such as golf courses.
	C	Impacts upon transport infrastructure, such as ports and coastal transport links e.g. Dawlish Warren.
	C	The squeezing of beaches and coastal habits as well as increased coastal erosion around visitor sites such as along the Jurassic Coast.
	C	Increased pressure on coastal management and water quality resulting in increased costs.
Longer Growing Seasons and	O	Lower costs in maintaining grounds and sports facilities, including under pitch heating.
Reduced Frosts	O	Reduced frost related accidents.
	O	A reduction in frost impacts on infrastructure.
	O	Changes to species within landscaping schemes in e.g. Caravan Parks.
	O	A longer visitor season for garden based attractions.
Flooding Increased	C	Direct flooding of accommodation and other infrastructure.
	C	Effects on insurance costs and planning regulations.
	C	Flooding results in bad publicity for areas thus deterring visitors.
	C	Water-logged gardens and sports facilities.
Potentially Increased Winds and Storms	C	Impacts upon infrastructure and transport links.
	C	Roofs and other structures vulnerable to structural damage all vulnerable in exposed locations
	C	Damage to caravan sites and other vulnerable installations.
	C	Increased pressure on indoor attractions.
	O	Greater storminess brings more fossils out of the rocks at places such as Lyme Regis, Charmouth.

MARINE ENGINEERING AND MARINE ACTIVITIES DOMAIN

Scope

Commercial activities operating within the marine environment, including offshore, nearshore and coastal activities.

See Also

Advanced Engineering, ICT, Environmental Technology, Coastal Erosion and Flood Defences, Built Environment, Utilities, Transport.

Background

Traditionally this sector has been dominated by large-scale ship building or refitting. This still continues in a very much smaller scale, including the development of naval ships in Devonport Dockyard. However, this business sector is now comprised primarily of small and medium sized companies operating in a number of areas across the region.

Specific activities of note include the development of leisure craft, such as yachts, which is an expanding market. In addition offshore infrastructure development, with particular focus on renewable energies, is a new and expanding market for companies in the region.

The South West has a traditional maritime base, and its decline over recent decades has prompted considerable investment by the SWRDA amongst others. This includes subsidies, training schemes and support for new technologies within the sector to build up its competitiveness in the region.

As a result marine engineering remains an important employer and contributor to the regional economy, although it is primarily in smaller scale niche markets.

Key Issues

- Changes to manufacturing processes may be required to accommodate increased internal and external heat.
- Opportunities to develop engineering solutions to climate change impacts in coastal zones.
- Changes to health risks to workers using inside and outside facilities.
- There are likely to be acute impacts upon infrastructure, particularly coastal based facilities and supply lines, and also on customers.
- Increased costs as a result of restricted water supplies and changes to energy costs.
- Increased levels of down time as a result of loss of energy supplies and telecommunications during periods of extreme climate impacts.
- Opportunities to design new coastal and offshore technologies to accommodate changes in sea levels and storm surges. This may include flood defence products and offshore installations.
- Opportunities exist to develop offshore and coastal based renewable energies, such as off-shore wind power and tidal barrages.
- Increased outdoor leisure activities will increase demand for watercraft and other marine services, including local ferry services.
- Global impacts upon the marine sector will have considerable impacts upon regional activities as a result of the global nature of the industry.

This sector will incur similar infrastructure and transportation impacts as other business sectors. In particular, it will be highly susceptible to impacts in coastal zones and within the marine environment. Furthermore, as with other sectors, transport links, particularly coastal installations such as ports and railway lines may be disrupted, as would electricity and telecommunications connections. However, a reduction in cold weather impacts, in particular a decline frost related impacts, will be beneficial to many winter activities.

Changes to planning guidelines, particularly in coastal regions, and potential increases in insurance costs in high risk areas will affect plant expansion and other developments. Climate impacts in other parts of the globe will have important consequences for many suppliers and customers as well as competitors of regional firms.

Components within engineering processes may be affected by changes in heating conditions and related requirements for increased coolants, with potential reductions in summer rainfall exacerbating this problem. In addition increased heating moderation in offices and factories have related health impacts and affect worker productivity, thus requiring changes to building design and heating/ventilation processes.

This sector has potential to benefit from changes in demand for watercraft and water based activities, including increased visitors year round and increased use of the marine environment throughout the region. Engineering solutions to many of the climate impacts on a global scale present opportunities through flood defence development, water quality evaluation technologies and consultancies involved in marine preservation or management.

Coastal and offshore renewable energy development has huge potential for the region. Recent developments in offshore wind farms, tidal barrages and wave power devices mean that the scope for marine based power generation within

the natural environment of the South West and overseas could lead to expansion into these areas.

Recent trials in wave energy devices in Plymouth have highlighted the potential for producing secure, renewable and localised energy supplies which both mitigate climate change and limit the effects of climate impacts on the National Grid**.**

The Way Forward

As with many economic sectors, marine engineering will respond to a combination of customer demand, risk avoidance, increasing costs, and government legislation. The ongoing threat of coastal erosion and related changes to planning regulations and insurance costs, as well as the dependence upon the marine environment, may result in this sector being more responsive to the need to adapt than other sectors.

Key drivers will include demands for technologies which accommodate climate impacts at the coast. Linked to this will be direct and perceived costs as a result of impacts such as sustained flooding and changes to insurance costs. Linked into this will be changes in building and planning regulations which will dictate where and how coastal and offshore facilities can be expanded.

New markets for marine based tourism and transportation activities will develop as more visitors come to the region. Increased demand for renewable energy, including increased government spending, will provoke businesses to consider this issue further and invest in this sector.

The introduction of further government legislation and incentives to both mitigate and accommodate climate change will also act as one of the primary drivers for change in this business and other sectors.

Potential Barriers

The small scale of many businesses involved in this sector means that it is often difficult to consider climate change on a medium to short term.

Uncertainties within the climate change debate pose a considerable barrier to change. In addition the cost of making changes to plants and other facilities are considerable and unlikely to take place until higher knowledge levels are developed within the sector.

Knowledge Base

Little research has been done within this sector, and as a result knowledge levels and engagement with business has been limited. It is unlikely that adaptation strategies in all but the larger businesses, such as The Association of British Ports, have begun. Considerations of economic stability and future expansion are priorities on the short time scale; climate change does not figure within this timing or planning for the majority of businesses.

However, the consideration of flood risks and planning changes is evident and this may prompt future adaptation considerations as the issue becomes more integrated within the business sector.

Opportunities within renewable energy has been acknowledged by many businesses, which may well lead on to looking at the wider issue of climate change and adaptation as more knowledge dissemination takes place and methods of integrating climate change into business planning horizons becomes more evident.

Challenges and Opportunities of Key Climate Impacts IN Marine Engineering and Marine Activities Domain

Climate Impacts		Challenges and Opportunities
Increased Summer Temperature	C	Increased cooling costs for offices, manufacturing processes and installations.
	C	Health effects upon staff, both in offices etc. and outdoors.
	O	Increased tourism and water-use providing new markets.
	O	Increased use of solar power and off-shore wind energy installations.
Increased Winter Temperature	C	The need to change current heating and ventilation systems within buildings, installations and craft to accommodate warmer winters and to meet new building guidelines.
	O	A reduction in cold weather impacts on supplies, manufacturing processes and infrastructure.
	O	Positive impact upon energy costs and staff health.
Flooding Increased	C	Direct infrastructure damage, indirect impacts upon supplies and markets.
	C	Increased insurance costs and changes to planning regulations affecting infrastructure development.
	O	New products/markets for engineered flood defences and “flood proof” infrastructure.
Increased Summer Rainfall	C	Restricted water supplies with associated cost implications.
	O	Increased use of solar power technologies in manufacturing
	O	Opportunities for expanded work outdoors.
Increased Winter Rainfall	C	Impacts on infrastructure, in particular buildings and installations.
	C	Increased downtime and delays as a result of water intrusion.
	O	On-site water collection and storage operations.
	O	Increased water supplies during winter months.
Increased Sea Levels and Tides	C	Direct and indirect impacts on infrastructure, markets and supplies, in particular impacts on port facilities, off-shore and coastal installations.
	O	New engineering requirements for coastal infrastructure and ship design.
	O	Engineering solutions to storm surges and tidal inundation,
	O	The possibility to develop products for tidal power generation.
Longer Growing Season and Reduced Frosts	C	None identified.
	O	A reduction in frost impacts on manufacturing and facilities.
Potentially Increased Winds and Storms	C	Increased direct and indirect impacts on infrastructure and supplies/markets.
	C	Increased down-time through loss of energy supplies.
	C	Increased repair costs and insurance costs.
	O	The opportunity to expand off-shore wind farms, such as the proposed site in the Severn Estuary.

TELEMARKETING DOMAIN

Scope

Commercial activities associated with telephone based sales, promotion and marketing through the use of call-centres and similar facilities.

See Also

ICT, Leisure and Tourism, Financial Services.

Background

This sector has seen massive expansion in recent years and has developed into a significant new area of economic development within the region. In many areas call centres and related activities have replaced some of the more traditional economic activity.

Tele-marketing companies tend to be relatively high users of labour and telecommunications equipment. In addition the products they market are very much dependent upon wealth levels within society and business activity in the region and beyond. Therefore, this sector will be very dependent upon activities in other business sectors.

This sector will be partly responsible for marketing the products and services to mitigate and adapt climate change, including climate proof goods and services and insurance products.

Industry Source

Key Points

- Changes to health risks to workers inside call centres, in particular those working with computer equipment.
- Impacts upon communication infrastructure, which is the main form of product delivery.
- Increased levels of down time as a result of loss of energy supplies and telecommunications during periods of extreme climate events.
- Opportunities to develop new markets within other business sectors as a result of climate change, including enhanced tourism opportunities.
- Increased opportunities to market government initiatives to mitigate and accommodate climate change through telemarketing activities.

This sector will be subject to much the same impacts as business in general, including infrastructure damage, increased insurance costs and planning considerations. In addition changes to energy costs as a result of climate impacts on power generation and price rises to mitigate climate change may have a particular impact upon this reasonably energy dependent sector.

Climate impacts upon communication structures, such as telephone masts, have the potential to disrupt telemarketing activities. These impacts may take place within the region or on a global scale as many telemarketing activities operate beyond the regional level.

The potential to market some of the goods and services that other business sectors may provide in order to respond to climate change are significant. This may include flood control technologies, new outdoor tourist activities, and insurance services for risk prone areas. As more goods and services are developed, this sector will be tasked with marketing these to customers in the region and beyond.

Telemarketing may also be employed to promote government or commercial initiatives to reduce greenhouse gas emissions or adapt to climate change impacts, such as flooding. This could be an important role for this sector.

The Way Forward

As with many economic sectors, telemarketing, will respond to a combination of customer demand, risk avoidance, increasing costs, and government legislation. However, telemarketing is very responsive to changes within businesses and is in a position to benefit from changes in marketing and products in other sectors.

Key drivers will include demands for marketing schemes for new technologies which, for example, predict and monitor climate impacts, and provide risk assessments to other business sectors.

Changes in energy supply costs, and possible disruption to supplies and communications services as a result of climate impacts, will be of significant importance to this communication intensive sector. Opportunities for on-site renewable energy supplies and energy efficient practices and technologies exist to overcome some of these challenges, as do satellite based communications equipment which is less susceptible to climate impacts.

Potential barriers

Uncertainties within the climate change debate pose a considerable barrier to change. However, it is the lack of engagement with this issue within the sector which poses the main barrier to incorporating climate change into the business practices of this sector. Similar levels of under-engagement within the customers of tele-marketing businesses means that this sector is only likely to respond once other sectors have products and services they want marketing.

Knowledge levels

No research has been done within this sector on climate change impacts or adaptation response, and as a result knowledge levels and engagement with businesses has been limited. It is unlikely that adaptation strategies have been considered or that the issue is of importance to many of the businesses in this sector.

A few exceptions may exist within businesses who operate in flood risk areas; however, it is likely that these businesses will relocate rather than attempt to adapt as relocation is relatively easy given a lack of heavy plant infrastructure.

As with other sectors, considerations of economic stability and future expansion are priorities on the short time scale, climate change does not figure within this timing or planning for the majority of businesses.

Challenges and Opportunities of Key Climate Impacts in Telemarketing Domain

Climate Impacts		Challenges and Opportunities
Increased Summer Temperature	C	Increased need for cooling of equipment and buildings and associated increases in costs.
	C	Health impacts upon staff who work inside, particularly with electronic equipment.
	O	Increased marketing of warm weather activities and services.
Increased Winter Temperature	C	The need to change current heating and ventilation systems within buildings and to meet new building guidelines.
	O	Positive impact upon energy costs and staff health.
Flooding Increased	C	Direct infrastructure damage, and indirect impacts upon supplies and markets.
	C	Increased insurance costs and changes to planning regulations affecting infrastructure development.
	O	Marketing of new technologies to monitor and manage flood risk areas.
Summer Rainfall Decreased	C	None identified.
	O	Marketing of water management technologies and initiatives
Winter Rainfall Increased	C	Impacts on infrastructure, in particular buildings and cabling.
	O	None identified.
Increased Sea Levels and Tides	C	Direct and indirect impacts on infrastructure, markets and suppliers.
	O	None identified.
Longer Growing Season and Reduced Frosts	C	Non-identified.
	O	Marketing opportunities for new crops and produce to customers, such as new wines and foods.
Potentially Increased Winds and Storms	C	Increased direct and indirect impacts on infrastructure and supplies/markets.
	C	Damage to overhead cables and communication infrastructure and signals.
	C	Increased repair costs and insurance costs.
	O	Marketing opportunities for storm-proof goods and services and insurance services.