Local Government Group

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The Value of Geospatial Information to Local Public Service Delivery in England and Wales

Final Report

Prepared for the Local Government Association (LGA) and Improvement and Development Agency (IDeA)

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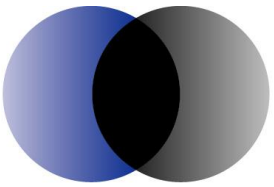

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Economics Policy Strategy

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Table of abbreviations

Abbreviation	Definition
AGI	Association for Geographic Information, the UK industry body for the geospatial industry.
BAU	Business As Usual
CRM	Customer Relationship Management
CGE	Computable general equilibrium model. This is a model of the economy that recognises linkages between markets and the relationship between inputs and outputs. The model is able to analyse issues at the industry, global, national, state and regional levels and to determine the impacts of various economic changes on production, consumption and trade at the macroeconomic and industry levels.
CLG	Department of Communities and Local Government
ELGIN	Electronic Local Government Network
FTE	Full time Equivalent – staffing level equivalent to one person working full time.
GDP	Gross Domestic Product is a measure of a country's overall economic output
GI	Geospatial Information, Information that describes world features according to a location in space.
GIS	Geographical Information Systems
GITA	Geospatial Industry Trade Association for the United States
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
IDeA	Improvement and Development Agency for local government
ICT	Information and Communication Technology
INSPIRE	Infrastructure for Spatial Information in Europe
OFT	Office of Fair Trading. The UK Government agency which enforces consumer protection law and competition law, reviews proposed mergers and conducts market studies.
LAMIS	Local Authority Management Information System
LBS	Location based services
LGA	Local Government Association
LIS	Local Information System
LLC	Local Land Charges
LLPG	Local Land and Property Gazetteer – the subset of the national database within the jurisdiction of a particular local authority
LPS	Local Public Services. Public sector organisations providing services at a local level, For the purpose of this study includes local authorities, Primary Care Trusts, fire services and police.
LSG	Local Street Gazetteer
MFP	Multi Factor Productivity is often seen as a proxy measure of productivity growth due to technology shifts; however, in the case of geospatial information the utilisation or absorption of this information can improve the quality of capital or labour itself.
NLPG	National Land and Property Gazetteer
NHS	National Health Service
NLGN	New Local Government Network
NNDR	National Non-Domestic Rates or business rates are collected from businesses by councils, pooled by central government and redistributed to councils on a formula basis.
NPV	Net Present Value - the present value of an investment's future net cash flows minus the initial investment.
PCT	Primary Care Trust – local service provider within National Health Service

Abbreviation	Definition
PPS	Planning Policy Statement
SaaS	Software as a Service
SDI	Spatial Data Infrastructure
SOA	Service Oriented Architecture
SOCITM	Society of Information Technology Managers. The representative body for IT managers in local government, whose business services group publish regular research reports on IT trends in local government.

Executive summary

Overview

This report examines the economic impact of the use of geospatial information in local public service delivery in England and Wales. Based on case studies in key application areas and applying a conservative valuation methodology, this study estimates that **GDP was approximately £320m higher** in 2008-9 in England and Wales than would have been the case without adoption of geospatial information by local public services providers[1].

Under a business as usual scenario, this would be expected to rise to **an estimated £560m in 2014-5**, but with more rapid introduction of government policies to free up data access and copyright and with improved awareness of the value of geospatial information at senior management level, **this could be improved to an estimated £600m by 2014-5**, with significant gains across various areas, but particularly in Primary Care Trusts (PCTs)[2].

There are additional benefits to citizens from more effective interaction with local public service providers, including reduced travel costs. Furthermore, **construction, transport and business services sectors are positively impacted**, and greenhouse gas emission intensity are lower than they would otherwise be to achieve the improved level of output.

Purpose

Geospatial Information (GI) already underpins many services and policy decisions in local public service delivery. The overall aim of this study is to provide a better understanding of the value GI offers in economic terms, to local public service delivery within England and Wales and recommend ways in which this might be further enhanced.

The findings will inform local public service providers where changes to current geospatial policy and practice can enable better and more effective use of GI in local public service design and delivery, and support cost savings in a period of public expenditure constraint.

Approach

The study approach has been designed to address the lack of existing "hard" evidence of economic benefits associated with the use of GI. The initial study stage included primary and secondary research; interviews; a workshop with key opinion formers and discussions with many other

[1] For the purposes of the study the scope of local public service delivery covers local authorities, emergency services and Primary Care Trusts (PCTs).

[2] PCTs in this context are taken to include the delivery as well as commissioning of primary care services within the National Health Service.

interested parties. The assembled evidence was then packaged for analysis using ACIL Tasman's computable general equilibrium (CGE) model[3], a well established and proven economic model used previously to evaluate the economic impact of geospatial information at a national level in Australia and New Zealand. CGE modelling takes account of feedback loops and as a result tends to produce much more conservative impact estimates than other economic valuation methodologies. Furthermore, as it takes into account productivity impacts only, it provides a lower bound estimate for the ultimate economic impact of geospatial information.

Policy Drivers

With the formation of a new government, there are likely to be substantive policy changes over the next few years. A key focus in these changes will be the transformation of services with cost savings, whilst achieving improved quality of service, as the primary objective.

In the context of the study, GI "intercepts" with a number of broad policy directions:

- Operational efficiency: the need to reduce costs while delivering high quality services;
- Shared Services: working across organisational boundaries and to operate through partnership;
- The Big Society: local government as an enabler of a more self-service approach that facilitates citizens to act for themselves; and
- Information economy: the move to 'data democracy' and greater transparency.

Sector-specific statutory regulation also relies heavily on GI. Key examples, referenced in the study, include planning; traffic management; flood risk and environmental protection.

Furthermore, there are strong indications that the importance of GI is being increasingly recognised in public policy and legislation:

- European Union level: the INSPIRE Directive (European Commission, 2007) provides a technical framework to facilitate the access and sharing of data to assist policy-making;
- National level: the UK Location Strategy (Department of Communities and Local Government, 2008) was published with the aim to maximise the value of location based data to the public, government and business sectors; and
- The response to a consultation on the policy options for GI from the Ordnance Survey, government announced free of charge access to a variety of Ordnance Survey datasets; the

[3] General equilibrium models provide a representation of the whole economy, set in a national and international trading context, using a 'bottom-up approach' – starting with individual markets, producers and consumers and building up the system via demands and production from each component. When an economic shock or disturbance such as an increase in a sector's rate of growth is applied to the model, each of the markets adjusts to a new equilibrium according to the set of behavioural parameters which are underpinned by economic theory.

proposal for a public sector-wide mapping agreement and the technical delivery of INSPIRE network services through the Ordnance Survey.

Geo-economics

The methodology adopted for the study is underpinned by solid economic theory and practice. We use the term geo-economics to describe our approach as it goes beyond conventional cost-benefit by modelling the national economy's ability to deliver more with the same resources by using geospatial information.

GI is a subset of the wider information technology industry. The role and value of information in determining broad macroeconomic outcomes has been increasingly recognised as advanced industrialised economies are shifting to what has become known as 'knowledge economies'. As such we are following a well-trodden path and the overall approach adopted, known as productivity accounting, is an established methodology for such work.

Market Failure and Government intervention

The report considers the consequences of 'market failure' in the market for information and the case for government intervention. The most important observations are that:

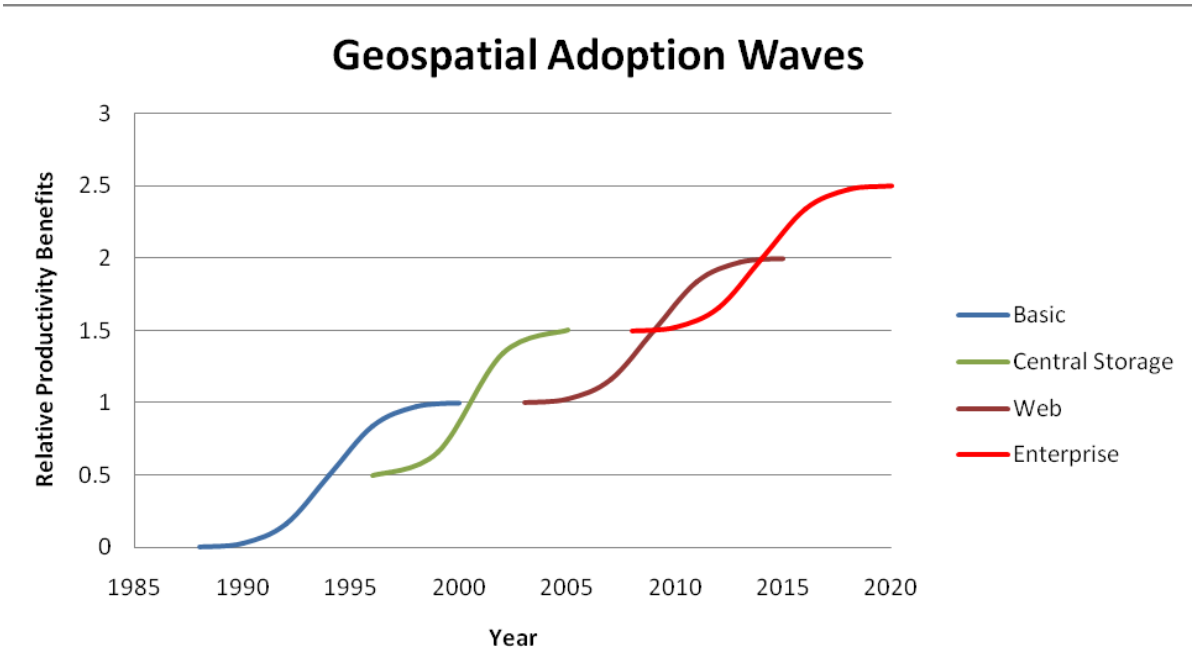
- GI is not a public good until it is placed in the public domain;
- Market failure does not automatically imply that government *should* intervene; costs and benefits from intervening must still be assessed. A public interest problem might have a private rather than public sector solution given the vibrancy of the GI industry, so Government has to carefully balance private sector interests with the wider public interest when deciding whether to intervene;
- Similarly, a natural monopoly situation does not mean that government *must* intervene; there are many private companies that have the ability to provide some of the key geospatial information services that would traditionally have been seen as the remit of government; and
- Finally, dynamics can be important and if government enters or supports a sector that is moving rapidly it should also consider its 'exit' strategy – along with the preceding comment this means that the appropriate role of government is fluid and shifts over time.

Adoption and Diffusion

We believe that GI adoption fits the Rogers model for technology adoption and diffusion, based on a "bell curve" succession of innovators (2.5 per cent), early adopters (13.5 per cent), early majority

(34 per cent), late majority (34 per cent) and laggards (16 per cent). We identify four waves of innovation commencing around 1990. These are demonstrated in the diagram below.

- The first wave began with the introduction of basic GIS on desktops moving beyond the innovator stage from 1990 onward;
- A second overlapping wave saw central storage and gradual linking of databases providing selected local government staff with wider access to internal data;
- A third wave arrived starting in 2000 with the introduction of web mapping. Most staff gained access to electronically stored maps accessible over an intranet and/or the internet. This wave is still working its way through local government organisations in England and Wales; and
- A fourth wave, involving the integration of these technologies into mainstream enterprise systems and the interoperability of data across organisations are just getting underway. The value of geospatial information will only be fully realised once this wave has been completed.



Case Studies

To provide the inputs to the economic modelling, we examined seven broad service areas in detail:

- Customer Interface – work done by local public service providers to improve the experience of interaction with them by citizens and businesses.
- Transport and Highways – covering route planning, streetworks and highways inventory management functions within single and two tier authorities.

- Planning and Consultations – planning is often the area where GI technology was first used in local authorities, the case studies particularly focus on the consultation process.
- Revenue and Benefits – raising revenue through Council Tax for domestic and non-domestic rates, fee-charging property search services and the payment of benefits to citizens.
- Health and Social Care – as a prime example of a service area with a very high public profile where the potential for efficiencies resulting from shared services between local public service providers, including PCTs is a priority.
- Safer Communities – focusing on the use of geospatial information in local authorities and police, particularly referencing Crime Reduction Partnerships.
- National Land and Property Gazetteer (NLPG) – is a land and property information service and fits the criteria by its virtue of its applicability across a wide range of services. The benefits of the NLPG are manifest in many of the services above so we focus here on data sharing.

In order not to under represent the scope of current and potential benefits, other applications identified during the research are also presented although these are not included in the economic evaluation.

Barriers and opportunities

The results of a survey of the local public services community identified the top three barriers to further implementation of GI as (i) lack of awareness of benefits and resistance to change amongst users; (ii) implementation costs (hardware and software); and (iii) inappropriate data pricing and/or restrictions on access.

We also offer a range of possible explanations for the "sub-optimal" rate of progress in implementation based on the experience of the study team in other sectors and geographies:

- Capacity building issues – lack of necessary human resources with the right skills and knowledge;
- Policy conflicts;
- Lack of incentives for managers to make changes;
- Concerns about mistakes or inaccuracies in the data or maps due to resultant impact on reputation or fears of potential litigation if data are released;
- Data "hoarding" – where officials seek to maximise remit or influence by retaining control of information; and
- Institutional inertia

Fortunately, there are powerful paradigm shifts in the market that offer opportunities for step change, including technological advances such as location based services, such as Google Earth or Bing,

designed for the consumer market but applicable to local public service delivery. Open source, shared procurement and site licensing are also positive trends in the market, driving down solution costs and encouraging competition.

Economic Modelling Results

Our analysis suggests that significant productivity improvements are already being gained through the use of GI and that the pace of benefits realisation will increase further as more local service providers move towards enterprise-wide implementation.

The case studies reveal strong business cases in many application areas, including:

- Channel shift – through deployment of transactional web mapping systems.
- Improved transport efficiency – by wide application of route optimisation and better streetworks management.
- Better decision making – using geospatially-enabled local information systems.
- Reduced data duplication – using master datasets such as the NLPG.
- Empowering frontline workers – by speeding up analysis and enhancing mobile working.
- Helping identify social deprivation – through data integration and analysis.

Our research found that the average annualised cost to benefit cost ratio was approximately 1:2.5 considered over an average 5 year project life cycle i.e. for every £1 invested a return of £2.50 would be realised. The raw analysis suggests a figure closer to 1:3.75 but we have reduced our assessment on the basis that our sample has a bias towards more innovative and better managed projects. A detailed analysis of the value of NLPG data sharing shows net benefits over a 5 year period in the range £15 million - £24million.

We estimated that the applications analysed have led to an accumulated 0.233 per cent increase in productivity in 2008-9 for local public service providers.

We also estimated that the improved services led to a 0.06 per cent improvement in the productivity of the construction sector and smaller impacts on land transport and business services sectors. In addition, there was a general increase in labour productivity equivalent to an increase of approximately 1,500 full time equivalent staff across the economies of England and Wales. This is as a result of the accumulated effects of improved citizen and business contact with local service providers.

The case studies also provided insights into the further increases in productivity that could arise by 2014-5. Drawing on the adoption curves, it was estimated that by this period, further innovation could

lead to a 33 per cent increase in these productivity estimates for the business as usual case. We assess that an additional 25 per cent increase in take up could be realised under the optimal policy case.

Wider economic Impact

For the year 2009 it is estimated that the adoption of GI in local public service delivery meant that:

- Gross Domestic Product (GDP) for England and Wales was £323 million higher than it would otherwise have been (around 0.02 percent of GDP).
- Government revenue from taxation was £44 million higher than it would otherwise have been.
- The delivery of goods and services by local public service providers was £232 million higher than it would otherwise have been.

Business as usual scenario (2015)

Under such a scenario, GI will continue to be more widely and comprehensively implemented at the rates predicted by the adoption curves outlined above.

By 2015, it estimated that GDP for England and Wales will be £561 million higher than it would otherwise be without the adoption of geospatial information applications. Further:

- The delivery of goods and services by local public service providers will be £372 million higher than it would otherwise be.
- Taxation revenue will be £89 million higher than it would otherwise be.

Optimal scenario (2015)

Under the optimal (ideal) adoption scenario, it is estimated that GDP will be £599 million higher by 2015 than it would otherwise be without the adoption of geospatial applications. Further:

- The delivery of goods and services by local public sector providers will be £399 million higher than it would otherwise be.
- Taxation revenue will be around £95 million higher than it would otherwise be.

Better policies and action to deliver the ideal scenario, therefore would result in around £38 million in additional GDP for England and Wales in 2015 and there would be additional taxation revenue (all else equal) of around £6 million.

Impact on emissions of greenhouse gases

The modelling also showed that the introduction of GI in local public sector service delivery resulted in the emissions intensity of the economies of England and Wales being around 0.013 per cent less in 2009 than it would have otherwise been. This is mainly attributable to fewer vehicle journeys.

Under a no change in policy, the modelling projected that emissions intensity of these economies will be 0.020 per cent lower in 2015 than it would have otherwise be. This percentage increases to 0.021 per cent with ideal policies. Due to the high-level characterisation of the impacts of the geospatial systems, these are considered to be very conservative estimates of the reduction in emissions intensity associated with the adoption of GI in local public service delivery.

Other benefits

Non-productivity related benefits include:

- environmental benefits arising as a result of better planning and management of infrastructure development.
- more sustainable environmental management through better and more accessible and interoperable data
- improved health and wellbeing of citizens dependent on local public services
- small improvements in time available for citizens for leisure and family activities.

Geospatial information also facilitates involvement in local decision making and, consequently, more opportunity for participatory democracy.

Recommendations

The report makes a number of strategic recommendations for improving the rate of adoption of geospatial information and the consequent benefits:

1. **Gaining Political Commitment:** Local public service providers should work with industry bodies, such as the Association for Geographic Information (AGI), to create a concerted plan of action aimed at promoting better top management and political understanding of the case for the better use of GI.
2. **Public Data Accessibility:** All geospatial information collected or created at any level of government should be made as readily accessible as possible for unrestricted public use unless there are overriding reasons of privacy or security not to do so. In making this recommendation, we do not imply that access to all government data should be at no charge.
3. **Copyright and Licensing:** Restrictions on the use and redistribution of government geospatial information through licensing and copyright should adopt a "light touch" approach focusing on protecting data integrity and large-scale copyright infringement.

4. **Geospatial Awareness:** Local public service providers leverage the drive for greater operational efficiency to organise a series of themed events presenting the savings and/or other benefits identified in each of the case study services.

5. **Business Case Training:** Local public service providers consider establishing a training programme for those responsible for developing business cases for geospatial projects, to equip them with the necessary tools and techniques. Training should not only cover developing and presenting the business case but also techniques for proving that the predicted benefits are realised after implementation.

1 Background to the report

1.1 Purpose of the Study

Geospatial Information (GI) already underpins many services and policy decisions in local public service delivery. The overall aim of this study is to provide a better understanding of the value GI offers in economic terms, to local public service delivery[4] within England and Wales and recommend ways in which this might be further enhanced.

It is published at a critical juncture. Dramatic cuts in public expenditure will be a central plank in government policy for an extended period and value for money and operational efficiency considerations will guide the thinking of all senior managers. Against such a backdrop, it is essential that, not only the value of GI is appreciated at the executive level, but also the role it can play in decision making is better understood.

GI is already an integral part of shaping and delivering a diverse range of services including planning, housing, employment, transport, community safety, health and social care, as this report demonstrates. However, it has the potential to be more widely and comprehensively exploited. Furthermore, if such information is also available to the citizen and businesses, it has the capability to enhance their ability to hold the public sector to account.

The purpose of the study is to assess the:

- Social and economic value of geospatial information and services to local public service delivery;
- Social and economic value of GI as a public good;
- Benefits of freeing derived data and core reference data from licensing (examples include addressing, transport data and administrative boundary information);
- Potential for efficiency gains and cost savings through improved sharing and reuse of GI in local public service delivery across organisational partnerships, leading to better co-ordinated and more effective approaches to the management, delivery, licensing and use of GI and services.

The findings will inform local public service providers where changes to current geospatial policy and practice can enable better and more effective use of GI in service design and delivery, and support cost savings in a period of public expenditure constraint.

The work will also support the activities of GIS and financial managers by providing examples of best practice in delivery of geospatial projects and their financial evaluation.

[4] For the purposes of this study, local public service provision is taken to cover local government, including police and fire and rescue services and primary care trusts within the National Health Service.

1.2 Geospatial Information

Geospatial information defines a location or place through a geo-reference in the form of coordinates, addresses or by defining areas such as postcodes or census output areas. This information refers to, amongst other features, streets, protected zones, properties, assets (e.g. lamp posts, signs, bollards), incident locations and administrative boundaries. The underpinning technology is used to capture, store, manage, analyse and visualise the data, often in form of maps. Most importantly, GI enables the linking and association of people and services through a common location which helps to identify where things happen, where there is a particular need or where to find my nearest service.

At the broadest level, GI is key to:

- Evidence-based decision-making;
- Designing and managing services and infrastructures;
- Achieving and enforcing regulatory compliance;
- Dialogue with citizens about their area and its future;
- Performance management;
- Describing and monitoring environmental conditions and change; and
- Understanding and locating customer needs.

It is an essential component in delivering many services including:

- Planning, economic development and regeneration, transport and traffic management, environmental protection and conservation, waste management, housing, schools admissions, care provision and customer services. These services use geospatial information to develop plans for areas and services, assess planning applications, determine transport accessibility, route bin collections, locate people's social and educational needs, manage assets and properties, target well-being and health improvements, identify sustainable business opportunities and target energy inefficiencies.
- Customer insight initiatives, where the geospatial context is used to gain a better understanding of customers' needs and enhance service delivery by relating it to the location of people, communities and businesses using socio-economic, demographic and environmental profiling techniques.
- Enabling citizens to help themselves in making the most appropriate choices and accessing what they need when they need it.

Furthermore, GI is an integrating technology, supporting the drive for more effective public services to be better focused on customers, shared across local strategic partnerships, managed more efficiently and used more intelligently.

The Society of Information Technology Managers in local government (SocITM) in its latest annual survey of the use of information technology in the sector, IT Trends (SocITM Insight, 2010), found that of fourteen defined technologies necessary for delivering better services, the top tools are all related to customer service, with GIS the most often mentioned (in over 80% of cases). So, it is clear that the value of GI is already widely recognised, both to improve the delivery of local services and underpin policy decisions.

In short, GI is fundamental to linking people, services, business and assets to a place – everything happens somewhere.

1.3 Approach

Many case studies published by commercial companies and public agencies, such as the IDeA, explain the benefits of more efficient use of geospatial information. Unfortunately, few articulate these benefits in financial terms.

An annual assessment of the size and growth prospects of the UK market, covering all sectors of the economy, is undertaken by ConsultingWhere (Coote, Rackham 2009). It currently estimates the size of the market at around £700m per annum; however, this is a supply-side assessment and does not assess the value of the levels of investment identified to end-user organisations. Ordnance Survey has also undertaken an assessment (Lawrence) but only summary information is in the public domain. Other research is of a more general nature, such as the study of the commercial use of public information (Office of Fair Trading, 2006).

In view of this lack of "hard" evidence of economic information, the study adopted the following multi-track approach to data collation, assessment and analysis:

i. Review of existing studies to determine the current take up of GI in local public services, future areas of opportunity and the fit within appropriate policy contexts;
ii. Selection of case studies in service areas linked to high priority outcomes;
iii. Face to face interviews, questionnaires and telephone contacts to identify suitable examples from specific local providers;
iv. Workshop with key "opinion formers" working with geospatial information in the local public services;
v. Assembling the evidence of costs and benefits from individual projects in the case study services, including assessment of the value both to the local public service providers

themselves, wider benefits within other parts of Government and other sectors of the economy;

vi. Assessment of costs and benefits in terms of impacts, referred to as "shocks" on the economy, validation of assumptions and consideration of alternative scenarios without the use of geospatial information;

vii. Using Computable General Equilibrium (CGE) Modelling to show the impact of GI on productivity within the local service providers, public services generally and as a public good to the wider economy, based on the case studies and other evidence.

It is important to note, at this stage, that some of the information collated on economic value is aggregated in the overall analysis to respect confidentiality.

1.4 Outputs

The outputs for this report are as follows:

- A review of the take up of GI in local public services;
- An assessment of the social and economic value of GI in local public services based on seven case studies;
- A review of the potential for efficiency gains and cost savings through improved sharing and reuse of geospatial information in local public service delivery across partnership;
- An assessment of the productivity gains resulting from implementation of GI on the wider economy.

For reasons of brevity not all the assembled evidence can be presented in the report but additional material maybe available on request from the authors.

1.5 Timeframe

The contract for the study was awarded in mid December 2009 and was completed during May 2010. The benchmark for the economic assessment is the financial year 2008-9. Where figures are based on earlier period, this is acknowledged in the report and the figures appropriately indexed.

1.6 Acknowledgements

The authors are indebted to staff from many local service providers who provided their knowledge and experience of the current and potential uses of geospatial information. They also devoted much time, energy and enthusiasm to collating costs and benefit information; thinking about the wider social impacts; and encouraging colleagues to participate. A list of contributors to the study can be found in Annex A-1.

We would like to particularly thank the project manager, Gesche Schmid, for her ceaseless support during a very busy period and Tim Allen and Steve Brandwood, who formed our project board, for their sound advice and guidance. Nick Holmes from the Welsh data unit also merits particular mention for supplying statistical information for the principality.

2 Setting the Context

This section puts the study into context, by outlining some of the "intercepts" where geospatial information can facilitate achievement of key public policy initiatives. For those unfamiliar with the local government sector, it also sets out the scope for local public services and lists the organisations which deliver these services. Finally, it discusses what is meant by wider economic impacts.

2.1 Policy and Legislative Context

Many different Government policies impact on local public service delivery. Geospatial information is an element in achieving the outcomes or efficiencies identified in many of these policies. In this section, we reference some of the most important.

As this report is published following a change of government, new policy initiatives are still emerging. However, if anything, emerging policies appear to underscore the importance of information in achieving policy objectives.

The most relevant overarching objectives are:

- **Operational efficiency**: the need to reduce costs in a climate of extensive public sector funding cuts yet to find solutions to the major challenges to public services which need to respond to high public expectations, demographic shifts and environmental change;
- **Shared Services**: the need for public services to work across institutional divides and organisational boundaries and to operate through partnership with the third and private sectors;
- **The Big Society**: in shifting the old role of public services in directly providing services to acting as commissioner, and increasingly, enabler of a more self-service approach that facilitates citizens to act for themselves;
- **Information economy**: the move to 'data democracy' and greater transparency: freeing up of public good data for engagement and accountability and use and reuse as an enabler of innovation for citizens and businesses, as exemplified by the linked data concept championed by Tim Berners-Lee (Bizer, Heath, Berners-Lee, 2010).

These and other more specific geospatial "intercepts" are examined in more detail in the following paragraphs.

2.1.1 Operational Efficiency

In the climate of reducing public sector spending, services will have to be provided more efficiently. Government has committed to sustain frontline services whilst making these reductions. This will

require innovative and new approaches in local public services including rationalising of processes and sharing of resources. The choice of case studies has been very heavily influenced by this agenda.

2.1.2 Meeting local needs

The coalition government has already emphasised its commitment to bringing power back to the local level and promoting more collaborative working through partnerships and shared services. The concept of Big Society exemplifies this, as does the Freedom to lead initiative[5], where LGA calls for public services to be redesigned and reshaped around the needs of local people. Delivery will place greater reliance on defining locally where the need is; better targeting of services and providing a more collaborative approach by local service providers to meet the needs of local people.

The Total Place concept[6] is based on a 'whole area' approach to public services and demonstrates how public agencies can work together more effectively at a local level to deliver better value for money. Total Place sets out a new direction for local public services and suggests the case for new freedoms from central control. It shows how all places will benefit from removing "ringfencing", streamlining funding and reducing burdens (HM Treasury, 2010).

The significance of the Total Place concept is a focus on local geography and on a more integrated approach to service provision. Geospatial information represents arguably the most important local information resource, acting as the "anchor point" for all events. Furthermore, it has the unique quality of being able to "join up" disparate information sources which cannot be related in any other way e.g. knowing that facilities or incidents described by different terms e.g. the House of Commons and London SW1A 0AA are in fact the same place.

2.1.3 Transparency and open data, digital inclusion

Since the Power of Information report in 2007, public policy has focused on the role of information as a driver for economic growth. The recent Making Public Data Public (MPDP)[7] initiative looks at the information resources that Government creates and maintains and the financial and social benefits of improving accessibility. As part of its transparency policy the new Government has endorsed the drive to make public data freely accessible. The Prime Minister says in a recent announcement about the right to data[8] that: "Greater transparency across Government is at the heart of our shared commitment to enable the public to hold politicians and public bodies to account; to reduce the

[5] http://www.lga.gov.uk/lga/aio/7789425

[6] http://www.hm-treasury.gov.uk/psr_total_place.htm

[7] http://blogs.cabinetoffice.gov.uk/digitalengagement/

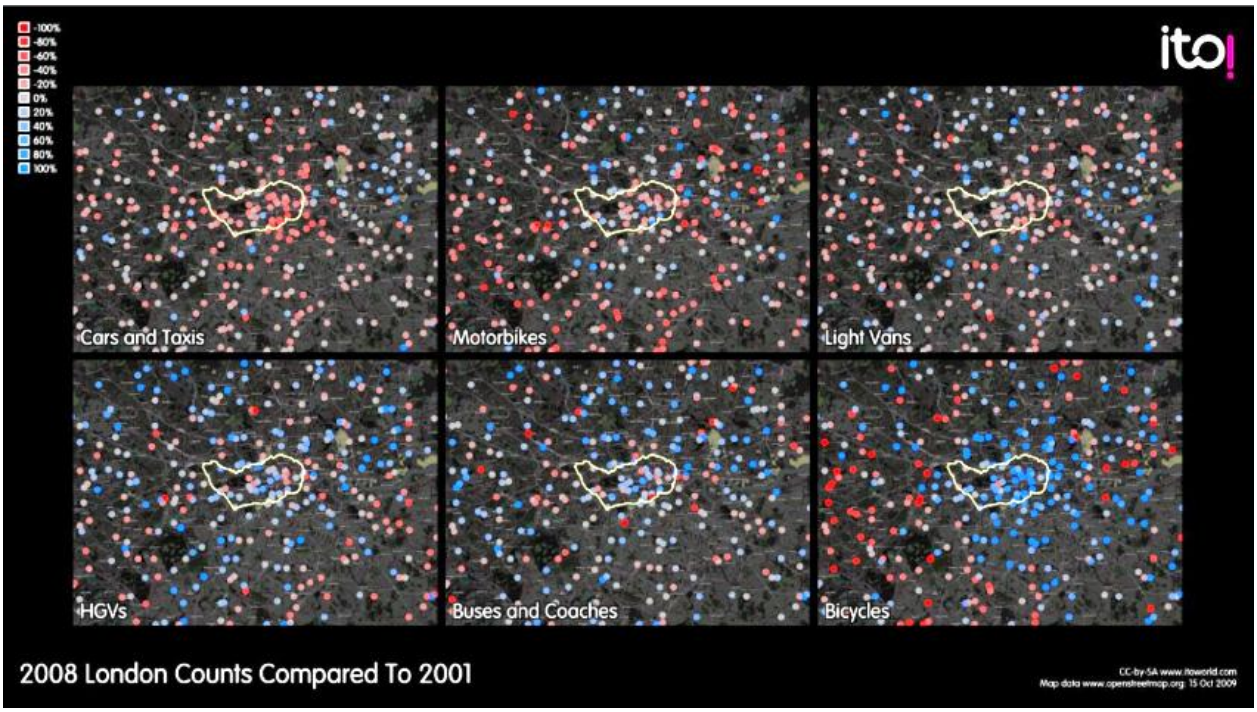
[8] http://www.number10.gov.uk/news/statements-and-articles/2010/05/letter-to-government-departments-on-opening-up-data-51204

deficit and deliver better value for money in public spending; and to realise significant economic benefits by enabling businesses and non-profit organisations to build innovative applications and websites using public data."

MPDP has drawn in outsiders to government and politics, particularly Tim Berners-Lee and Nigel Shadbolt, and emphasised the role of geospatial information in achieving many public policy objectives. For instance, the effects of congestion charging on road usage patterns in London, is graphically illustrated using maps "mashed up" from public and free data sources, see Figure 1 used during the launch event for data.gov.uk in November 2009.

The Berners-Lee and Shadbolt philosophy offers the opportunity to fundamentally change the use and value of public sector data by publishing this data in an open linked data format so that it can used flexibly by anyone for numerous applications.

Figure 1 **Comparison of traffic counts, through the period before and after the introduction of congestion charging**



Note: Reductions during the period are shown in red, increases in blue and congestion zone is outlined in yellow.

Data source: ITO World contribution to Data.gov.uk launch event (Nov 2009).

2.1.4 Geographic Information policy and legislation

Recent European and UK information policy highlights the importance of improving the delivery and better use of geospatial information.

The European INSPIRE directive requires the access and sharing of data to assist policy-making in relation to activities that impact on the environment. It is the first legal mandate to establish an

infrastructure for geospatial data across Europe and requires the creation of common data content specifications across the EU for themes, such as boundaries, addresses, transport networks, land use, protected sites and regulation zones. This will facilitate the data interoperability and, through that, wide use and exchange of information sourced from different organisations delivered through web enabled services.

The UK Location Strategy (CLG, 2008) was published with the aim of maximising the value of location based data to the public, government, UK business and industry. Under the title of "Place Matters" it aims to provide a consistent framework to assist national, regional and local initiatives and service delivery. The strategy is backed by resources which will support communication, user engagement and development of long-term strategy in relation to government's use of geospatial information.

Both the Location Strategy and INSPIRE are being implemented through the location programme led by Defra[9]. Currently, this is predicated on creation of a UK Location Information Infrastructure to facilitate the management and sharing of location based data using common standards and protocols. Subject to the view of the current UK coalition administration, the programme proposes a discovery metadata service linked to the government data.gov.uk initiative to allow anyone to search and evaluate data. A further aim is to coordinate the publishing of geospatial data according to a common framework.

Local government is a key partner as it has obligations as a data provider to comply with the EU directive and, because it is a major data user, to benefit from the programme.

2.1.5 Government policy on Ordnance Survey

Ordnance Survey provides or facilitates much core reference map data in Great Britain. This data is licensed to the public sector through various different mapping agreements. Local government including local authorities, police, fire and rescue, national parks and passenger transport associations are licensed to use the data through a Mapping Service Agreement. The National Health Service (NHS) is licensed through a separate agreement while central government has access to OS data through a Pan Government Agreement.

Recent moves to make a range of Ordnance Survey[10] mid and small scale map data including administrative boundaries and postcode units free of charge and accessible under a collective commons licence (CLG, 2010), is a significant step in improving data access and signalled a substantial shift in government policy toward public sector geospatial information.

[9] Location.defra.gov.uk

[10] https://www.ordnancesurvey.co.uk/oswebsite/opendata/

The Announcement of plans for a common public sector mapping agreement and the technical delivery of INSPIRE network services through the OS were also significant features of the response. However, there is also recognition that other key issues, such as copyright on data derived from Ordnance Survey data and definition of the organisation's public task remain unresolved.

The case studies and economic models exemplified in this study represent largely the situation prior to the recent government announcement on OS data and INSPIRE technical delivery These drivers will have an impact on future adoption of new technologies with potential for increased value add services.

2.1.6 Other Statutory Requirements

The availability and use of GI is already a statutory requirement for a wide range of services including:

- Planning policy and local spatial frameworks. Definition of areas for protection and development, rely on the use of GI. There are also regulations related to its use as part of consultation processes;
- The Traffic Management Act (Department for Transport, 2004) places a duty on local traffic authorities to ensure the expeditious movement of traffic on their road network and in surrounding areas. It specifies the use of geospatial data in the management of streetworks and parking restrictions;
- The Flood and Water Bill (HM Parliament, 2010), which is a response to the Pitt review following the disastrous floods in 2007, requires Unitary and County Councils to take a risk based approach to managing local flood risk, specifying use of maps and information systems based on geospatial information in a number of sections;
- The Wildlife and Countryside Act (1981) places a duty on local authorities to define local nature reserves and public rights of ways through GI;
- Environmental Assessments (2004) require a formal environmental assessment of certain plans and programmes that are likely to have significant effects on the environment where a significant amount of data is held as GI and assessments are carried out using GIS.

These are just a few examples of an increasing volume of legislation and regulation that relies on the use of GI as an enabler to deliver services and safeguard citizens, business, properties and the environment.

2.2 Local Public Services in England and Wales

The study covers local public services in England and Wales. Scotland and Northern Ireland are not within the scope of the study although many of the conclusions we believe are equally applicable in these administrations.

Local public services include, for the purposes of this study, all local authority tiers, police, fire, passenger transport services and Primary Care Trusts (PCTs), in order to capture the increasing emphasis upon sharing of services between these organisations.

Expenditure by Local Government Authorities in England and Wales was around £150 billion in 2008-09. This represented around 32 percent of total expenditure on public administration. When this is combined with expenditure on the Primary Care Trusts, total expenditure on public service delivery comprised around 49 percent of total expenditure on public administration in 2008-09 in England and Wales (HM Treasury, 2009), (Welsh Assembly Government, 2009).

Table 1 **Expenditure on public administration**

2008-09	Total Expenditure
	£ million
Local government authorities	
England	142,844
Wales	7,655
Total	150,499
Primary care trusts	
England	75,799
Wales	4,556
Total	80,355
National Health Service excluding Primary Care Trusts	
England	15,525
Wales	933
Total England and Wales	16,458
Public administration (not included above)	
England	235,757
Wales	16,832
Total	252,589
Total public administration	
England	440,156
Wales	28,702
Total	468,858

Note: PCT expenditure is estimated from an assumption that it comprised around 83 % of total health expenditure.
Estimates based on Statistical Releases by the Department of Communities and Local Government, Treasury, and Welsh Local Government Statistics.
Source: (Department of Health, 2007), (Welsh Assembly Government, 2009), (HM Treasury, 2009)
(Department of Communities and Local Government, Dec 2009)

The organisation of delivery of these services is not uniform across the country. In Wales and in the urban parts of England, for instance, a single tier all-purpose principal council is responsible for most local authority functions. This is either described as Unitary, Metropolitan or London

Borough depending on its location. The remainder of England has a two tier system, in which responsibilities for services are divided between county and district authorities. Police, and in many places fire and rescue services, are delivered by separate single purpose authorities. This diversity of responsibility is illustrated in Table 2.

Table 2 **Local authority responsibilities for major services**

	Metropolitan areas	Shire areas				London area		
	Metropolitan Districts	Unitaries	County councils	District councils	Single purpose authorities	London boroughs	GLA	Joint Arrangements
Education	✓	✓	✓			✓		
Highways	✓	✓	✓			✓	✓	
Transport planning	✓	✓	✓			✓	✓	
Passenger transport	✓	✓	✓				✓	
Social care	✓	✓	✓			✓		
Housing	✓	✓		✓		✓		
Libraries	✓	✓	✓			✓		
Leisure & recreation	✓	✓		✓		✓		
Environmental health	✓	✓		✓		✓		
Waste collection	✓	✓		✓		✓		
Waste disposal	✓	✓	✓			✓		✓
Planning application	✓	✓	✓	✓		✓		
Strategic planning	✓	✓	✓	✓		✓	✓	
Police					✓		✓	
Fire & rescue	*	*	✓		✓		✓	
Local taxation	✓	✓		✓		✓		

Data source: Local Government Association, 2010

A further important area of public service delivery, currently separate from the local government structure above, is the Primary Care Trusts (PCTs)[11]. The PCTs are responsible for managing 83 per cent of total expenditure on health by government. The trusts purchase over 94 per cent of the services they supply from the National Health Service and are at the front line of health service provision in the

[11] PCTs in this context are taken to include the delivery as well as commissioning of primary care services within the National Health Service.

local communities. In view of the importance in the study of the potential for shared services between local government and PCTs, the latter are included within the study scope.

2.3 Wider Economic Impacts

A core objective of this study is to assess the value of geospatial information as a public good in the wider economy. This covers a range of impacts including on those who benefit directly from specific services received, those who benefit indirectly, and those who ultimately pay for the services (i.e. taxpayers).

Geospatial information and related technologies can reduce costs to the local public sector through the potential to lower the cost of local tax collection, reduce charges for services such as planning consents by making processes more efficient. However, the important point is that where local service providers have the ability to deliver a service faster, or a new and better service as a result of using geospatial methods, this implies real potential to alter processes, incentives, and behaviour across the full range of economic sectors. Every economic entity – be it households, businesses or non-profit organisations – must at some point deal with local public service providers, or depends upon facilities maintained or services provided by the local public sector.

Through this study report we evaluate, as far as is possible, the nature and magnitude of such efficiency savings.

3 Geo-economics applied to local public services

In this section we introduce the concept of Geo-economics, as the application of economic theory and practice to the field of geospatial information. Geo-economics is a new field with relatively few established metrics and standard approaches. Some of the key arguments for the approach adopted here are developed, including issues of productivity in the public sector and the role and impact of knowledge within the economy.

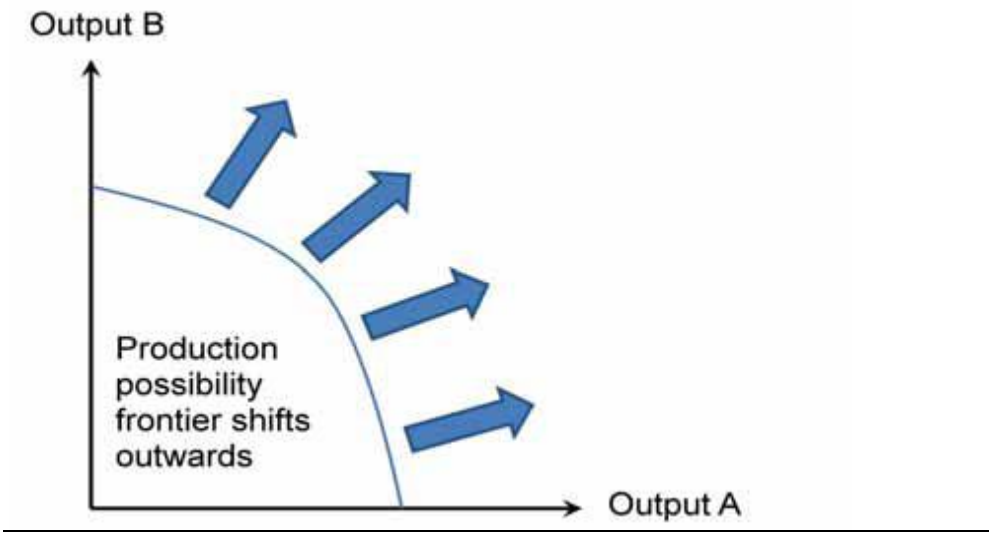
We discuss the need to consider firstly, the "counterfactual" - that is, the improvements in efficiency that technology would have generated in the absence of geospatial information; and secondly, the elasticity of demand for services. The section concludes by examining what economic research leads us to believe it is reasonable to expect in terms of technology adoption. It also models the application of this research to the geospatial information in the local public service market.

3.1 Geospatial information, the economy and society

3.1.1 Increasing productivity in public service delivery

The effect of introducing geospatial information technology and services on the economy can be summarised as the ability to deliver more with the same resources by using geospatial technologies; this idea is summarised in Figure 2 which shows an economy's so called "production possibility frontier" shifting outward as a result. One of our aims is to provide a better understanding of the likely extent and the factors affecting the rapidity of this shift in the local public sector.

Figure 2 **Geospatial information and the economy's productive capacity**



Source: ACIL Tasman

There will always be winners and losers from shifts in technology and services – some tasks or jobs may, for example, become redundant – but the argument is that, overall, society can produce more and better outputs with the same inputs. This means that losers can be compensated while still leaving extra value for the economy as a whole. This 'extra value' may come in several forms:

- extra time available to existing staff, who can thus be redeployed in other production or service areas, or to improve product or service delivery;
  - some of the implicit savings may result in an actual lowering of costs to public service providers which in turn enables more services to be provided for the same amount of money or the same level of services for lower budget appropriations. In the current budgetary climate, such developments are crucial to maintaining service levels;
- more widely, if there is strong competition among commercial adopters of the new technology and if many or all firms adopt the technology, better products and services *as well as* price reductions may flow to final consumers who thus benefit from what economists call 'consumer surplus' (an amount that they would have been willing to pay but are not asked to pay);
  - where there is some degree of 'imperfect' competition so that firms can 'hold on' to the extra value in terms of reduced input costs or a premium charged on new products to final users, this may free up financial resources that can be reallocated to a number of areas.

A proportion of the 'extra' value to the economy is thus captured by final end users, and some of it is captured by the 'intermediaries' that deliver products and services (and this can include government, non-profit and commercial users). Economic growth in turn means the 'size of the pie' as a whole increases, which feeds back to these organisations as increased demand for their products. This 'size of market' effect is in addition to the effects discussed above.

Improved outcomes in areas such as health, education, social care and the environment are important non-market benefits from the use of geospatial information; these will also have longer term impacts on the economy which are harder to estimate and beyond the scope of the modelling for this report. These long term effects may however be critical to sustainable economic growth and should not be underestimated.

The range of possibilities means that the impacts of introducing geospatial information can differ widely by application and across sectors, and accounting for these impacts can be difficult (see Box 1), which indicates a practical issue with attributing benefits from new technology when it consists of a range of complementary innovations including geospatial ones.

The terms data, information, and knowledge are often used interchangeably. Information refers to data that has been organised so that it can be communicated, reproduced or interpreted. Whilst this is knowledge, it is only of a 'rudimentary' type. As long as it remains unused, its value resides mainly in the *options* it creates for future analysis and 'value addition'.

Box 1 **Emergency Planning**

Local authorities have the responsibility under the Civil Contingencies Act 2004 for the coordination of emergency planning. The most recent exercise at Dudley in the West Midlands to test the response of local authority, "blue light", NHS and other local public service providers carried out in January 2010 was based on a scenario of a serious fire in a vacant town centre office building.

In the conventional situation, the GI coordinator would need to reach the emergency control centre and assemble the necessary situation maps when the exercise was announced. However, using their tailored geospatial system (GIS-MO), which has over 400 geo-referenced datasets currently available, the coordinator didn't need to be present as the operational users could establish the necessary exclusion zone automatically and run queries to locate all citizens, schools and businesses within it. Details of all school-age children and vulnerable people, community and medical centres for evacuation and treatment, access routes for emergency services and other "ad hoc" analyses to answer specific questions from the exercise management team were also provided. The geospatial innovations sit alongside many other innovations, such as in communications, fire and rescue equipment, and medical facilities.

The assessment of the emergency planning team was that the immediate availability of analysis, speed of response to "ad hoc" queries on location, improved decision making and easier communication with the public provided by GIS-MO contributes to a significant reduction in the likelihood of serious injury and loss of life. However, the significance of the reduction in the context of all the other contributing innovations and the variations in response depending on the specific nature of a particular incident make it difficult to evaluate the general case.

Source: Dudley Metropolitan Borough Council

Geospatial information can aid deeper knowledge creation and enable inventive or innovative activity, thus ultimately contributing to the production of 'useful' knowledge. The 'core' geospatial industry specialises in generating, as well as utilising, geospatial information to create value added products and services.

Value addition does not always occur along a 'linear' path to market. Invention and innovation involve complex knowledge networks that are currently still very much the realm of economic research; however, the role and value of information in determining broad macroeconomic outcomes has been increasingly recognised as advanced industrialised economies are shifting to what has become known as the 'knowledge economy'. The role of research and development and human capital has been emphasised as influencing levels of long run economic growth (key papers by Grossman and Helpman, 1990, Romer, 1990). More recently, the Power of Information report (Mayo E, 2007) put this into the context of the United Kingdom economy.

Knowledge is sometimes seen as a kind of 'multipurpose' capital that can be transferred across sectors and applications; however, there is some controversy about this interpretation as there is a distinction between specific knowledge (which cannot be transferred) and other types of knowledge (which are hard to define and measure). The economic literature on knowledge capital, and it links with information, is extensive and increasingly concerned with empirical verification (e.g., Eckwert and Zilcha, 2001, Loof and Heshmati, 2002, Haag et al., 2004, Gibbs and Middleton, 2008)

In a related development, the Nobel Prize winning economist Joseph Stiglitz has referred to the rise of informational economics as a "change in paradigm" (see Stiglitz, 2000b, Stiglitz, 2002). This report

echoes the sentiment in the context of geospatial information, arguing that full appreciation of the value of geospatial information involves a change in paradigm at various levels.

A number of reports in applied economics have scoped economic issues that are specific to geospatial information, and given some indications of the value of geospatial information (Oxera, 1999) and spatial data infrastructures or 'SDIs' (European Commission, 2006). The Cambridge study (Newbery et al 2008) on models of public sector information provision via trading funds, specify and test some model specifications that yield estimates of key demand elasticities for public information (including geospatial information). The paper provides a rigorous, 'theory driven' approach to arrive at long term price elasticity estimates, and along with the literature cited above, points to potentially high returns from geospatial information (and investment in SDIs).

However, there are potential weaknesses in these studies. In the response to the consultation on Ordnance Survey (CLG, 2010) it is suggested that the broader welfare benefits are not likely to be as significant as assumed in the Cambridge study. Also, there is still uncertainty about how much money and other resources have already gone into, and are continuing to flow into the maintenance and upgrading of SDIs.

One approach to addressing the problem of evaluating the direct and indirect economic impacts of geospatial technologies and services is to view their impacts through the prism of productivity. That is, the impact such applications have on the efficiency with which resources are employed in producing outputs and the overall impact of these accumulated productivity improvements (productivity shocks) on the wider economy and by inference economic welfare generally.

3.1.2 Productivity accounting

Productivity accounting is a branch of economics that attempts to attribute measured productivity gains to its sources. It is briefly discussed here so that the reader will have a better understanding of how the accumulated impacts of productivity improvements can be translated into wider economic impacts. That is, how productivity shocks that are employed to model the impact of geospatial information in this report.

Traditionally, productivity accounting decomposes productivity gains into gains from two major inputs, namely capital and labour, and a residual called multifactor productivity (MFP).

MFP is often seen as a proxy measure of productivity growth due to technology shifts; however, in the case of geospatial information the utilisation or absorption of this information can improve the quality of capital or labour itself. This type of impact is called *embodied* technological change and is particularly hard to measure. For example, if key employees are able to make consistently better decisions then the quality of labour has essentially improved – dealing with geospatial information consequently has knowledge effects which become embodied in the labour stock.

Detailed investigation of these complexities with regard to geospatial technology is beyond the scope of this report, and as already indicated these issues have been touched upon here to assist the reader in understanding some of the discussion that follows. The first point, in relation to which the above terminology becomes important, is the history of productivity change, which really sets the geospatial information technology shift into its proper context.

3.1.3 With and without Geospatial

The economic impact assessment is based on modelling 'with-and-without' scenarios using a computable general equilibrium (CGE) model (further details on the modelling approach are presented in Annex 8A.3). The model provides the capability to analyse the flow-on impacts of changes in different sectors of the economy following the introduction of a new technology or related changes to work practices (or productivity 'shock') and to compare the impacts of these changes on economic aggregates such as GDP, consumption, employment and investment.

3.1.4 Market failure

Much of the large and ever-expanding body of theoretical literature in informational economics is concerned with the consequences of 'market failure' in the market for information, but the literature is wide and varied (some examples are Lawrence, 1999, Eckwert and Zilcha, 2001, Chernew et al., 2008).

Box 2 explains key economic concepts which are often used when making the case for government intervention.

Box 2 Market failure and natural monopoly arguments

Public goods exist where provision for one person means the product is available to all people at no additional cost. Public goods are said to be non-rivalrous (that is, consumption by one person will not diminish consumption by others) and non-excludable (that is, it is difficult to exclude anyone from benefiting from the good). Common examples include flood-control dams, national defence and street lights.

Given that exclusion would be physically impossible or economically infeasible, the private market is unlikely to provide these goods to a sufficient extent. The nature of public goods makes it difficult to assess the extent of demand for them. It is ultimately a matter of judgement whether demand is sufficient to warrant government provision.

Externalities occur where an activity or transaction has positive (benefits) or negative (costs) economic welfare effects on others who are not direct parties to the transaction. Public goods and some externalities are similar analytically – externalities have public good characteristics in that they are non-rivalrous and non-excludable.

Information failures occur where there is insufficient or inadequate information about such matters as price, quality and availability for firms, investors and consumers to make informed decisions. Government may perceive a role to complement or verify market supplied information – for example, government licensing, registration and labelling regulations for chemicals and pharmaceuticals.

Natural monopoly occurs where it is more efficient for one firm to supply all of a market's needs than it would be for two or more firms to do so. It arises where there are significant economies of scale resulting from fixed costs which are large relative to the variable costs of supply. Monopolies may charge excessive prices, so regulation or government ownership is often adopted.

Source: Productivity Commission (Australia)

In addition to these, governments take into account equity based arguments. With regard to geospatial information, 'supply side' arguments for a role for government can be identified in the following areas:

1. Making data available: infrastructure investment, collection and publishing of data are activities that have 'public good' as well as 'natural monopoly' justifications:
    i once data are released into the public domain, anyone can use them;
    ii there are significant economies of scale in data collection and in the use of data and the infrastructure that supports it.
2. Providing middleware, basic standards, and regulatory frameworks: the government can play a role to help overcome information failure, through for example (i) awareness and best practice guideline information, (ii) criteria for selecting suppliers, (iii) international initiatives such as INSPIRE and (iv) setting applicable standards. It can play a role in providing 'middleware' (e.g., a Registry) where the market fails to provide such middleware. It also has a responsibility to develop regulatory frameworks where:
    iii there are few incentives for 'core' private geospatial industry companies to direct potential users to sources of basic data or to other providers;
    iv similarly, successful private providers have little incentive to self-regulate and/or standardise; it is in their interest to minimise the potential for the loss of repeat customers.
3. Training and education: governments are traditionally involved in training and education as private companies often under-invest in this area because they risk losing that investment when their staff members move to competitors ('free riders').
4. Assisting small business: this has an equity component but also an innovation system rationale; most of the geospatial industry companies are small or 'micro' businesses with 5 to 20 employees (Park et al., 2008).

At the same time, there are 'demand side' arguments for governments' involvement with geospatial information:

5. To assist with efficient provision of services: governments provide many services that benefit from use of geospatial information.
6. Policy making: governments recognise that having access to geospatial data and modelling of geospatial events over time can play a significant role in shaping policy (e.g., coastal erosion and land development); this also relates to governments' wider responsibilities to their constituents (for example social welfare, health and sustainability). The role that geospatial information plays in driving the "information economy" is also increasingly widely recognised.

Key observations

It is important to note that:

- geospatial information is not a public good until it is placed in the public domain (it is to some degree 'excludable' and is not a public good by virtue of its mere existence);
- market failure does not automatically imply that government *should* interfere; costs and benefits from intervening must still be assessed;
  - this also means that government has to carefully balance private sector interests with the wider public interest when deciding to intervene, and ideally seek solutions that deliver the wider results whilst not impeding private initiatives;
- similarly, a natural monopoly situation does not mean that government *must* perform this function; there are several private companies that have the ability to provide some of the key geospatial information services, and are even able to afford some of the infrastructure spending, that would traditionally have been seen as the remit of government;
- finally, dynamics can be important and if government enters or supports a sector that is moving rapidly it should also consider its 'exit' strategy – along with the preceding comment this means that the *appropriate role of government is fluid and shifts over time.*

The key tests for involvement of the public sector are:

- A public interest need is to be met, and
- A public agency is sole provider, or
- The private sector is unable to provide a particular product or service, or
- Based on national competition policy measures, use of a public sector provider is the most cost efficient use of resources.

3.1.5 Government failure

While the term 'market' failure is employed almost routinely in debates about what governments should or should not do, concepts of 'government failure' are not discussed as frequently. Stiglitz (2000a) outlines four major reasons for the systemic failures of government to achieve its stated objectives in his textbook *Economics of the Public Sector*: limited information; limited control over private market responses; limited control over bureaucracy and limitations imposed by political processes.

In the context of the use of geospatial information in England and Wales, it was commented several times during the preparation of this report that national and local government holds a large amount of geospatial data but that this is either not being shared effectively across departments (i.e. held in 'silos') and sometimes not released at all, and that there is a lack of knowledge as to what data are available where, and how one can access them. This situation could indicate aspects of 'government

failure' in the economist's sense of the term. It has led to suboptimal data sharing within government as well as lower data use and re-use by non-government entities.

Stiglitz (2000a, p. 205) provides a number of explanations for this type of public sector inefficiency, including an absence of competition (a corollary to being the natural monopoly), the absence of incentive pay and various principal-agent problems such as the pursuit of bureaucratic objectives and high levels of risk aversion exhibited by government departments.

3.1.6 Elasticity of demand for information

The elasticity of demand measures the change in the quantity demanded which occurs following a change in the price of the product or service being traded. This is an important consideration for geospatial information policy, as many government data custodians continue to charge for geospatial information.

There is evidence that charging a price, however low, can have a strong deterrence effect, in particular when potential buyers are unsure of what they are buying or how it will assist them (uncertainty of product is a peculiar feature inherent in the market for traded information; see Stiglitz, 2000b).

Secondly, where a price is charged for information, there is evidence that demand is elastic, i.e. responds relatively strongly to changes in the price charged (and 'cuts out' as price exceeds a threshold level). A recent example comes from New Zealand's National Institute for Water and Atmospheric Research (NIWA):

> "This year, we opened up web-based access to our archived data free of charge. The response was excellent with the number of registered users of the National Climate Database rising from 130 to over 4000." (NIWA Annual Report 2008)

In other words, a drop in price to zero saw 'demand' multiply by more than 30-fold. However, this may not reflect the 'true' price elasticity because of the large backlog of demand that may have been met in the first year. The Cambridge study similarly cites other sharp increases in demand following the introduction of free access policies and concludes that in most instances the price elasticity is likely to be between 1.0 and 2.0 (Newbery et al., 2008). Although, as observed, doubt has been expressed about the validity of their conclusions, price elasticity greater than 1, at the bottom end of their range, means that for each percentage change in the price, there is a greater percentage change in demand.

If the price elasticity of demand for geospatial information is significantly greater than one, it means that reducing the price of geospatial information will significantly spur use and uptake of that information.

3.1.7 Technology adoption and diffusion

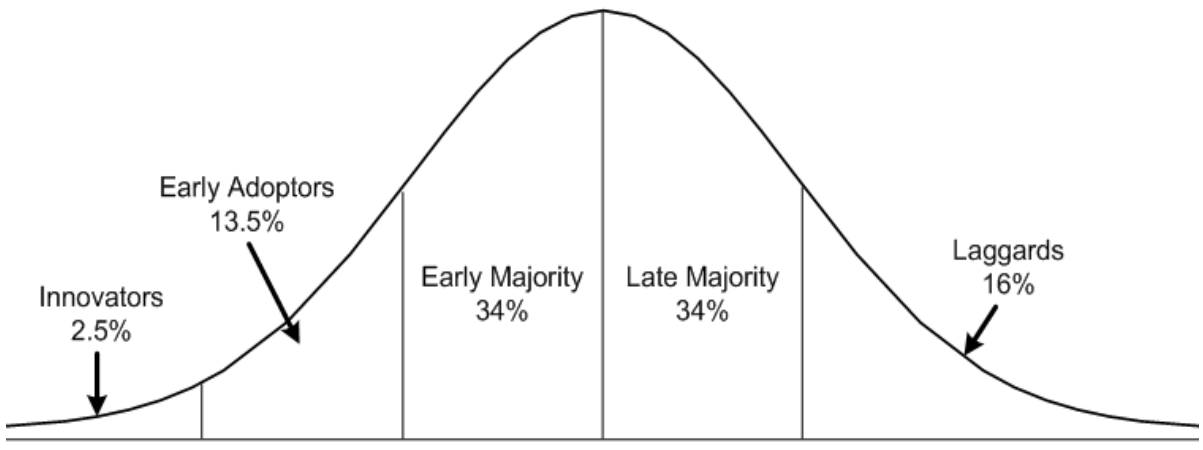
As indicated in the last section, the economic impact of geospatial information will ultimately reflect the level of adoption as well as the degree to which benefits are reaped by individual adopters. Making data available and reducing price are clear levers by which adoption and diffusion can be accelerated.

More broadly speaking, the classic textbook reference by Rogers (1964) identified a five-step decision process involved in technology adoption and diffusion:

1. Knowledge – potential adopter becomes aware of an innovation but has no particular opinion of it (this could be via advertising or through word-of-mouth);
2. Persuasion – the potential adopter seeks further information to help form an attitude toward the innovation;
3. Decision – the potential adopter engages in activities that lead to a choice to adopt or reject the innovation (the process is internal to the person and can be difficult to measure empirically; however considerations of price and perceived usefulness/necessity will play into this decision);
4. Implementation – the innovation is adopted and put into use (e.g., user installs geospatial data software or uses car navigation aids);
5. Confirmation – person evaluates the results of an innovation-decision already made which may affect decisions such as whether to continue using the innovation or return to previous status quo (e.g. remove software or return car navigation aid)

Rogers also estimated the categories of adopters as being innovators (2.5 per cent), early adopters (13.5 per cent), early majority (34 per cent), late majority (34 per cent) and laggards (16 per cent), see Figure 3. These reference figures are adopted for the current report, as they were based on and have been broadly corroborated by many case studies including those in the original contribution by Rogers.

Figure 3 **Roger's model of adoption**



Data source: Rogers (1964)

Rogers does not indicate a typical 'speed' of adoption or rate of diffusion over time, although the received wisdom now states that adoption typically follows an S-curve path with a 'tipping point' occurring at some stage where rapid uptake in the broader population occurs.

The Bass model, named after Frank Bass whose 1969 paper concerned take up of consumer durables (Bass, 1969), still forms the main mathematical approach to predicting the rate of adoption over time. It follows Rogers' model by differentiating between innovators and imitators, but importantly for the purposes of this report, it differentiates between two coefficients:

- the coefficient of innovation, external influence or advertising effect, and
- the coefficient of imitation, internal influence or word-of-mouth effect.

The critical finding which has been widely validated is that the latter coefficient is much more important in determining the rate of uptake over time (by a factor of twenty or more).

This has important policy implications for the geospatial information sector. It means that people are far less likely to adopt if they read or hear about a product; rather, they need hands-on experience or 'demonstration' of the benefits. The private sector is traditionally very efficient at doing this, and in the case of car navigation aids we are witnessing the 'take-off' phenomenon now – where rapid adoption occurs as a result of the demonstration effects.

The issue with assuming a simplistic S-shape uptake curve is, however, that the geospatial information market as a whole is dynamic over time and that there are in fact many different types of spatially enabled products and services. While we may already be past the turning point for car navigation aids, enterprise GIS is much lower in the curve. We return to this point in considering the specifics of geospatial information in local public services.

3.1.8 Adoption in local government

It is useful to the predictions of future use to review the patterns of diffusion of geospatial information within the community from an historical perspective.

Geospatial information has been in operational use in local government in England and Wales for well over twenty five years. Although, some pioneering systems, such as Local Authority Management Information System (LAMIS) were operational by the early 1980's (Gilfoyle I, 2004), substantive "take-up" was really stimulated by the report into the Handling of Geographical Information in 1987 (Chorley, 1987). In 1990 it began to move beyond the innovators phase on the Rogers adoption model.

We can identify four interlinked and overlapping waves of adoption:

Basic Implementation: this first wave of implementation was characterised by the introduction of basic desktop geographic information systems (GIS) for specific projects or within a single department.

This was, in part, facilitated by availability of Ordnance Survey digital mapping through the first Service Level Agreement with local government. By 1998, the market survey of GIS in Local Authorities (Allbrook, 1998) reported that virtually every local authority stated that they had a digital mapping system or GIS, compared to only 82% in 1995.

Central Storage: the second wave, facilitated by the development of national standards, such as BS7666 for land and property gazetteers, is characterised by the gradual linking of discrete data bases and storage in centralised corporate database management systems. This wave brought with it increased productivity, as users could combine an increasing array of datasets across a number of services, including highways, planning and estate management, as well as managing local issues including providing faster and improved information to the public. In 1998, Allbrook's survey identified less than 10% linked to corporate systems, however by 2002, a comprehensive survey into the use and management of geographic information in local e-government in the UK (Higgs & Turner 2003) showed this figure had risen to around 80%. This wave had largely run its course by 2005.

Geospatial Web: the third wave is characterised by widespread access to geospatial information by both staff and the public through the web. Although static maps have been available for almost as long as the internet has been in existence, the ability to make "non-trivial" queries and, more importantly, to complete transactions over the web, is considered the benchmark level for this adoption wave.

The importance of this wave is that it hugely increased the number and range of stakeholders able to interactively access geospatial information. Although a few pioneering authorities were active in this area as early as 2000, there was little evidence of more than a handful of authorities with fully operational transactional capabilities in 2002 (Higgs & Turner, 2003). The e-Government initiative stimulated an acceleration of implementation up to 2005, and the LGA GI survey published in 2009 (Local Government Association, 2009) puts the figure for "view only" web mapping at 89%. However, the recent SocITM Better Connected survey (SocITM, 2010) finds only 50% of authorities have transactional capabilities.

We can expect acceleration in this rate, especially with the arrival of enterprise Google maps and other similar offerings. However, whilst adoption could be completed in 2-3 years, this will not occur without action to address some of the important barriers to adoption outlined later, so we believe that a "steady state" adoption curve would not complete until 2015.

Enterprise Geospatial Integration: the fourth wave is the integration of all of these technologies into mainstream enterprise systems where geospatial information becomes as much a part of doing business as email and the internet has become. There are only a small number of organisations that have reached this position, with perhaps Dudley MBC, London Borough of Kingston upon Thames and Liverpool City Council being amongst the notable exceptions. The enterprise wave is characterised not

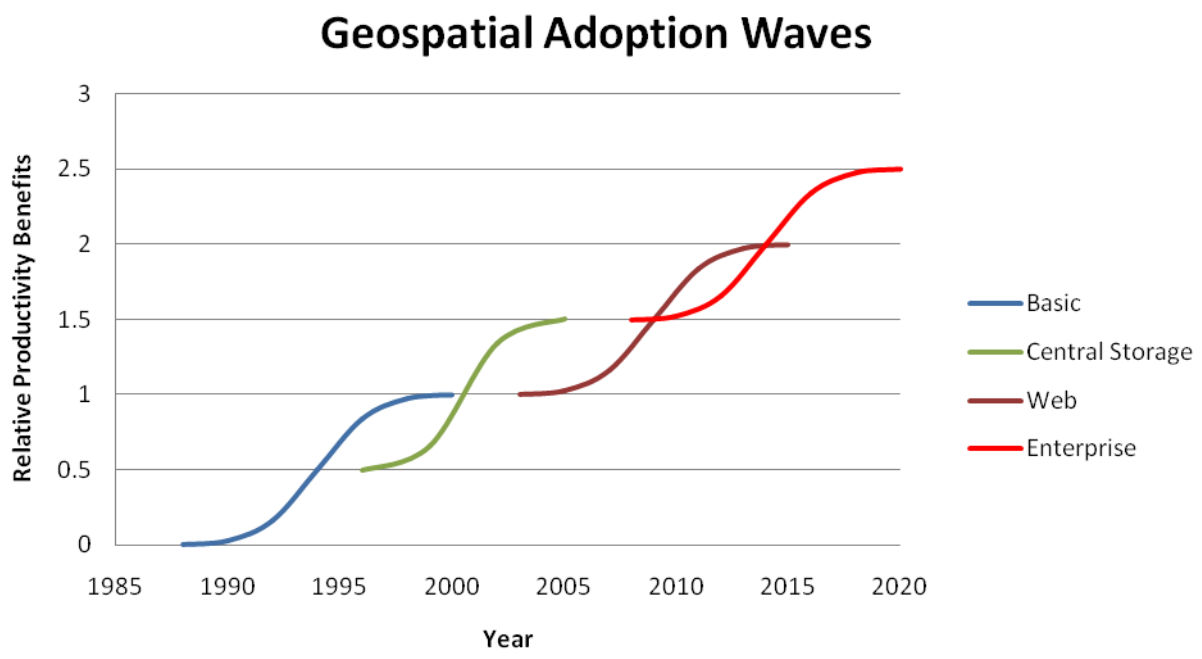
only by geospatial information being embedded in the corporate information and systems architecture but also a high level of awareness within user departments of its full potential.

The enterprise wave is being facilitated currently by the move within organisations to look at IT as a driver for efficiency by rationalising processes and greater information sharing. We believe that core geospatial information, such as addresses, transport networks and geo-referenced demographics will be key enablers of the roll out of Service Oriented Architectures (SOA), see Box 3, and will therefore reflect their adoption trends. Interoperability standards such as those mandated under INSPIRE will also be vital to this process.

At the current speed of travel, reflecting the rates of adoption observed in previous waves and considering current economic conditions, it seems likely that by 2015 we may reach 50% adoption, with completion as late as 2020. Again, this position could be significantly improved with timely action on barriers to adoption as outlined in section 5.

These waves are represented in Figure 4 showing how each wave builds on the value added by those that have gone before. The Y axis should be conceptualised as a measure of relative productivity improvement, with each wave building on the benefits accumulated from the previous one.

Figure 4 **Four waves of innovation in geospatial systems in local government**



Data source: ConsultingWhere

Box 3 Service Oriented Architecture (SOA)

SOA is a framework and methodology in which software systems are implemented as collections of web services that communicate with each other through standard interfaces. The services are self-contained and do not depend on the context or state of other services. These services can be combined to create complete business applications or used individually – this latter mode allows applications to be migrated gradually to an SOA.

Services within an SOA can be regarded as "black boxes"; external components accessing them neither know nor care about how they perform their function. This means existing software can be made part of the SOA by creating a "wrapper" of code around it. It is then the wrapper that is "exposed", so the component can be "consumed" (called) by, any application that is authorised to access it. This approach is referred to as "loose coupling".

The number of applications supported by most local service providers is huge and it is increasingly difficult to meet the demands of users if a "silo" approach to new development persists. SOA allow the Council to retain legacy applications by building a web service front-end to access data and fundamental business rules without the need for their wholesale replacement.

It also facilitates the integration of shared "mission-critical" functions and datasets (for instance a master address database). In addition, it encourages the use of reusable components rather than them being written from scratch each time. Application boundaries can also be extended to include functions outside the enterprise, through Software as a Service ("SaaS").

Source: ConsultingWhere Ltd.

4 Case studies

4.1 Introduction

4.1.1 Analysis

For the purposes of this report, relevant projects and sectors were chosen to ensure relatively broad coverage of the major services where geospatial information is already, or is starting to be, used heavily by local public service providers. The analysis draws on previous reports and findings and combines these with insights gained from a workshop with some leading practitioners and a number of face to face and telephone interviews supplemented by written submissions. Case studies were selected to obtain information about economic value and benefit of GI to specific service areas ('internal' benefits) and beyond ('external' benefits).

4.1.2 Geospatial application types

The study considers a wide range of geospatial application types in use within local public service providers in England and Wales. The application types identified, contribute to one or more of the activities found in each service, namely:

- Strategy formulation;
- Information management;
- Customer relationship management;
- Planning and design;
- Operations;
- Support.

Annex A.2 maps these major activities onto a classification of generic geospatial application types. It is adapted from that developed by the US geospatial industry association GITA (Samborski, 2006). Whilst a few applications are usually associated with a single service, such as environmental management, most are cross-cutting, so called horizontal applications capable of deployment using different datasets or functions in many services. For instance, improved transport logistics, through route optimisation, is applicable to all services where staff or customers have a travel component to their activities.

4.1.3 Case Study Criteria

Given the wide range of applications in use and the range of local public services to which they can potentially be applied, the criteria adopted for case study selection, were:

- A clearly identifiable geospatial component played a key role in delivering specific benefits in each case;
- Availability of data from exemplar authorities where the cost and benefits had been established (or could relatively easily be established) using sound financial principles;
- Succinctly explained in terms of their efficiency impacts on service provision and positive impacts on other parts of the economy;
- Sufficiently generic that they can be widely replicated across England and Wales in two tier and unitary local authorities, Primary Care Trusts (PCTs) and emergency services.

4.1.4 Selected service scenarios

With these criteria in mind we selected the following services for more detailed analysis:

- Customer Interface – improving the experience of citizens and businesses in their interactions with local public service providers;
- Transport and Highways – covering route planning, streetworks and highways inventory management functions within single and two tier authorities;
- Planning and Consultations – planning is often the area where geospatial information technology was first used in local authorities, the case studies particularly focus on the consultation process;
- Revenue and Benefits – raising revenue through Council Tax for domestic and non-domestic rates, fee-charging property search services and the payment of benefits to citizens;
- Health and Social Care – as a prime example of a service area with a very high public profile where the potential for efficiencies resulting from shared services between local public service providers, including PCTs is a priority;
- Safer Communities – focusing on the use of geospatial information in the local authorities and police, particularly referencing Crime Reduction Partnerships;
- National Land and Property Gazetteer (NLPG) – is a land and property information service and fits the criteria by its virtue of its applicability across a wide range of services. The benefits of the NLPG are manifest in many of the services above so we focus here on data sharing.

In order not to under represent the scope of current and potential benefits, other applications identified during the research are summarised in the final section of this part of the report. It should be stressed however that these areas are not factored in to the financial calculations of economic impact presented at the end of the report.

For each service area, at least two case studies have been financially evaluated. Further qualitative evidence is also presented to illustrate the breadth of applicability. The final section of each service area focuses on the implications for the economic evaluation that follows.

4.2 Customer Interface

The case studies selected have been chosen to illustrate where savings can be made by providing applications that allow customers (citizens, businesses and community groups) to access public information via the web, and where a geospatial component was key to the creation or delivery of the web based product. This self-service approach is a central objective of the government's plans to change the communication channel between local public service providers and citizens, now referred to as "channel shift". We look first at an example of improved information access in South Tyneside, then public fault reporting within East Sussex and finally to evidence-based decision support for internal and external customers in the Nottingham Insight project.

4.2.1 Web mapping: South Tyneside Council

The metropolitan borough of South Tyneside Council covers a relatively small, mainly urban area along the south bank of the River Tyne, centred on the town of South Shields. In 2004 the Council first started providing simple web mapping facilities (the geospatial component) as part of an e-government initiative to give customers location maps for finding schools, libraries and other local facilities. The council has been gradually enhancing the facilities ever since.

The Council created its 'My South Tyneside' web facility using IShareMaps[12] software. It is designed to be quick and easy to use and includes a property search facility based on the local land and property gazetteer (LLPG) and "My Nearest' search facility. An email alert service enables citizens to receive regular alerts which let them know about local events; new or changed planning applications; new road works and a range of other council service information. Ongoing developments of the website, particularly the web mapping application and related service improvements, have been achieved within existing departmental budgets.

The web statistics for unique visitors to the council site are impressive and the alerts service has now attracted over 2000 subscribers since its inception in early 2008. In 2009 there were 38,295 unique visits to South Tyneside's online mapping facility. Research carried out by SocITM in support of the government's Service Transformation initiative, calculated typical transaction costs of £0.17p for a web transaction, £4.00 for a phone transaction and £7.81 for a face-to face transaction (North West e-Government Group (NWEGG)). Using these estimates costs for web transactions as opposed to phone transactions, this represents an estimated saving of £146,669 in the calendar year.

4.2.2 Online Fault Reporting: East Sussex

East Sussex County Council has established a series of web mapping facilities which enable citizens and businesses to more efficiently and effectively interface with a group of Councils, by facilitating

[12] http://www.isharemaps.com/

access to information and to enabling online fault reporting. East Sussex runs these services in partnership with, and on behalf of, a number of participating authorities, including all district and borough councils within the county and the police. It is a good example of an operational shared service where savings are derived from not only channel shift but also reduced ICT costs.

The interactive facilities make the website amongst the most advanced in the terms of geospatial customer interface. The Fault Reporting system takes the customer through the stages of making a report on over 15 categories, including traffic signals and road signs, abandoned vehicles, missed bin collection, pavement and road condition, graffiti, fly tipping, verges and dead animals.

It also allows the customer to track the progress of addressing a previously reported fault. This is achieved by linking the online fault reporting directly to a workflow system which manages, monitors and reports on each case.

The key benefits to the participating local service providers are:

- More cost effective contact (meeting the channel shift targets set out in the Varney report)
- Reduction in service costs, with 18800 fault incidents logged over 5 years with an approximate net saving of £60000;
- Cost of remedial action reduced by more accurate location;
- Savings on abandoned cars by removing vehicles before they are vandalised.

However, there are other significant benefits for citizens and businesses:

- Improved customer satisfaction;
- Increased public participation – it is quicker so more people make the effort to report faults.

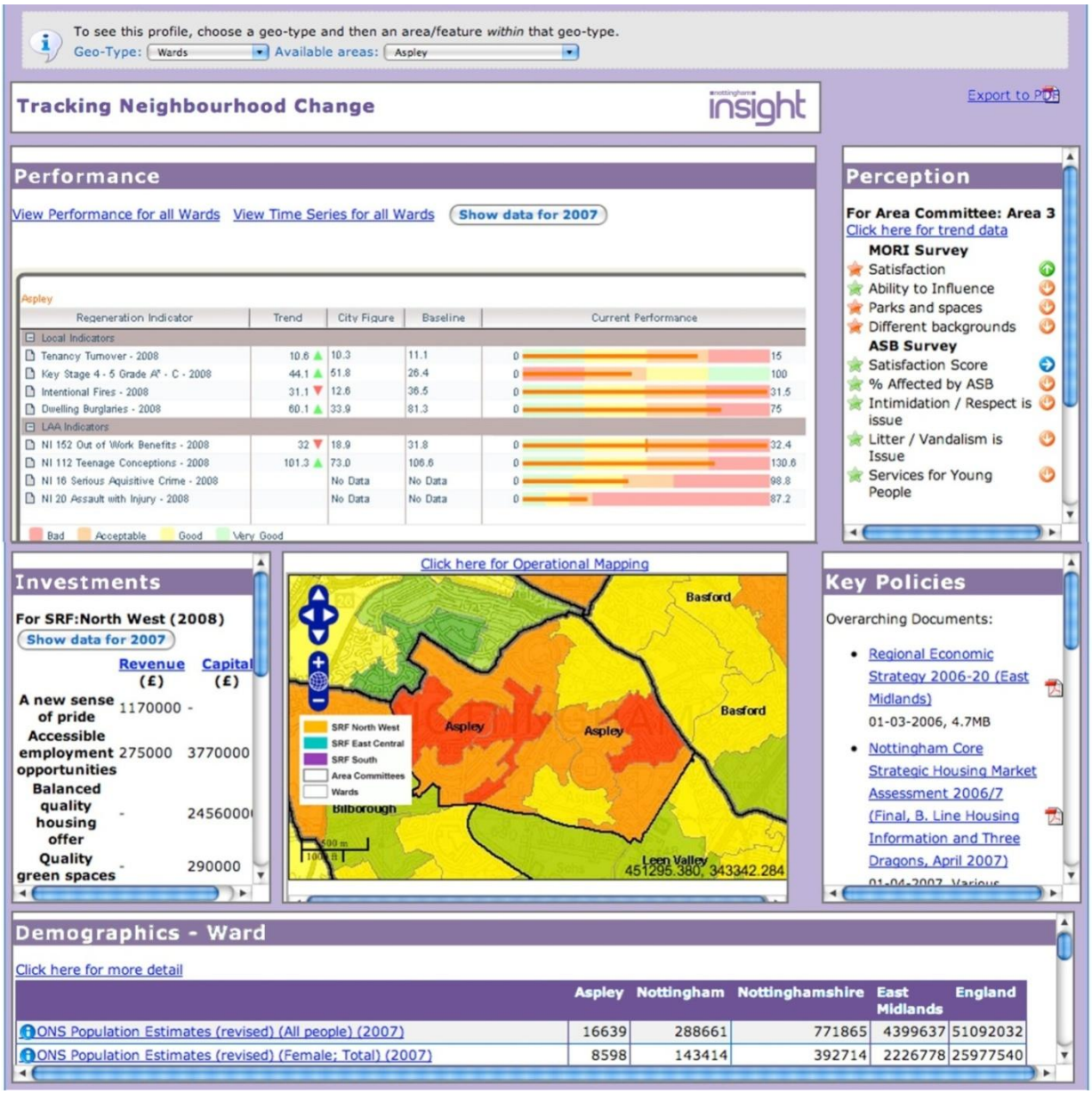
4.2.3 Local Decision Support: Nottingham Insight

Nottingham city council, working with the local NHS, police, districts and the County have created a Local Information System[13], designed to provide a platform for better decision making in relation to the city's Strategic Framework and the policies and plans that support it. Based on the Instant Atlas[14] product, it provides ready access to comprehensive, up-to-date information to a very fine-grained level, which in tandem with the site's analytical tools, enables decision-makers in service planning and policy implementation to assemble evidence to support strategic choices. Almost all the information within the system is geospatially referenced, so not only does it aid visualisation but also support a wide range of geospatial analyses. See illustration in Figure 5 below. The Insight team estimate that at least 70% of all uses would not be possible without the geospatial information capabilities.

[13] http://www.nottinghaminsight.org.uk

[14] http://www.geowise.co.uk

Figure 5 **Nottingham Insight**



The recent report published by Communities and Local Government (CLG), titled *Understanding the value and benefits of establishing and running a local information system* (Foley, 2010) provides considerable evidence for the value of systems such as that in Nottingham. It finds that the major benefits are related to reducing the time taken by staff both inside and outside the participating organisations to find the information they require. The LIS study team has also developed a very useful online value assessment tool, based on the metrics derived from the study, which calculates a range of costs and benefits. It assesses the net benefits, taking into account development and on-going support costs, of Nottingham Insight at between £320,000 and £460,000 per annum.

4.2.4 Qualitative Information

There are many other variations on the generic type of web mapping and local information systems illustrated above. The SocITM Better Connected study (SocITM, 2010) in its survey of local authority websites, highlights some of the other opportunities for location information:

Westminster City[15]

To assist users of 'sat nav' in their cars, Westminster goes beyond postcodes and provides 'Points of Interest' files which you can download in order to load the locations of council car parks directly into your 'sat nav' system;

London Borough of Brent[16]

The 'Find My Nearest' facility is accessed from the home page and it definitely seems that ease of use was a top priority. The drop-down menu immediately informs users what they can search for and top of the list are schools, libraries and recycling centres.

4.2.5 Inferences for economic modelling

In the case of South Tyneside net benefits (savings) flow from the ability to "channel shift" the citizen interface to a cheaper and more effective medium and apply to both the local service provider (reduced costs staffing call centres, etc.) and citizens (reduced time needed to obtain information).

In East Sussex, the savings accrued from citizens being able to notify the local authority of faults, enabling the local authority to be able to respond more quickly and in the case of abandoned vehicles, before the problem is exacerbated by the vehicle being vandalised. The local service providers also derived benefits from sharing of services between the county council, districts and the police.

The Nottingham Insight example is potentially even more powerful in its economic impact, being able to improve the quality of decision making. It is however difficult to track and attribute specific benefits obtained through better decision making. As a consequence, our estimate of benefits obtained, which is based on time savings only, almost certainly understates the level of actual benefits.

The qualitative examples indicate the potential for further savings from innovative use of more and diverse types of geospatial information such as school locations and enabling systems to interface directly to GPS-enabled smartphones and satellite navigation devices.

[15] http://www.westminster.gov.uk/services/transportandstreets/parking/masterpark/satnav/

[16] http://www.brent.gov.uk/

Although the content of the services and their functionality will vary, there is no reason, in our judgement, why the financial benefits described here should not be realised by all local service providers. The rate at which this will happen will, in our opinion, depend crucially on removing certain barriers to implementation, particularly issues surrounding derived copyright on government information, which currently restrict local service providers in how and what they are able to display.

4.3 Highways, Roads and Transport

This service area is another example where geospatial information can make a difference at the frontline of service delivery. Our first case study, focusing on Daventry District Council, looks at the benefits of route optimisation applied to household waste collection. However, its importance is that waste collection is but one example of the many applications of route optimisation to logistics problems which exist in all service areas. We then look at savings resulting from reducing the incidence of road closures due to streetworks, through improved coordination between statutory undertakers (utilities, local authorities) and construction contractors. The Islington case study then examines the value of geospatial information in highways inventory management.

Two of these applications, route optimisation and streetworks coordination not only have benefits for the local service provider but, crucially and more widely, for citizens and businesses as well.

4.3.1 Waste Management Efficiency: Daventry District Council

In October 2006, Daventry District Council was chosen to undertake a project feasibility study for the Northamptonshire Waste partnership, with funding from the East Midlands Centre of Excellence. The objective of the project was to look at the potential to improve the efficiency of waste management within the county. The Services under review covered domestic refuse, green waste and dry recyclable collections and supporting infrastructure i.e. vehicle depots, fleet maintenance, transfer/treatment facility locations.

Daventry first recorded all of its existing routes to enable the study to compare new routes against baseline data. In effect, the comparison matched "new electronic routes" against routes that had historically been produced using local knowledge and experience. The rounds were then optimised electronically using a dedicated software package called RouteSmart[17]. The software developed several different collection scenarios and Daventry chose the one that best supported local need, while at the same time generating savings.

Initially, cash savings were identified in the following parts of the service:

- Mileage reduction of 12-13% delivering savings of £25,000 p.a.;

[17] http://www.routesmart.com/default.aspx

- Spare capacity to allow for vehicle washing, securing savings of £17,000 p.a.;
- Employee overtime virtually eliminated, saving approximately £28,000 p.a.;
- Planned purchase of an additional 6 wheeler Refuse Collection Vehicle (RCV) reduced to a 4 wheeler, saving £25,000.

More recently however, route-optimisation has shown that by implementing a 4-day working week for refuse & recycling collections, the service could be delivered by sixteen rounds as against eighteen at present. This will yield substantial savings in manpower costs and avoid the need to purchase additional vehicles. Implementation of the plan will generate cash savings of £153,000 per annum.

4.3.2 Streetworks Coordination: Electronic Local Government Network (ELGIN)

ELGIN[18] publishes streetworks and other highway information on the web. It is designed to facilitate coordination of activities between neighbouring authorities and statutory undertakers, such as utility companies, enabling them to reduce road space occupation and to meet their statutory obligations under the Traffic Management Act. Savings to utilities from self-coordinating their activities are significant- the savings from a single shared occupation are often measured in £100,000s. In one reported case[19], using a similar system, Westminster City Council achieved the coordination of 104 works from 26 contractors performed over a single weekend. There are also clearly benefits to transport operators and travelling public from reduced journey delays.

The ELGIN business model is a good example of a shared geospatial "cloud-based" service, where, for a relatively small "upfront" subscription, joining authorities get access to shared services and obviate developing and supporting their own computer system. The approach also supports interoperability and data sharing, with all information being presented in a common format on a single website.

Internal benefits

The annual operating cost of ELGIN is approximately £350,000. For the current 45 subscribers, operational savings estimated on the basis of the experience of users[20], including staff savings and reductions in ICT development and support costs total about £860,000 pa. Although the benefits cannot be totally ascribed to geospatial data, the system would not be nearly as effective without it and therefore a 50 per cent apportionment of benefits is considered conservative. This equates to a saving of £430,000 per annum.

[18] http://www.elgin.gov.uk

[19] Personal communication from Richard Duffield, Intelligent Addressing

[20] Personal communication from James Harris of Jacobs (operators of ELGIN)

External benefits

There are clear external benefits to the travelling public, land transport operators and utilities as a consequence of reducing the number, or duration, of road space occupations and closures caused by streetworks.

Within the scope of this study it was not possible to determine the size of the external benefits other than by making a very informal assessment. However, the savings are real and so we have included what we judge to be a "lower bound" estimate by combining information from separate sources.

A trial undertaken by the London Borough of Islington, working with a firm of Transport Planning experts, Peter Davidson Consultants[21], is instructive. They are able to predict traffic congestion effects from planned streetworks in the Borough and surrounding region by simulating the traffic flows with and without a particular road closure.

As a "pro bono" contribution to this study, the consultants tested the effect of avoiding a road closure in a particularly congested part of Islington, Holloway Road. The consequent difference in journey times was estimated to be 17,600 vehicle hours per day[22].

This example of an important road closure in a major city does not, of course, represent the typical impact of the average road closure across the country. However, in discussions with users reported by the ELGIN operators[23], it was estimated that better coordination of utilities work reduced road space occupation by an estimated 30 days per annum and as indicative estimate, it reasonable to assume that each might save on average 10% of the Holloway Road journey time reduction.

If savings of this level were realised across the 172 authorities responsible for streetworks management in England and Wales, we estimate that fuel costs alone would be reduced by £9 million per annum.

4.3.3 Highways Inventory Management: London Borough of Islington

In order to streamline and automate its operations, the Council has collected highways inventory information for the entire area of the borough and implemented an enterprise system to store, query and view the data. The overall project, including system design and implementation work, costing circa £2.2 million spread over three years. As part of the project, the highways management team have been equipped with geospatially-enabled systems to allow them dramatically increase the number of maintenance work orders undertaken without increasing the team size. The system allows officers to provide a more informed customer response, not only to queries but in getting a better

[21] http://www.peter-davidson.com

[22] Personal communication from Peter Davidson Consultancy.

[23] Personal communication from James Harris, Jacobs ELGIN

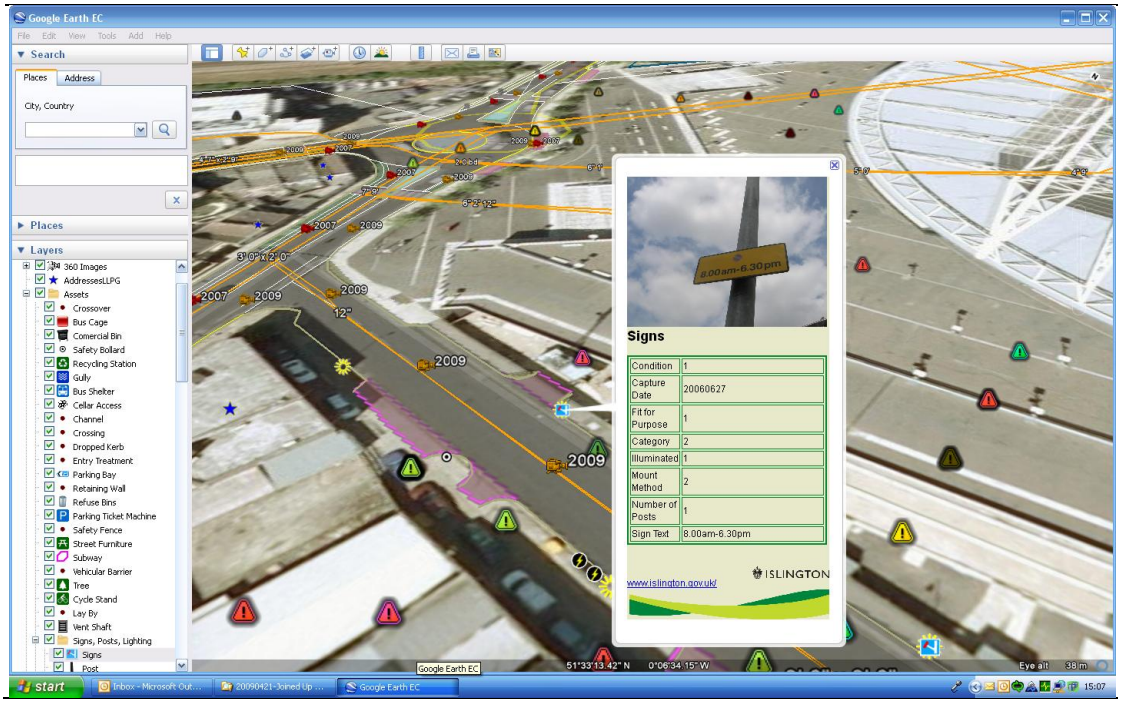
understanding of how assets are used so design of schemes is improved. Savings have been generated in several ways including, productivity of response to reactive maintenance up 200% for the same cost, improved repudiation rate on claims from 2 in 10 defended to 9 in 10, back office costs, higher staff satisfaction rates and reduced sickness absence, reduced site visits and reduction in crime and anti social behaviour.

The total savings equate to around £1.2m per annum to the service and a further £1.6m in total costs to Islington as a borough (e.g. in reduced police costs). The cashable element of the saving is around £500,000 pa, making the project pay back in real terms within 5 years.

The biggest benefit is in the increased knowledge the system provides and how that knowledge can be used to make improvements to the experience for residents. Overall satisfaction with the "street scene" has improved since the changes to the ways of working even when the national trend has seen a decline.

Figure 7 illustrates how the team are now deploying the highways information on the backdrop of 3D imagery using Google Earth Enterprise[24]. Islington anticipate further benefits from being able to make this application, overlaid with an extensive array of other geospatial information, available to all staff and the general public.

Figure 7 **Islington Google Earth**



Data source: Islington Borough Council

[24] See http://earth.google.co.uk/

The authority believes that the benefits can be evaluated simply in the form of time saved. The average fully absorbed cost of an employee to the organisation is estimated at around £45 per hour, so if every employee were able to reduce their information gathering activities by only one hour per annum that would equate to £180k of efficiency saving.

4.3.4 Qualitative Information

AXESS West Sussex

AXESS is a partnership of local public service providers in West Sussex. One of the recent initiatives under this partnership has been the Street Scene project which has delivered service improvement and cost efficiency for street cleaning at Crawley Borough Council.

Using a combination of e-forms, a CRM system, LLPG, internal and external GIS maps, SMS text messaging, e-mail and web services, information from the customer is passed to the team to resolve street cleaning complaints with no paperwork or administrative overhead.

The benefits delivered to Crawley BC are extensive and extend beyond the realms of cost savings and service improvements. Staff members have seen the benefits of running a project professionally, have felt empowered and engaged and have understood the 'end-to-end' service delivery process, appreciating each other's roles and responsibilities.

This project combined ICT reforms with transformation of both the front and back offices and used collaborative procurement across multiple organisations to secure the necessary services to support the technical integration development.

This project won the best business transformation award at the NLPG awards in 2009 (IDeA, 2009).

Lancashire Travel Care

Travelcare, Lancashire County Council's in-house provider of passenger and goods transport services, operate 150 wheelchair accessible minibuses and employs over 300 driver attendants and passengers assistants who transport adults to day services and children to special schools. Travelcare charges for all the services it provides and has an annual turnover is in excess of £7m. The organisation recently purchased route optimisation software following a limited trial. Travelcare will initially use it to re-plan its mail delivery and dial-a-ride services and anticipates being able to reduce mileage / emissions by between 10 per cent and 15 per cent whilst maintaining current levels of service.

4.3.5 Inferences for economic modelling

The case studies demonstrate that geospatial information is making a difference at the frontline in a range of applications. The benefits are easy to understand and evaluate. Furthermore, they are widely applicable, meaning that most local authorities could adopt the best practice described. We believe

that it in most cases it is only awareness of the potential value and the inability to express the benefits in financial terms that are barriers to adoption.

The benefits of route optimisation can be applied to logistics operations in all service areas. The qualitative examples presented above illustrate its application to street cleaning and to transportation in social care.

The potential for significant reduction in road closures for streetworks, as demonstrated by the ELGIN example, has internal benefits resulting from lower IT costs but more significant is the external savings for utilities, the transport sector and travelling public. The internal benefits feed into the local public sector "shocks". The external savings are used to generate a small shock to the land transport sector and contribute to the estimate of increased productive labour capacity. The impact on the utility sector is thought to be significant but there is a lack of robust evidence, so as elsewhere we have taken a conservative approach and not applied any financial "shock".

The highways inventory management project at Islington forms one of the case studies used to estimate the overall shock on the local government sector. Its extension into a wider information system will clearly have future benefits but is not included since the system has not been rolled-out. However, it does illustrate how the advent of Google Earth and similar consumer-oriented systems can be applied within the enterprise and, as such, awareness of their potential of is part of the underpinning for our "ideal case" for geospatial in 2015.

4.4 Planning and consultations

The value of geospatial data in this service area goes back to the very earliest GIS implementations in the 1980s. Some of the simplest applications, such as using geospatial information to identify adjacent properties that must be notified as part of the planning application process, were implemented in the basic (standalone) and linking of geospatial systems to other information systems. Another stimulus to adoption was the use of geospatial information for improving the internal planning workflows under the e-government initiative designed to bring Government services online in the period 2002-05. However, the ability to make savings from automating the planning consultation process facilitated by internet (public access) web mapping technology is one that is still in the "late majority" phase of implementation.

4.4.1 E-Planning: Tendring District Council

The primary source for this service area is the work undertaken Tendring District Council, which covers a mainly rural area along the east coast of Essex and includes the towns of Clacton and Harwich. It has been chosen because of the clear demonstration of benefits realisation in the strategically important service area of electronic planning (e-Planning) as part of the wider electronic service delivery agenda.

The Council created an 'e-planning blueprint' in October 2005. Phase 1 of the work was to provide public access to planning and licensing information. This was achieved using a software package named Public Access[25] that allows people to view partial information about planning applications including Ordnance Survey maps (excludes planning drawings and associated documents) on the Council's website. The next phase of e-planning known as 'end-to-end' or e2e planning includes the ability to:

- receive applications, and most importantly plans, electronically;
- scan hard copy applications and plans into the existing planning system;
- display the information on the Council's website; and
- 'back-scanning' of planning histories to make this accessible electronically to the planning service.

The final phase of the project was the improvement of Geographical Information Systems (GIS) to display information spatially (on maps), both internally and externally via the web.

Importantly, after completion of this third phase, a Value for Money assessment was undertaken to establish whether the expected savings had been achieved. The study team were impressed by the rigour with which this was undertaken and the strength of evidence assembled. It is included as Annex A.1 to this report, as it can be used as a template for other authorities attempting such an exercise in the future.

The study showed annualised savings of £49,500 per annum realised mostly from reduced calls on planning staff time. As the information is available online, staff no longer need to answer questions from the public at the Council offices. The percentage of the saving attributable to geospatial information was assessed by staff at approximately 50 per cent. The savings would have been higher but some of the savings were diverted into creating a permanent GIS officer post within the planning function.

4.4.2 Shared Services: Derbyshire Partnership

In 2002 the local councils in Derbyshire together with the Derbyshire Constabulary, Derbyshire Fire and Rescue and Peak District National Park formed the Derbyshire e-government partnership and won a £2 million grant to develop joint e-government initiatives. The partnership's aims and objectives include joined-up two-tier provision of services to citizens; common access to systems for citizens; and cross-boundary access to services. It enables partners to afford systems and services that would otherwise be out of their reach.

They initially developed a number of shared service initiatives including a common customer relationship management system (CRM) and informational website facilities. Having demonstrated

[25] http://software.idoxgroup.com/modules/idox_public_access.cfm

the success of these initiatives, the partnership extended its activities to cover e-planning, location independent working, citizen authentication and property rationalisation. The joint geographical information system (GIS) component has helped to underpin most of these projects.

The key to success in respect to the GIS has been the creation of a shared geospatial data infrastructure, based on Geostore[26]. However, equally important is improved "networking" of staff with GIS responsibilities which have helped the GIS partnership create an environment which actively promotes the sharing of information and knowledge (Pugh P, 2005).

The GIS component has yielded estimated cashable savings for the whole partnership valued at £593,000 over a five year period. The project and financial analysis is detailed in a case study titled *Front Office Shared Services: Derbyshire Partnership* (IDeA, 2007) .

4.4.3 Qualitative Information

Flood Risk Assessment: Partnership of Urban South Hampshire (PUSH)

PUSH is a partnership of the unitary authorities of Portsmouth and Southampton; Hampshire County Council and district authorities of Eastleigh, East Hampshire, Fareham, Gosport, Havant, New Forest, Test Valley and Winchester. It has recently undertaken a Strategic Flood Risk Assessment (SFRA) which involved production and delivery of key mapping outputs and guidance to assist Planners and Flood Risk Managers meet their housing and development targets set out in the South East Plan whilst avoiding flood risk and demonstrating compliance with PPS25 (Schmid, 2009). Geospatial information and related data can be viewed online as part of the resources available to support risk assessment and decision making.

The economic benefits in terms of improved planning and response to floods are potentially very significant. All local authorities will be required to respond to the Flood and Water Management Act 2010 and this type of study illustrates how geospatial information is essential to cost-effectively producing the required assessments.

New Topographic Data Source: London Borough of Brent

London Borough of Brent was the first public authority to adopt UKMap[27] as one of its large scale mapping databases. This product includes a highly detailed large scale topographic mapping layer containing several useable attribute fields; high resolution aerial photography; land use; building heights and a digital terrain model; and a point dataset which contains tree locations and heights.

[26] See http://www.pbinsight.eu/uk/products/location-intelligence/geodata-management/geostore/

[27] http://www.theukmap.co.uk

Previously, these datasets needed to be purchased separately. Planning-specific benefits identified include:

- The inclusion of land use information will deliver further savings for strategic planning as the authority will not need consultants to create additional data sets. It now has the opportunity to reuse data collected once for many applications by many different organisations.

- Identifying hard landscaped front gardens that, when combined with crossover or dropped kerb data, allow Brent to identify possible revenue from required crossovers and identify likely increased surface runoff from impermeable front gardens. Hard landscaped rear gardens may assist Environmental Health in determining suitable site investigation methods for contaminated land enquiries.

- As only 3% of trees protected by Tree Preservation Orders (TPOs), the location of garden trees within the dataset will greatly assist in mapping TPOs.

- The inclusion of building height data for each building polygon allows for a quick method of building 3D models. This will be of benefit to Planning when looking at producing digital models of proposed developments.

Another key consideration for Brent was that the dataset does not contain any OS copyright material and the licensing arrangements allow for Brent to own any derived data it creates (so long as its use is not for commercial gain) and for this derived data to be shared freely with partners and contractors.

Although it is too early to fully evaluate the financial benefits (the purchase is an additional cost to the Ordnance Survey mapping service agreement), Brent believe that a substantial return on investment can be achieved with payback within a single financial year.

Infrastructure capacity planning: Surrey County

A widespread issue in local government is re-inventing the wheel, each authority individually setting in motion programmes of change and development. The result of this is that time and money can be unnecessarily spent. The Surrey Improvement Partnership have addressed this by undertaking a county-wide infrastructure capacity study and by developing costed infrastructure schedules[28] in conjunction with all 12 Surrey Authorities (County Council and 11 Districts and Boroughs), key infrastructure providers (transport, utilities, education, health) and other

[28] http://www.southeastiep.gov.uk/categories/surrey/news/surrey-infrastructure-report-to-save-las-money

interested stakeholders (the voluntary sector, community services, business). Of particular relevance to this study is the business case toolkit for shared services[29] which provides example business cases and resources for savings evaluation.

4.4.4 Inferences for economic modelling

The potential economic benefits from incorporating geospatial information as part of planning and consultations are significant – however, they are particularly difficult to pin down quantitatively. Putting infrastructure in the 'wrong' place as a result of poor planning decisions can clearly create significant legacy issues, impose large costs (including on future generations), and waste enormous resources. The ability to make smart planning decisions more quickly (i.e. bringing forward the date at which appropriate infrastructure comes on stream in the right place) is clearly also valuable.

Local public sector providers are intimately involved in these processes and hence it was always anticipated that this would be a large economic impact for the current study. However, the subset of benefits which were able to be estimated and included in this report is clearly a 'bottom end' (conservative) estimate as they only include verifiable estimates from the development planning processes of Tendring District Council and Derbyshire Partnership. The value derived on large infrastructure project is likely to be more substantial but our research has failed to uncover any well-documented examples.

In terms of external benefits, the Tendring case study clearly demonstrates that there are citizens' benefits from avoiding the need to visit the Council's offices to view documents as part of the planning consultation process. This is clearly replicated in most planning authorities and the data supplied by Tendring feed into the estimation of labour productivity improvement.

4.5 Revenue and benefits

This service area is perhaps not the most obvious in its use of geospatial information. However, there are applications in respect of revenue generating activities, such as council tax and business rate (NNDR) collection and local land charges search which rely on accurate geospatial and property information. Furthermore, the use of geospatial information to increase rates of benefits claiming is also a significant but often under-exploited application.

4.5.1 Property Searches: National Land Information Service (NLIS)

Our first case study focused on one of the earliest deployments of "cloud computing" in the local public services field. NLIS is an online system for the processing of requests for search information

[29] http://www.southeastiep.gov.uk/categories/corporate-transformation/documents/partnership-toolkit-for-shared-services-stage-7-producing-a-business-case

required by solicitors as part of the house buying and selling process. The conveyancer uses a web based system to search and locate the correct property which then indicates the local authority responsible for providing search information and whether the property is within a coal mining area. In addition, the solicitor can use embedded mapping tools to delineate the boundary of the property being searched. At the local authority the same geospatial capabilities are used to assemble all information on planning and building control applications in the area, national infrastructure projects and any local authority financial charges over the property.

NLIS is significant in that the system benefits are realised (i) in the local authority by rationalising and speeding up the process of responding to search requests; (ii) by the solicitor in reducing the time spent by their staff on administrative tasks and mitigating the risk of litigation from inaccurate definition of the property and (iii) to the members of the public and businesses in speeding up the process of conveyancing.

Internal local authority savings

Unfortunately, the study team were unsuccessful in identifying a local authority able and willing to articulate savings in financial terms. The potentially negative financial implications of the recent Information Commissioner's Office (ICO) published guidance on property searches and Environmental Information Regulations (EIR) (ICO, 2009) was, we believe, a factor in discouraging participation.

Benefits to Solicitors

The benefits to solicitors (conveyancers) have been measured and publicise by Land Data, the community interest company that administers NLIS contracts on behalf of local government. They estimate that for each individual case, solicitors save an average of £50 per transaction as a result of reduced legal, administrative and accounts staff time compared to the traditional paper process (Land Data, 2008). Statistics from the Land Registry for volumes of housing transactions over the last 5 years, suggest these average 1.1 million on an annual basis over that period. LandData statistics show that around 25% of transactions currently use NLIS. On this basis, the realised savings would be in the region of £14m per annum.

Citizen and business user benefits

The time savings for citizens and businesses that result from the reduction in queries relating to searches, have been conservatively estimated, from discussions with practitioners, at 15 minutes per transaction and the resulting savings feed into the calculations of labour supply shocks detailed in section 6.

4.5.2 Benefit Claims: Newark and Sherwood District Council

The value added by geospatial information in improving the claiming of benefits is well demonstrated by work that has been undertaken by Newark and Sherwood District Council. Working together with the Nottingham City GIS team under a Regional Improvement and Efficiency Partnership (RIEP) initiative, a customer segmentation study using detailed geodemographic data and the LLPG, identified about 3,000 households likely to be eligible for benefits but not claiming it. These households were targeted with personalised mailshots.

Although, the response rate was relatively low, a high proportion of those who did respond were eligible and the consequent awards for housing and council tax benefits, pension credits, attendance allowance, disability living allowance and carers allowance are now estimated to total £77,000 per annum.

Furthermore, the data has been passed to Department of Work and Pensions (DWP) who have identified another 1,000 people eligible for at least one type of extra benefit. The approach is readily replicable at the marginal cost of running the analysis for each district within the Nottingham partnership.

4.5.3 Inferences for economic modelling

The lack of local authorities able to quantify their savings from NLIS was disappointing. However, this does not mean that there have not been substantial savings from this system and its use of geospatial information. However, the benefits to solicitors generated by NLIS do feed into the external shocks to the business services sector in which legal work is classified. The time savings for citizens and businesses that result from the reduction in queries relating to searches also feeds into the calculations of labour supply shocks detailed in section 6.

In the Newark and Sherwood case study, the value is realised by the citizen. The productivity shock within Government is a transfer from central to local government since the benefits concerned are provided by central government funding. The further significance of this work is that the Department of Work and Pensions (DWP) are now using the analysis and have identified another 1,000 people eligible for at least one type of extra benefit. As the benefits of the initiative result in a transfer of money between parts of government they are not included as inputs for the CGE modelling in this report.

4.6 Health and social care

Health and social care addresses the health and well-being of citizens within their local area. This is delivered directly through partnership with the provision of social care services and local NHS bodies. This study refers to Primary Care Trusts (PCTs) as the NHS body where the majority of patient service decisions are made. When considered together with social care, geospatial information offers many

opportunities for improving priority health outcomes whilst also increasing the efficiency with which services are provided (and potential flow-on cost reductions). Geospatial information can be used to support strategic decision making, for example through the identification of health inequalities, and to provide better targeted services to the population in general and vulnerable people in particular. Geospatially referenced health information can also support specific analyses and discern long-term trends.

Efficient tracking of local food poisoning outbreaks enabled by geospatial information will indeed have led to significant direct benefits to citizens. Local authorities have been able to identify the source of outbreaks more quickly as incident cases can be swiftly and conveniently marked and tracked in the GIS mapping environment (and immediately shared between managers and field workers where a common platform is used across the local authority), and as a consequence local authorities has also been able to release and more effectively communicate findings to the public.

For the purposes of this study, however, it has been impossible to verify the aggregate value of these types of health benefits – there will likely have been thousands of small incidents where citizens benefited, for example by avoiding particular foodstuffs or establishments, but no single event was large enough to be noted for this study (also see discussion of pandemic response below).

More broadly speaking, however, our understanding of the potential for geospatial information to improve efficiency of health care delivery suggests that as a service area the health related market is still at an early stage of development. It would appear that few PCTs and other relevant bodies have adopted geospatial systems and inputs for routine operations. In terms of the Rogers adoption curve, we are clearly in the early adopters phase. As is characteristic of this stage of adoption, there are few examples of robust financial business cases, since there are often no comparable studies to reference and the pioneering nature of many applications mean that establishing the financial return is often subjugated to the research value. Our case studies in this area are relatively small examples of what, in our judgement, will be much wider applicability in the future, almost certainly stimulated by the linked policy drivers of shared services and total place. Consequently, there is also greater emphasis on qualitative assessment, than in other case study areas.

4.6.1 Shared Services: Swindon Borough Council

Swindon Borough Council is a unitary local authority in the South West of England which has a mix of high-growth urban and rural areas within its authority. Swindon is at the forefront of implementation of integrated working between the local authority and PCT, being one of the first where the Chief Executive of the Primary Care Trust is also the Group Director responsible for Adult Social Care within the Council. Social services within the Council are supported by the corporate GIS team which has two full time equivalent (FTE) staff. They undertake specialised tasks which go beyond routine mapping and statistical analysis available through the web mapping facilities. The PCT has also recently moved existing staff into geospatial roles partly as a result of a health sector-wide agreement to provide

enhanced access to Ordnance Survey data. Two case studies exemplify the use of GI in local public services:

Locality Working

In support of the initiative to improve sharing of services, Children's Services are establishing a series of local "clusters" where staff will be co-located to provide services closer to the community. The choice of location for, and service area of, these clusters, is dependent on many geospatial components including availability of suitable buildings, public transport accessibility and profiling of local customer needs. Comprehensive and up to date geospatial data was available including that relating to suitable buildings, addresses, the public transport network, local population statistics and ACORN[30] lifestyle profiles. This data together with geospatial analysis tools meant that the Council's GIS team were able to complete the analysis using multiple geospatial factors to determine the most suitable location for the service clusters.

Identifying the most suitable location for service clusters was completed within five working days and at a cost of approximately £2,000 including staff time and overheads (with an apportionment for the geospatial systems infrastructure). In the absence of the geospatial capability it is estimated that the same task would have taken over a month to produce and cost in excess of £10,000.

Pandemic Response

The recent concerns about the spread of "swine flu" coming on the heels of similar concerns about "avian flu" has caused the Government to focus local agencies on how to minimise the impact of a pandemic upon the economy of the country. In 2008, as part of the preparation for a possible pandemic the NHS working together with partners including the local authority needed to establish local collection points for distribution of antiviral drugs to reduce the overload on GP surgeries and hospitals. The analysis of potential sites taking into account accessibility, security and other local factors such as travellers' sites, homeless and vulnerable people was undertaken in three person days using GIS. The use of GIS represents a saving of £8,000 over the approach that would have been necessary with conventional maps, additional data collection and site visits.

Although both relatively small initiatives in themselves, these projects have a high impact outside the Council and show the potential for further use of GI.

[30] ACORN is a commercial geodemographic tool, from CACI, used to identify and understand the UK population and the demand for products and services. It is used to profile customers, target markets and determine where to locate operations.

4.6.2 Family Nottingham: Smoker Profiling

The Nottingham city council GIS team and partners, such as NHS Nottingham city, have been developing the use of the geodemographic tool Public Sector Mosaic (Experian)[31] to improve equitable delivery of services. An example is NHS Nottingham city's work to ensure equitable access to New Leaf smoking cessation services in the city; this has involved identifying population types most likely to smoke - and where they live - and comparing these with the profile of clients accessing New Leaf.

The study found that:

i) the service was generally well targeted at high smoking groups;
ii) there were pockets across the city with high proportions of smokers but poor service uptake;
iii) the New Leaf Service managers were able to use simple 'hot spot' maps to identify areas of high need and poor service and quickly respond by increasing clinic availability in those areas;
iv) Hot spot maps are now routinely provided for service monitoring.

Dr Jeanelle de Gruchy, chair of Nottingham Shared Intelligence Network and Deputy Director of Public Health, NHS Nottingham City, recently praised this project "This piece of work is just one of the many benefits of successful partnership working across Nottingham City. Without the geospatial information and its analysis these insights and the consequent service improvements made possible by re-prioritising resources could not have been realised."

The initiative was also highly commended in the Health Service Journal awards and has been published in the British Journal of Healthcare Computing. (de Gruchy J, 2007)

4.6.3 Litter Inspections: Scarborough Borough Council

The environmental health consequences of poor litter management are important particularly in an area which is highly dependent upon its tourist trade. In this case study, the environment service recognised that by improving their record management they could undertake more inspections and replace their unreliable spreadsheet system.

Using ArcPad[32] software inspectors are now able to enter the start and end point for each report directly on the map, automatically record the time and date and consistently record street names and classes using a drop down lists rather than manual typing.

[31] MOSAIC is a commercial consumer classification produced by Experian, for more details see http://strategies.experian.co.uk/.

[32] www.esri.com/software/arcgis/arcpad/index.html

As the application was an extension of previous work undertaken by the authority's GIS team it was completed with only 3 man days customisation. The cost of the software was just over £400 and the hardware used was existing PDA / mobile telephones so had no additional costs. The system has been in operation since June 2008 and has been very resilient with little further support required.

A total of 53 days inspection work was been carried out within the first year of operation, involving just over 6000 individual site inspections. The savings, estimated at 2 hours per inspection day, mean that payback was achieved within one year.

4.6.4 Qualitative Information

In the course of our research a large number of existing projects were identified where, although no quantitative cost-benefit analysis had been undertaken, geospatial information was providing significant benefits to local service providers. Examples are outlined below:

Healthy eating: Sandwell Primary Health Care Trust

A healthy eating initiative called Eatwell was taken forward after analysis with digital maps showed residential areas at risk of becoming "fresh food deserts". Sandwell Primary Care Trust's food policy and transport planning teams first used maps to show properties within ten minutes of a supermarket either by public transport or on foot. A combination of GIS and transport planning software helped identify the spaces that fell outside the ten-minute parameter. The Eatwell partnership then looked at what shops there were in the spaces and encouraged them to stock fresh fruit and vegetables at affordable prices if they were not already doing so. Forty-three retailers came on board to join the initiative[33].

Accident and Emergency Admissions: London Borough of Camden

In order to help analyse A&E admissions, hospitals are now also collecting the location of the incident leading to admission. This is providing much richer information for research into the causes for crime and accident hotspots. In Camden, the Primary Care Trust reacted by providing a service referred to as CART (Camden Ambulance Response Team) to aid the ambulance service and police in areas where there are known to be high probability of alcohol-related incidents.

4.6.5 Inferences for economic modelling

The above discussion demonstrates that geospatial information has great potential to impact on health and social issues, which in turn can have a range of direct and indirect economic consequences.

[33] http://www.dottedeyes.com/case_studies/

In addition to the case studies and validation studies cited here, it must be recognised in particular that the rapid response capabilities of local authorities are critical to containing and minimising impacts such as time off work from future pandemics or other outbreaks. These may come from a large array of sources (including animal to human transmission, food poisoning, water and air pollution, etc.).

For the purposes of the economic modelling in this study, wider economic impacts such as reductions in time off work could not be included. Part of the difficulty here is that it cannot be predicted when and which outbreaks will in fact be avoided, and of what virulence they would be. This economic value is nevertheless real, and can be considered an 'option' value of having access to the best rapid response capabilities.

Our sample of case studies which informed the modelling for this report only included the estimated implied expenditure savings to the Swindon Council itself, which was estimated at 0.07 per cent of its annual expenditure. This saving was pooled with the other productivity impacts identified in the following sections and as discussed in more detail in Section 6 of this report.

We concluded that the application of geospatial systems in the Primary Care Trusts was not sufficiently high in 2008-9, our baseline period, to include any shocks for the health care sector. However, our interviews did indicate that the momentum for applications of these systems in the primary care trusts was likely to grow over the next five years as awareness of their applications increases through the demonstration effect. We consider that the PCT sector will move out of early adopter stage and into the initial stages of the early majority stage of the adoption profile over the next 2-3 years. The PCTs will be able to take advantage of the advances in geospatial information technology and "leap frog" many local authority implementations as the do not have legacy applications which need to be upgraded.

We estimate that an improvement in productivity of up to 0.10 per cent might be possible by 2015 under the business as usual case. However with improved awareness of the potential productivity gains, linked to process transformation studies within the total place programme and better interoperability of systems, it would not be unreasonable to conclude that a productivity shock of up to double this amount might be possible – equivalent to 0.15 per cent.

4.7 Safer communities

The safer communities' service area covers the work of the police and local authorities implemented in part through local Crime Reduction Partnerships. The range of applications of geospatial information is wide and in certain areas, such as crime analysis, well developed. However, the evidence from the case studies suggests that the potential particularly within the police forces is only at an early stage of development with the efficiency savings of many other potential applications identified but not yet realised.

Fortunately, many police services are well versed in the preparation of business cases and establishing strong links between benefits and financial return, so we have been able to assemble a strong set of examples. As would be expected due to the nature of the task, local service providers in this area are often unable to be identified because of security and confidentiality reasons. For this reason, we do not identify all case study sources.

4.7.1 Crime Analysis: Undisclosed Police Service

Our first study is a general example from the police service to illustrate a base level of functionality that has a very clear cost benefit based on a small subset of a much larger set of benefits:

- The creation of a force-wide database of geo-referenced CCTV camera imagery is one of the key benefits of enhanced GIS. This is based on a 75% reduction in the time spent per robbery to analyse the crime scene.
- The availability of high resolution aerial imagery allows the planning of photographic sorties enhanced with access to the full range of mapping and imagery products envisaged. In some cases the need to fly may be eliminated by access to appropriate imagery. This application is 100% reliant upon the availability of up to date geospatial information, so savings are entirely attributable.
- Reduction in resource requirements for local intelligence units and reduction in data capture time because it is not necessary to update data held in legacy applications. In monetary terms the saving extrapolated across police forces in England and Wales is estimated at circa £4m per annum based on the average cost of police and civil staff grades engaged on this work.

4.7.2 Intranet Mapping: South Yorkshire Police

South Yorkshire Police was one of the earlier adopters of GIS and by 2007 had implemented a web based mapping information system that displayed data and information from the master data repositories such as Command & Control and the Crime Management System. The data displayed is linked across the South Yorkshire Police Force area to the bi-weekly tasking processes that occur simultaneously within each policing command unit. It reflects six different crime themes and anti-social behaviour. Multiple analyses of these seven themes are overlaid upon four scales of Ordnance Survey mapping.

The GIS team realised that the system was being used for a wider range of activities than the implementation had envisaged (South Yorkshire Police, 2007). They monitored usage over a two month period and were able to demonstrate savings of in excess of £600,000 per annum could be made across the force area in time savings on various crime analysis activities, such as hot spot mapping and repeat victimisation patterns, by migrating users to this system.

4.7.3 Street Patrolling: London Borough of Barnet

Barnet is situated in the north west of Greater London, bordering on Hertfordshire. The overall population in 2008 was estimated by ONS to be 331,500, the second largest population of the 33 London boroughs. The borough has recently deployed geospatial technology (CLG, 2009) to allow street wardens to locate, identify and photograph abandoned vehicles; graffiti; antisocial behaviour and fly tipping, and send information immediately back to head office. This ensures a rapid and efficient response immediately against compared to what was formerly a three-to-four-day process. As a result, street wardens equipped with the system, called StreetPatrol[34], are able to spend up to 70 per cent of their time on patrol; those without this capability were only managing 30 per cent. Based on average salary alone it is estimated that mobile system-enabled wardens are delivering £180,000 per annum in efficiency savings.

In addition, the improved speed of response also realises cost savings. Barnet estimate that an abandoned vehicle costs approximately £50 to recover however, if the discovery is delayed and consequently the vehicle is set on fire, the cost of recovery and reparation is circa £4,000.

4.7.4 Worcestershire Crime Reduction Partnership

Worcestershire County has a strong track record in the use of geospatial information, particularly for crime analysis. The Research and Intelligence Unit includes a team of analysts who form part of the Worcestershire crime reduction partnership. Although much of their work is of an operational nature which can make it difficult to separate out the value proposition, a particular recent project illustrates the contribution of their work very clearly. As part of the Local Area Agreement a number of "stretch targets" were established for particular types of crime reduction to encourage exceptional performance. During the period of assessment, the methodology for national crime recording changed which made it impossible to prove by conventional statistical means that the target had indeed been met. The community safety partnership analyst in Wyre Forest disaggregated the statistics and remapped them onto a consistent set of areas for the entire period. This resulted in the obtaining of a grant from central Government worth £250k for achieving the stretch target. Without geospatial data this would have been much more difficult in the view of David Onions, the Corporate Business Intelligence and Performance Manager at Worcestershire County Council.

4.7.5 Qualitative Information

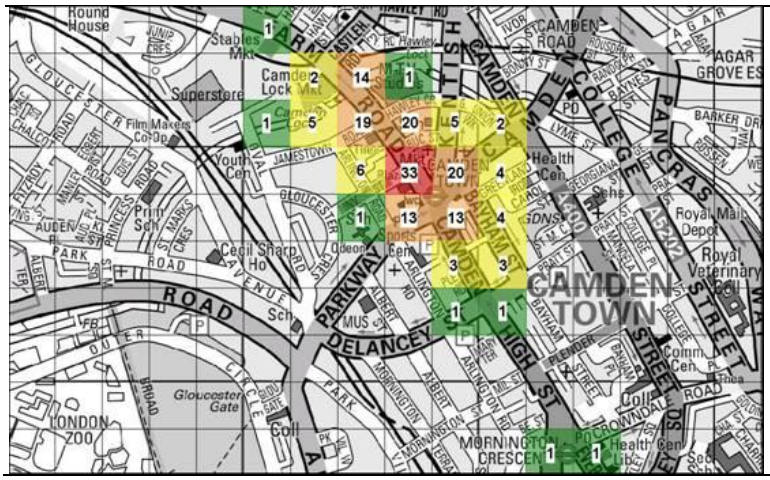
During the workshop with experts, a large number of other applications with significant potential were identified:

[34] http://www.esriuk.com/literature/documents/streetpatrol_flyer_final.pdf

Performance Evaluation

The London Borough of Camden has been particularly active in evaluating the success of their crime reduction initiatives. These are reviewed biennially against the targets set by using geospatial information linked to: local crime statistics, fear of crime surveys, demographic information and partner services local information, (such as that from the ambulance service in Figure 6). This has allowed them to more rapidly identify initiatives that are failing and rethink them or close them down. Quantifiable benefits, in terms of time saved by redeployment of resources, are possible from performance data but this has not been undertaken yet.

Figure 6 **Incident Locations identified by members of the public**



Note: highest incident rate per grid square shown in red, lowest in green.

Data source: Camden CRP Licensing Policy Review. London Ambulance Service records

4.7.6 Inferences for economic modelling

The use of geospatial systems within police services is currently restricted in most instances to use by office-based crime analysts and has yet to be adopted widely for mobile use.

Chief Inspector Nick Barker, staff officer responsible for GIS at the Association of Chief Police Officers' (ACPO), offered some insights into the opportunities:

> "Some forces are far more sophisticated than others and are looking at a much better use of GIS in briefings and control rooms. Ideally we would be able to see GIS combined with mobile data to see live briefings. Officers could receive up to date relevant information whilst on patrol to their PDA's. The PDA's could then complete statements, crime reports, collision reports without having to return to the office or duplicate work. An iPhone App in the insurance industry allows clients to complete car insurance claims from the accident site. There is no reason that similar technology could not be used by police officers. Accident data, vehicle details road and weather conditions could all be fed in from other data sharers enabling a very comprehensive and accurate picture to be produced.

> Aerial imagery that is height adjusted would have excellent uses for firearms and public order operations. At major incidents it can be very confusing trying to explain over the radio where you want a cordon. Being able to draw it on a map that is then sent to officers PDA's directing them to the cordon would assist significantly. Add GPS to the equation and we could instantly tell which officer is where and who has entered the cordon. These are just two of a wide range of potential applications"

This indicates that the full potential of geospatial information is not widely recognised within this area. The most pressing barriers to implementation are awareness but also include issues concerned with improvements to data access, some related to security concerns.

Despite these limitations, the case studies where financial analysis was available exhibited some of the most attractive return on investment cases identified during the study.

4.8 National Land and Property Gazetteer (NLPG)

This service area is different in nature from those above in that it is based upon a specific information source. The NLPG is a national geo-referenced database, owned and created by local government in England and Wales. It records all postally addressable and non-postally addressable objects (such as railway stations) in England and Wales. It is maintained by all local authorities who have statutory responsibility for naming and numbering streets and properties in their area. These authorities submit a Local Land and Property Gazetteer (LLPG) to a central hub system which is then assembled into the NLPG. All entries in the database have a geographical location. The NLPG project commenced in 1999 and has gradually grown in adoption and sophistication over the intervening period.

As the NLPG is used to underpin many of the service areas and applications described above, it is essential that we did not "double count" its effect in evaluating the financial value of geospatial information. The case studies used in evidence under this section are therefore based on the value of efficiencies derived from better creation, enhancement and maintenance of the NLPG by local public service providers rather than its use in applications. However, for reference, the case studies in which the NLPG forms part of the solution are listed in Table 3 below.

Table 3 **Applications of NLPG**

Local Service Provider	Application
AXESS partnership	Street cleaning
Tendring District Council	E-Planning
Swindon Borough Council	Health and Social Care
Derbyshire Partnership	Service sharing
Newark and Sherwood District Council	Benefits Claiming
South Tyneside Council	Customer Interface
East Sussex County Council	Fault reporting
Scarborough Borough Council	Litter inspection
London Borough of Islington	Highways Inventory management

4.8.1 Newport City Council

Newport City Council in Wales is a relatively small unitary authority in the very south east of Wales. It has one large urban area, Newport, on its southern edge. The use of the LLPG within Newport is well developed. A common LLPG database is used as the source of address information for many departmental systems and is gradually being extended as either systems are replaced, or enhancements to those systems, such as support for web services, enable data sources such as the NLPG to be more readily utilised.

Rationalising the addresses held by the Council has benefits from a citizen perspective because if each service area carries a different address for the location where a person lives, it makes it much more difficult to join up the services provided to that person.

An additional consideration in Wales is that the NLPG is produced to a national standard and is capable of operating in multiple languages, which is important as the Welsh Language Act requires systems to support both English and Welsh equally.

The fundamental basis of the cost-benefit case for update once and share with many systems is simple. It is estimated from observation that the average time to apply each address update to each system is three minutes. There were approximately 2,300 updates per annum made only once to the primary database instead of having to be applied to 17 separate systems. This has yielded an estimated annual net benefit of approximately £57,000 per annum. As this rationalisation could not have been achieved without the LLPG it is justifiable to attribute these savings to geospatial information.

4.8.2 Plymouth City Council

Plymouth City Council has realised significant savings, increased service efficiencies and improvements in customer care with their use of the NLPG[35] .

The NLPG, through a series of dynamic links and update procedures, feeds departmental back office systems and corporate IT applications, including the Council's corporate feedback mechanism 'Have your Say', the authority's CRM and Plymouth's corporate GIS and Intranet based mapping portal. Other departments benefiting from the resource include Environmental Health, Land Charges, Education, Council Tax and Business Rates.

Consolidation of address datasets is saving an estimated £150,000 per annum by eliminating the duplication of work. Additional savings are being realised through a reduction in staff resources and related infrastructure required for frontline query resolution.

4.8.3 Blackpool Council

Blackpool has been one of the frontrunners in implementation of the NLPG and has created one of the country's most up to date geographic databases of land, street and properties[36]. Blackpool is seeing substantial rewards as more and more of the council's services benefit from geospatial information and technology.

[35] See full Plymouth City Council case study write up at http://www.iahub.net/docs/1213972899486.pdf

[36] See full Blackpool Council case study write up at http://www.iahub.net/docs/1204200629176.pdf

If the authority had not implemented LLPG and GIS, it would have been difficult to achieve the levels of service that it does at present. The technology and data simply allows the Council to operate much more efficiently and in a better way. Without it, staff numbers and overheads would cost hundreds of thousands of pounds more each year, so there is a very clear return on investment.

The LLPG has eliminated the need to maintain 7 of the council's key datasets; saving the council £750,000 since data was consolidated. Ease of access to the address data is a key factor with the LLPG software allowing other systems to easily incorporate LLPG addresses. Blackpool's website provides live LLPG-linked address look-ups that greatly enhance searches, allowing staff and citizens to get the information they need quickly.

4.8.4 Huntingdonshire District Council

Huntingdonshire District were involved in mid 2000s in linking address datasets held by the Valuation Office Agency (VOA) and the LLPG to reduce wasted effort in identifying and tracking business property taxation information, and improving the completeness of NNDR billing. This initiative has more recently been extended so that the LLPG now feeds 19 different business systems.

The LLPG team processes an average of 10 new properties per day and amend 50 records per day. This typically takes 5 minutes per property amounting to 60 x 5 minutes = 5 hours per day. The LLPG team processes new and amend records each day. The cost of maintaining a gazetteer for each system has been estimated at £13K per annum.

If each of the 19 business systems served were manually maintained to the same accuracy level as the LLPG then each would require the same amount of administration time per property. In practice, there would also be an additional management overhead to ensure all updates are synchronised and consistently entered. Additionally, there would be other costs associated with sorting problems where addresses became (inevitably) out of synchronisation between systems.

As a result of data sharing, the Council estimate that it would incur an additional expenditure of £247k, if the Council did not have a LLPG.

4.8.5 Qualitative Information

There are a number of other benefits in efficiency and quality of service that have not been evaluated because of time limitations, for instance:

- Sharing common NLPG information with the police, fire and rescue services in emergency situations such as flooding or other natural catastrophes;
- Minimising insurance premiums on council property by accurately positioning them in relation to perceived hazards, such as areas of high crime or flood plains;

- SatNav enhancements by use of more accurate NLPG geographical coordinates rather than postcodes.

4.8.6 Inferences for economic modelling

The four examples above have been used as part of the input to the CGE modelling to calculate the overall economic impacts. As would be expected they show that the potential gains from efficient data sharing increase roughly in line with increases in size and rate of change of the population, which tend to be reflected in the number of records in the LLPG and their volatility.

Information available in relation to the progress in linking the NLPG to datasets in other services is well developed as a result of the national coordination of the NLPG by IDeA and their contractor Intelligent Addressing. This has enabled the study team to analyse the cost-benefit of completing the roll-out of the NLPG across a range of property-related services in some detail. This is reported separately at section 6.4.

4.9 Other Services

Given the range of local services in which geospatial information plays a key role, it was not possible to provide a comprehensive analysis of the value derived. However, during the study many other applications were identified which had strong business cases and wide applicability. In this section we look briefly at other service areas where geospatial is contributing to efficiency savings and helping to promote shared services and other Government initiatives.

4.9.1 Flood Disaster Response: Kingston upon Hull[37]

In June 2007 normal working day very quickly transformed into a disaster of unprecedented proportions for the city of Kingston upon Hull following the deposit of more than 100mm of rainwater on the city in less than 24 hours.

A critical issue for the Recovery Team was to establish how many households had been directly affected by the flooding, to ascertain their personal circumstances and to arrange for the appropriate level of council support to be put in place. With 24 hours' notice, the Recovery Team recruited more than 750 volunteer staff from across the council to undertake door to door surveys in flood affected areas, supplied with survey forms and high visibility tabards, to ascertain the basic details of the level of impact. Over a three day period more than 25,000 houses were visited and details gleaned which built a picture of the scale of response to be provided.

[37] http://www.localgov.co.uk/view/docs/awards2008/customer/finalists/Hull.pdf

Survey data was entered onto a bespoke database by a volunteer team of 20 staff which enabled not only individual household data to be captured but also to enable a citywide picture of impact to emerge through the use of advanced GIS mapping software. This database quickly became the Management Information tool for directing the response to the flooding and is still in use today, holding records for more than 27,000 households across the city.

Further information on this study has also been published by CLG as an exemplar of best practice[38].

4.9.2 Heat Loss Mapping

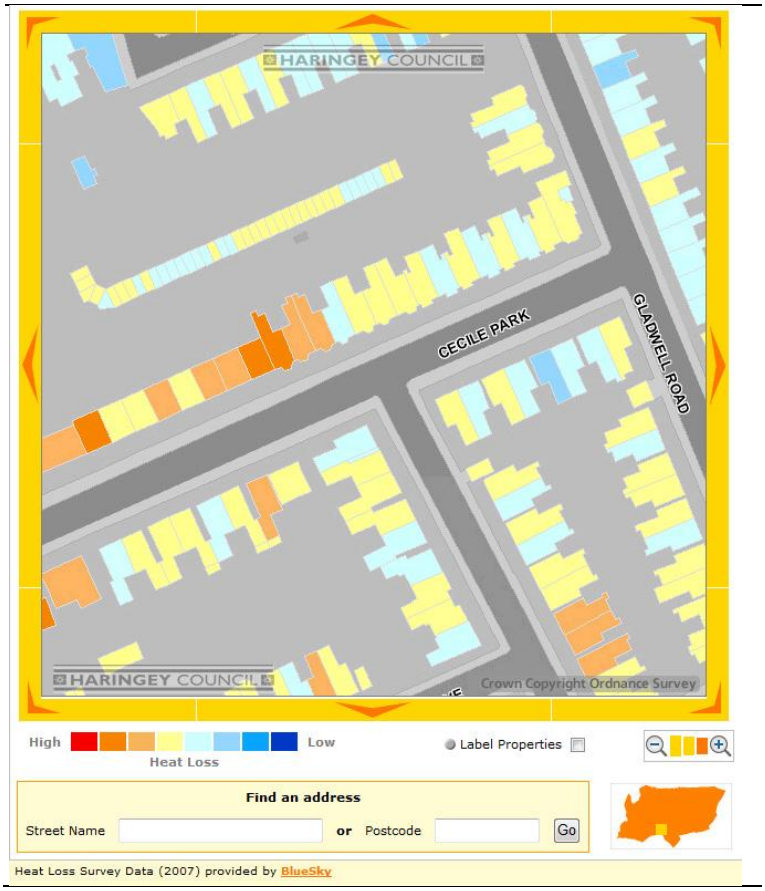
In 2007 the Government introduced a bill to combat global warming and climate change by tackling rising carbon dioxide emissions. The Climate Change Act, which became law in November 2008, commits the UK to cutting emissions by at least 80% by 2050 and at least 26% by 2020.

In order to promote energy efficiency, a number of Councils, including Dartford Borough Council, Peterborough City Council and London Borough of Haringey, have commissioned thermal imaging surveys[39] of their areas enabling property level heat loss assessments to be made. Figure 8 illustrates the Haringey system, where the council use the digital image map in its geographical information system (GIS), in conjunction with Ordnance Survey mapping and the NLPG, to help identify communities to target with awareness campaigns The data is also accessible on the council website where local residents can simply enter their postcode and house number to get a personalised 'score' for their property together with advice on improvements in insulation, energy efficiency and reducing consumption.

[38] http://www.communities.gov.uk/documents/planningandbuilding/pdf/pps25guideupdate.pdf (pg 61)

[39] See http://www.bluesky-world.com

Figure 8 **Haringey Heat loss map**



Data source: London Borough of Haringey

4.9.3 Inferences for economic modelling

It is important to note, that these other services do not contribute to the financial evaluation and consequently, the overall value of geospatial information to the economy, particularly in terms of future potential is almost certainly understated.

5 Barriers and opportunities

5.1 Nature of Barriers

Section 3 of this report highlighted a number of economic issues (including 'market failure' and the role for government) in the provision of public services while Section 4 detailed many case studies that document the economic contribution that geospatial information makes to public service delivery. From the discussions in these sections it is clear that geospatial information systems has already produced substantial benefits in the delivery of local public services and that these benefits have been growing over the past 20 years with each wave of adoption.

It is also clear that there are a number of barriers that have held back, and are continuing to hold back, the use of geospatial information in local public service delivery and need to be addressed.

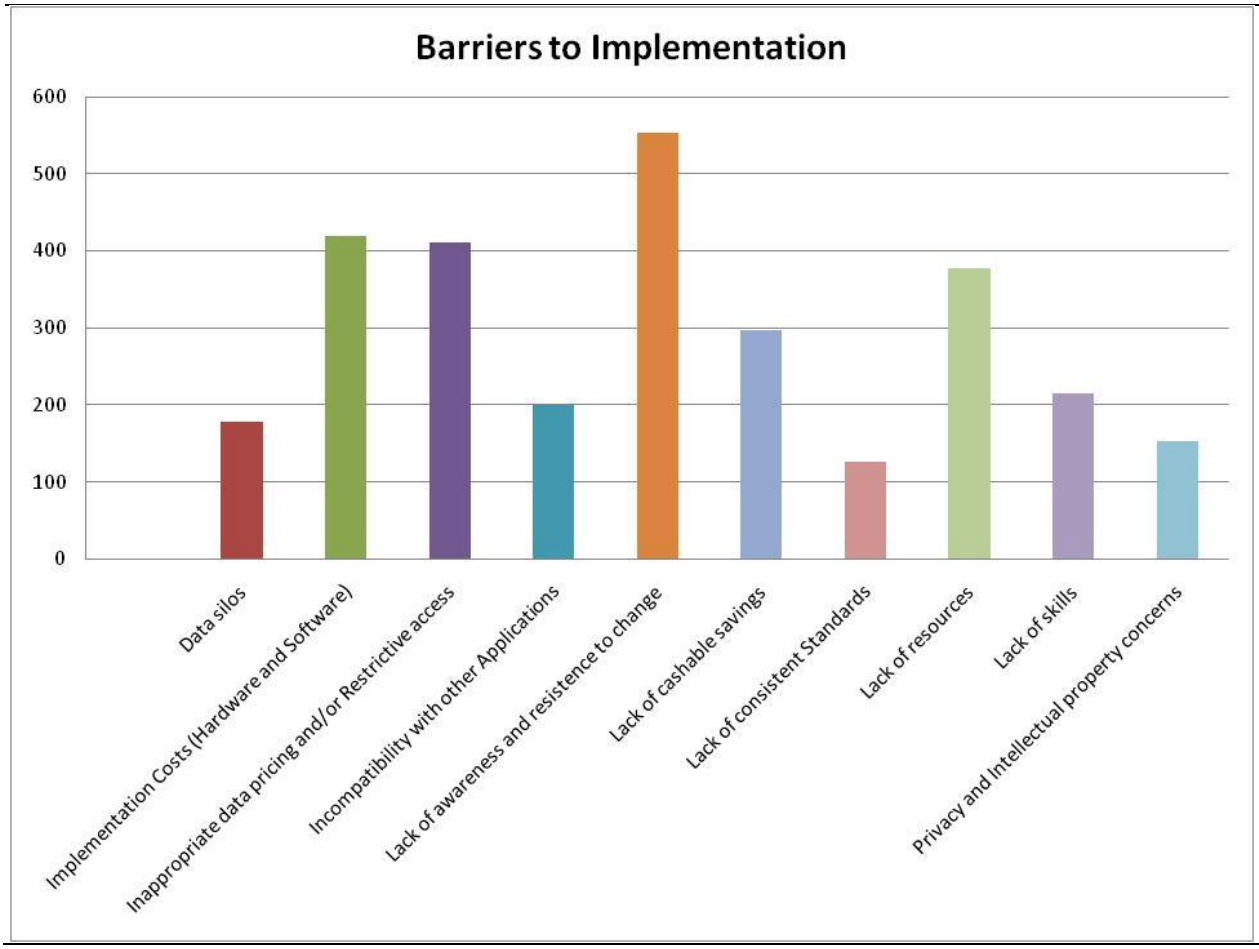
In contrast, there are significant opportunities flowing from recent technical and business innovations. In addition, strategies can be foreseen to reduce the fragmentation of data and improving the access for all users in local public service delivery.

In this section therefore, we focus on the barriers and some possible explanations for their continued existence, examine the opportunities that could be realised from recent advances in the geospatial information market and makes some inferences from international comparisons. In the final part these considerations are brought together to create a "blueprint" for achieving the potential without barriers, referred to also as the 2015 "ideal" case.

5.2 Barriers to implementation

As part of the study, the Local Government Association undertook a sample survey of 20 users in local public service delivery, supplemented by 9 attendees of the study workshop, to identify and rank the barriers to greater use and benefits from the geospatial systems and applications. The results of this survey are provided in Figure 7.

Figure 7 **Survey results – barriers to implementation**



Note: The y axis represents a scale of importance based on each respondent being able to allocate 100 marks across the barrier types

Data source: Local Government Association Survey

The top three barriers to further implementation were identified as (i) lack of awareness of benefits and resistance to change amongst users, (ii) implementation costs (hardware and software) and (iii) inappropriate data pricing and/or restrictions on access. Lack of cashable savings and resources also scored highly.

Although this is a relatively small sample, other discussions held as part of the study and our knowledge of the market, suggest this reflects the general position accurately. Considering each of these in more detail:

Lack of Awareness and resistance to change

Our case studies show that the innovators and adopters in local public sector providers tended to be geospatial information managers and related professionals and not top management.

Although geospatial information has been in use in some services for many years, it is often still seen as a specialist domain. In many local public service providers there is also a lack of awareness of its value as an integrating technology, capable of allowing quite disparate datasets to be linked through location. Furthermore, the role of geospatial information as an integral part of "enterprise" transformation projects is not understood – section 3.1.8 also alludes to this issue.

The resistance to change is seen in services where the use of geospatial information does not have an established track record - social care is perhaps the most noticeable example from the case studies. In other organisations the resistance to change maybe manifest at middle management level where it is seen as separate from, and not as important as, other initiatives.

Implementation costs

The costs of hardware and software required to implement GIS has historically been relatively high compared to other ICT projects. We feel this is less of an issue today, as a result of the advances outlined in the opportunities section below. However, the high ranking given by the survey indicates that there is an issue of awareness of these opportunities within the geospatial community itself.

Inappropriate data pricing and/or restrictions on access.

The sample survey was completed before the results of the Ordnance Survey consultation were known. Two parts of the response are relevant to this barrier. First, the release of much of the OS portfolio of medium and small scales data without charge and under a collective commons licence will be addressing both pricing and derived copyright issues for these datasets, although it has to be recognised that these data will only be sufficiently detailed for a limited number of applications for local service providers. Secondly, the plan to create a "one government" agreement for access to large scale OS data will affect the pricing discussion. At this stage it is not clear whether costs will increase or decrease as a result.

The organisation of, and access to, this data was assessed by survey respondents as uncoordinated, unnecessarily complex and difficult. They saw a need to lessen the complexity, standardise licensing arrangements and simplify administrative arrangements to support data use across a range of services at minimum cost. The current concerns about the threat of breaching copyright law if, for example, data is shared between public sector organisations, citizens or business are still relevant in respect to OS large scale data.

Lack of cashable savings

In some instances, the benefits accrue over many years so that while the benefit cost ratio can be high, the payback period can be long. This does not suit short term budgeting.

However, the majority of our case studies exhibit relatively short payback periods – in some cases, such as route optimisation, this can be within the financial year of investment. This is also true where an existing enterprise infrastructure has already been created as the incremental cost is small compared to the benefits of introduction to an existing application to a new service. Finally, as this report shows, some of the benefits accrue to stakeholders and not to local public service providers.

Local government is a major user and producer of geographic information. Local public services need competitively priced geographic information and flexibility in using and sharing this information. Geography and the capacity to tailor services to the needs of places, people and businesses are crucial to effective local public service delivery. Increasingly, local services are provided through cross public, private and third sector co-operation. Effective use of data and information that can be shared is vital, and exemplified by the Total Place[40] concept which has wide support.

Compatibility, privacy, implementation costs and lack of standards are real for the GI professionals and while they may not be ranked as highly in this survey, are nevertheless barriers that could constrain the benefits realised if not addressed.

5.3 Explaining the barriers to implementation

A range of possible explanations for the "sub-optimal" rate of progress in implementation can be offered from the experience of the study team in other sectors and geographies:

- Capacity building issues: part of this is a shortage of staff with relevant and up to date knowledge and skills;
- Policy conflict: the stated need to charge for data to fund the next round of geospatial data collection and maintenance efforts which is in conflict to the government policy, for instance, the transparency agenda;
- Lack of incentives (referred to by economists as the principal-agent problem)[41]
  - difficulty in linking pay to specific outcomes such as data release
  - senior officials have little incentive to engage and are already 'stretched' with competing priorities;
- Other factors
  - individuals may be concerned about mistakes or inaccuracies in the data or maps
    i. impact on reputation
    ii. fears about potential litigation if data are released

[40] Total Place - a government initiative under the operational efficiency programme - will change how public services will have to be delivered effectively and efficiently across organisational boundaries.

[41] The principal-agent problem arises when management does not have the same objectives as the owners.

- data 'hoarding'
  i. as officials seek to maximise remit or influence
  ii. institutional inertia.

Consideration of these possible causes feeds into the recommendations for actions to support achieving the discussion of the potential without barriers detailed in section 5.4.

5.4 Opportunities

5.4.1 Future Directions in Geospatial Information

This is a time of radical change in the geospatial information industry. The policy context has been covered in Section 2 of the study, so in this section we focus on the technological, business and market impacts, with particular reference to those that will have direct economic effects on implementation of geospatial information applications.

Location Based Services

The overarching change is the concept of geography as context. It embodies the idea that geospatial data becomes a basic ingredient of an information system, ubiquitous to all applications. Consequently, we may even stop talking about geospatial applications, as all applications will embed geography, it being only the extent to which this is relevant or explicit that will vary. This change is most powerfully illustrated in the emergence of the consumer-focused location based services (LBS) such as Google maps, Bing and Yahoo. These are "disruptive technologies" in that they are changing the way in which staff in local public service providers view geographical information by making it more accessible and intelligible, helping to raise awareness and much more cost-effective to use more widely.

Locationally-enabled Smartphones

The emergence of the smart phone as a business tool will also be a significant enabler. In his AGI foresight paper Peter Batty argues that:

"A significant development in the next 5 years will be the move of applications aimed primarily at consumers into the enterprise space. Just as today vehicle navigation is used in both the consumer and business space, other geospatial applications that emerge in the consumer market will also be adopted, sometimes in a "hardened" form in the enterprise". See the AGI Foresight Study (Coote et al 2010) for further details.

An example of one of the myriad of location-based applications emerging in this way is the Asborometer[42]– a recently launched application that provides information about Anti Social Behaviour statistics in your current location from the GPS receiver in your IPhone.

The effect upon the market of enterprise LBS will be to increase the functionality and reduce the per seat cost of client-end GIS.

Open Source

Open source will become a more significant factor in both software and data accessibility and availability by 2015. Jo Cook, one of the leading UK proponents of the open source movement in her AGI foresight study paper (Coote et al, 2010) believes that "Sharing and making code and data open will be the "*de facto*" approach", although some doubts remain about functional maturity of some components and availability of support services." There will also be a huge growth in active and passive "crowd sourcing".

The effect upon the market of open source will be to increase the competition for supply of systems (and services) associated with implementing geospatial applications in local public sector providers.

Shared Procurement

The opportunities to drive better deals with commercial data and systems suppliers, by virtue of shared procurement approaches is one of the main attractions of shared services and partnership working approaches. There is an opportunity to apply this type of approach increasingly to geospatial information. Some recent commercially confidentially agreements that have been reached offer savings typically in the region of 25% over single authority procurements. Of course, the Mapping Service Agreement between local government and Ordnance Survey is a large scale example of such collective procurement, resulting in substantial savings, compared to individual negotiation.

Site Licensing

There is an increasing appetite in the vendor community to enter into "site licensing" arrangements by which the customer can make unlimited use of the software suite in return for a longer-term (typically 2-3 years) commitment.

5.5 International comparisons

In looking at barriers to implementation, a review of developments in other comparable economies is informative:

[42] www.asborometer.com

United States

Bill Clinton's 1994 presidential 'Executive Order' launched the US national spatial data infrastructure (NSDI) initiative. It was of the first legislative mandates in the geospatial world, and amongst others actions, put a requirement on public sector organisations to more openly share geospatial information. Government recognition of the value of geospatial information has been further underlined more recently by its status as one of the "top level" lines of business in federal budget, referred to as GeoLoB. This is large part a response to disasters (natural and man-made), such as Hurricane Catrina and 911 where a lack of interoperability between geospatial systems hampered relief efforts. The GeoLoB business case for the budget year 2009[43], spells out the challenge as they see it:

> "Optimal use of geographic data and geoanalytics can significantly improve the way that governments plan their strategies, manage their organizations, and offer goods and services to the public. There are numerous geospatial efforts being conducted independently across Federal agencies, resulting in disparate data silos and services, investment opportunity losses and compromised business understanding."

One of the significant parts of this effort in relation to this study is the drive to reduce procurement costs under what is referred to as the SmartBUY blanket purchase agreement[44].

Canada

Geoconnections, a joint public and private sector body, funded by government has been in existence for nearly 10 years. Its aim is to "help decision-makers use online location-based (or "geospatial") information, such as maps and satellite images, to tackle some of Canada's most pressing challenges.[45]"

Significant to this study is the work it commissioned which examined the impact of geospatial policies of government organisations on the business sector and community at large (KPMG Consulting, 2001). Amongst others it offered the following conclusions:

- Return on Investment: users surveyed referred to a similar 1:4 ratio of investment to benefit i.e. for every dollar invested in producing and distributing geospatial information, four dollars of growth is generated for the economy, through increased resource allocation, profits, taxes, etc. (report section D);
- Copyright and licensing: Digital geospatial data should be licensed at no royalty cost to users with respect to use and redistribution (recommendation 5);

[43] http://www.fgdc.gov/geospatial-lob/FY09-Redacted.pdf

[44] http://www.fgdc.gov/geospatial-lob/smartbuy/index_html

[45] http://www.geoconnections.org/en/aboutGeo.html

- Data sharing policy: should encourage and allow free the exchange and sharing of geospatial data by data agencies with other government departments and other levels of government (recommendation 6).

Australia

Recent work on establishing the value of geospatial information to the economy (ACIL Tasman, 2008) examined 22 sectors of the economy, estimating the cumulative contribution to the economy of between AU $6.43 (£4.2) billion and AU $12.57 (£8.4) billion in Gross Domestic Product (GDP), equivalent to a total shock of 0.6% – 1.2%.

Constraints on access to data were identified as the key barrier to adoption, estimated to have reduced the direct productivity impacts in certain sectors by between 5% and 15%. It is estimated that this could have resulted in GDP and consumption being around 7% or AU $0.5 billion (£330 million), lower in 2006-07 than it might otherwise have been.

5.6 Removing barriers to Adoption

The interviews and discussions undertaken as part of the study indicated clearly that the contribution from the application of geospatial information and systems could be substantially accelerated if barriers to optimal access were removed. The key enablers are partly reliant upon an improved public policy approach to access and licensing/copyright. The remainder are within the ambit of local public service providers, and relate to increased awareness and use of “best practice” strategies, tools and techniques. We examine what we believe to be the critical actions below:

Political Commitment

A major barrier to realising the clear benefits identified in the study is the lack of senior management and political understanding and commitment.

Too often within local public service providers, GI is seen as something technical, that enthusiasts in some services push as part of service development. GI is not treated as a corporate asset, in contrast to for instance, staff and property, and lacks a recognised executive champion. The Chief Information Officer is the most obvious choice for such an advocate, whereas frequently the task is given to the head of IT or a particular service manager both of whom have a specific service focus rather than a “cross-cutting” brief.

At a political level the situation is many respects worse, with few politicians at local or national level even aware of what is meant by geospatial information, let alone the benefits it can offer.

Recommendation: Local public service providers should work with industry bodies, such as the Association for Geographic Information (AGI), to create a concerted plan of action aimed at promoting better top management and political understanding of the case for the better use of GI.

Data Accessibility

Much of the geospatial information supplied by government can be considered a public good with many positive internal and external benefits. Although this has been, in part, recognised by the freeing up of access to many of Ordnance Survey's medium and small scale digital products, the same is not true of all government departments. The extended timescales and restricted scope of INSPIRE, means that we cannot rely on this initiative alone to achieve optimal access. Furthermore, the resistance to access is in many cases, cultural rather than practical, being related in the minds of public servants to concerns over quality and liability.

Recommendation: all geospatial information collected or created at any level of government should be made as readily accessible as possible for unrestricted public use unless there are overriding reasons of privacy or security not to do so. In making this recommendation, we do not imply that access to all government data should be at no charge.

Copyright and Licensing

There are ample examples in the case studies which show that current restrictions on redistribution of geospatial information through the use of licensing and copyright work against the goal of optimising usage. In particular, concerns about the legality in relation to copyright of providing Ordnance Survey data within web mapping sites is limiting the benefits of many projects.

The issues surrounding copyright on information derived from use of Ordnance Survey data, is another area of frustration within local public service providers. Deferred in the government response to the OS consultation, it is one of the clearest impediments to realising optimal benefits within the sector identified by the study.

Recommendation: Restrictions on the use and redistribution of government geospatial information through licensing and copyright should adopt a "light touch" approach focusing on protecting data integrity and large-scale copyright infringement.

Geospatial Awareness

Greater awareness within organisations of the potential for geospatial information and systems to improve the way local public services are provided would, in our view, provide a major stimulus to the evolution of adoption and innovation. As discussed elsewhere in this report, once adoption moves past the early majority stage, acceleration in the rate of adoption can be clearly influenced by optimising awareness. The availability of well documented, cost-justified, case studies gives policy

makers more confidence that they are not taking excessive "pioneering" risks and that realising the promised benefits is a well trodden path.

Recommendation: We recommend that local public service providers leverage the drive for greater operational efficiency to organise a series of themed events presenting the savings and/or other benefits identified in each of the case study services.

Making the business case

The study team has had first-hand experience of the general lack of understanding the techniques for preparing and presenting business cases within the local public services geospatial information community. The lack of understanding extends from grasping the terminology, through the process of identifying the intercepts of geospatial information with the policy agenda, to how benefits can be measured and presented. This is clearly an issue that needs to be addressed if optimal adoption is to be realised.

Recommendation: We recommend that local public service providers consider establishing a training programme for those responsible for developing business cases for geospatial projects, to equip them with the necessary tools and techniques. Training should not only cover developing and presenting the business case but also techniques for proving that the predicted benefits are realised after implementation.

It is our considered view that the result of implementing these recommendations would be faster and wider delivery of productivity benefits within the public service providers and a more rapid promotion of knock on benefits to other sectors of the economy.

An estimate of the financial impact of removing these barriers is explained in section 6.

6 Results

In this section we bring together the geo-economic considerations outlined in section 3, the financial analysis from the case studies outlined in section 4 and the assessment of barriers to implementation and opportunities made in section 5. The financial inputs to the Computable General Equilibrium (CGE) model are considered, and the consequent impacts on the economy, in both "business as usual" and optimal (ideal) cases.

6.1 Macroeconomic modelling

For this report, ACIL Tasman's CGE model, *Tasman Global*, was used to estimate the impacts that local service provider adoption of geospatial information has had on the broader economy to date. Further, estimates were made of the future potential benefits that may arise if current applications continue to evolve and if new identified opportunities are pursued.

Tasman Global is a large scale, dynamic, computable general equilibrium model of the world economy that has been developed in-house by ACIL Tasman. *Tasman Global* is a sophisticated tool for undertaking economic analysis at the regional, national and global levels. Tasman Global draws on the GTAP global data base developed at Purdue University.

General equilibrium models such as *Tasman Global* mimic the workings of the economy through a system of interdependent behavioural and accounting equations which are linked to an input-output database. These models provide a representation of the whole economy, set in a national and international trading context, using a 'bottom-up approach' – starting with individual markets, producers and consumers and building up the system via demands and production from each component. When an economic shock or disturbance such as an increase in a sector's rate of growth is applied to the model, each of the markets adjusts to a new equilibrium according to the set of behavioural parameters[46] which are underpinned by economic theory.

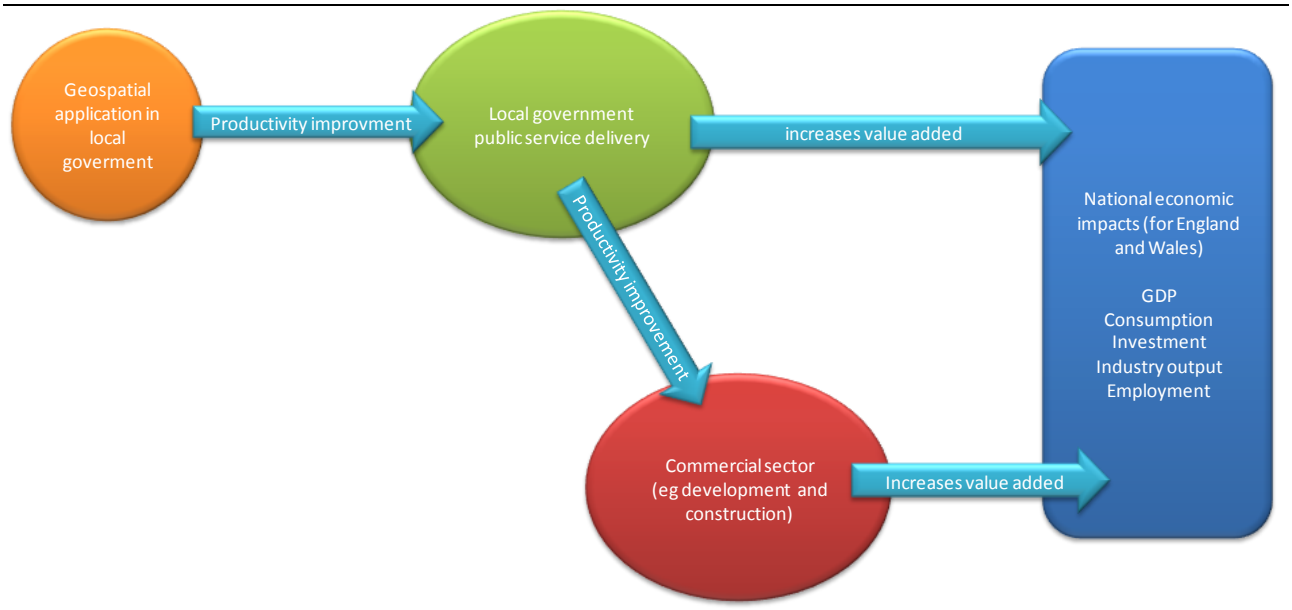
In addition to recognising the linkages between industries in an economy, computable general equilibrium models also recognise economic constraints. For example, increases in demand for labour may result in increases in real wages.

While these models can appear complex, it is the way in which they can translate the impact of changes in one sector to the wider economy that is so powerful. A simplified illustration of the linkage is illustrated in Figure 8.

[46] An example of a behavioural parameter is the *price elasticity of demand* – the responsiveness of demand for a commodity to a change in the price of that commodity. Each of these markets – for example the market for a commodity or a factor such as labour or land or the market for capital goods – is then linked through trade and investment flows.

This diagram shows how a change in productivity arising out of a geospatial application, for instance in a local authority, increases the overall productivity of local government and also leads to an increase in productivity in those parts of the commercial sector that depend on that local government service (for example the construction and business services sectors). The local government, construction and business services sectors experience an increase in efficiency which feeds through to the wider economy. The accumulated impact of these changes is an overall higher level of economic activity in England and Wales (expressed in terms of GDP).

Figure 8 **How productivity shocks feed through into the national economy**



Data source: ACIL Tasman

A key advantage of GCE models is that they capture both the direct and indirect impacts of economic changes while taking account of economic constraints. For example, *Tasman Global* captures the expansion in economic activity driven by a productivity improvement or investment in one sector, and at the same time accounts for the constraints faced by an economy in terms of availability of labour, capital and other inputs. Another key advantage of CGE models is that they capture a wide range of economic impacts across a wide range of industries in a single consistent framework that enables rigorous assessment of a range of policy scenarios.

More detail of the *Tasman Global* model is provided in AnnexA.3.

6.2 Database aggregation

The database which underpins the model contains a wealth of sectoral detail. The foundation of this information is the input-output tables that underpin the database. Industries and commodities in the model can be aggregated or disaggregated as required for a specific project.

For this study the model has been aggregated to:

- England & Wales;
- 32 industries/commodities.

As the model is a global model it accounts for trade between countries. In this application, it accounts for trade between England and Wales, the rest of the United Kingdom and the rest of the world.

For the purposes of modelling the impacts of geospatial information we subdivided government services into four components: local government; Primary Care Trusts (PCTs); the rest of the National Health Service; and the rest of government. The allocation of the different functions within these divisions is summarised in Table 4.

Table 4 **Breakdown of Public services for the purposes of modelling**

Component	Organisations
Local government	• London Boroughs, Metropolitan Districts, Shire Counties, Shire Districts and Shire Unitary Authorities. • Fire authorities • Police authorities • Passenger Transport authorities • Greater London Authority (and other regional bodies) • Waste Disposal authority • Coroner's courts.
Primary health services	Primary Care Trusts
Rest of National Health Service	Strategic health authorities Strategic health trusts Ambulance Trusts NHS trusts and mental health trusts Department of Health
Rest of Government	The remainder of National Government activities

Note: This breakdown of public expenditure was developed in consultation with the Local Government Association

Data source: Local Government Association, ConsultingWhere and ACIL Tasman

Productivity improvement in any one of these sectors will, in most cases, have knock on benefits into other sectors of the economy. For example, if the productivity of delivery of local public health services through the PCTs is improved, it reduces the call on the resources in the rest of the National Health Service, freeing up resources to provide more efficient service delivery of health services generally.

6.2.1 Internal Benefits

It is perhaps a reflection of the "technology-driven" approach adopted in the past to geospatial information systems, that relatively few organisations have taken a rigorous approach to establishing cost-benefit in advance of implementation.

However, during the study, the team was able to obtain sufficiently detailed data from 17 case studies, covering a wide range of applications and organisation types, where data about financial benefits could be directly linked to geospatial information, as listed in Table 5.

Table 5 **Case studies**

Local Service Provider	Application
Newport City Council	NLPG Data Sharing
Blackpool Council	NLPG Data Sharing
Plymouth City Council	NLPG Data Sharing
Huntingdonshire District Council	NLPG Data Sharing
Daventry District Council	Waste Collection Route Optimisation
Tendring District Council	E-Planning
Swindon Borough Council	Health and Social Care
ELGIN	Streetworks Management
Nottingham Insight	Local Information System
Derbyshire Partnership	Shared Information Services
London Borough of Barnet	Street Patrol
South Tyneside Council	Customer Interface
East Sussex County Council	Fault reporting
Scarborough Borough Council	Litter inspection
South Yorkshire Police	Crime analysis
London Borough of Islington	Highways Inventory management
Undisclosed Police Authority	Operations

Source: Case Studies

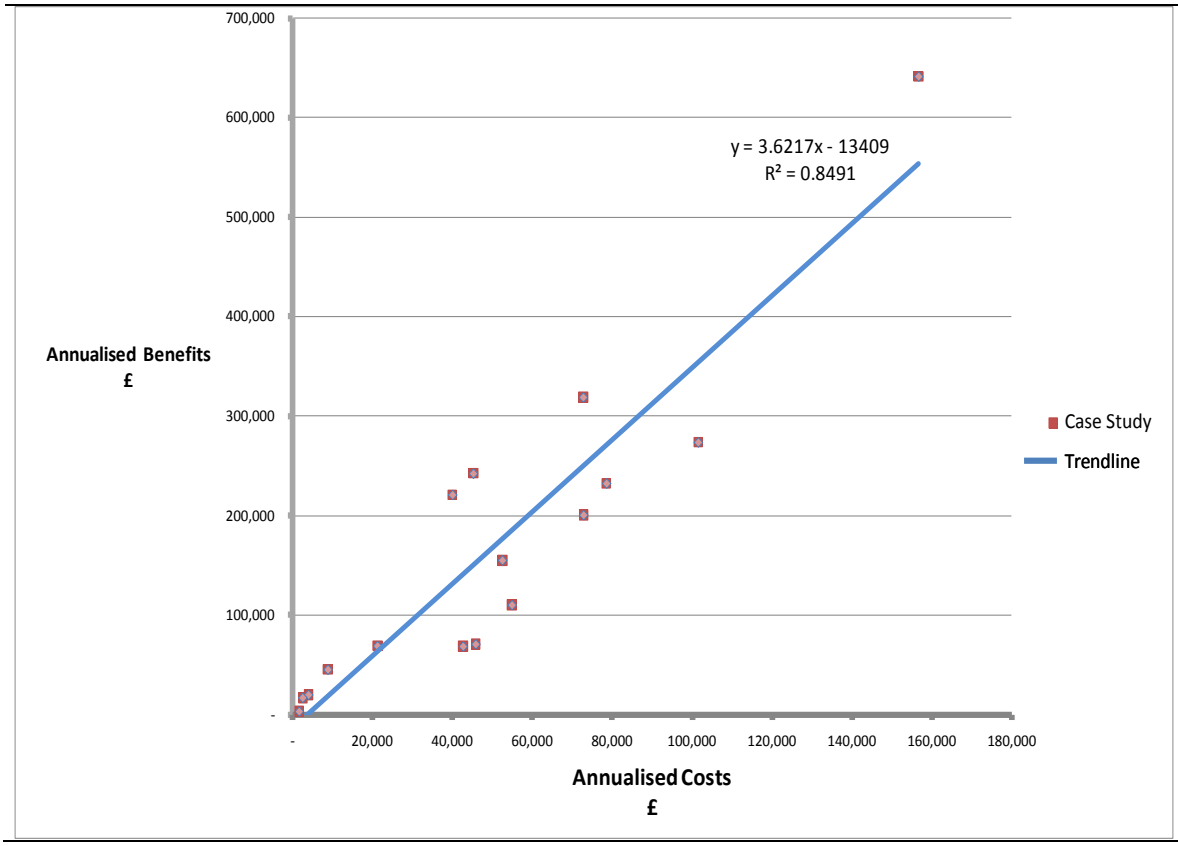
The net benefits derived by local public service providers were estimated using the following methodology:

i. Financial assessments of specific project costs and associated benefits realised within the organisation were drawn from the case studies. Note that only the components of benefits directly attributable to geospatial information were included.

ii. Financial information was indexed to a common base line of the 2008-9 financial year.

iii. In order to provide a statistically valid approach to cost-benefit across multiple organisations and services, a regression equation was derived to represent a best fit to the data. This showed an acceptable correlation of cost to benefit of 92% (R^2=0.84), see Figure 9, leading us to assess the resulting calculations to be within a confidence limit of plus or minus 10%.

Figure 9 **Relationship between project costs and benefit**

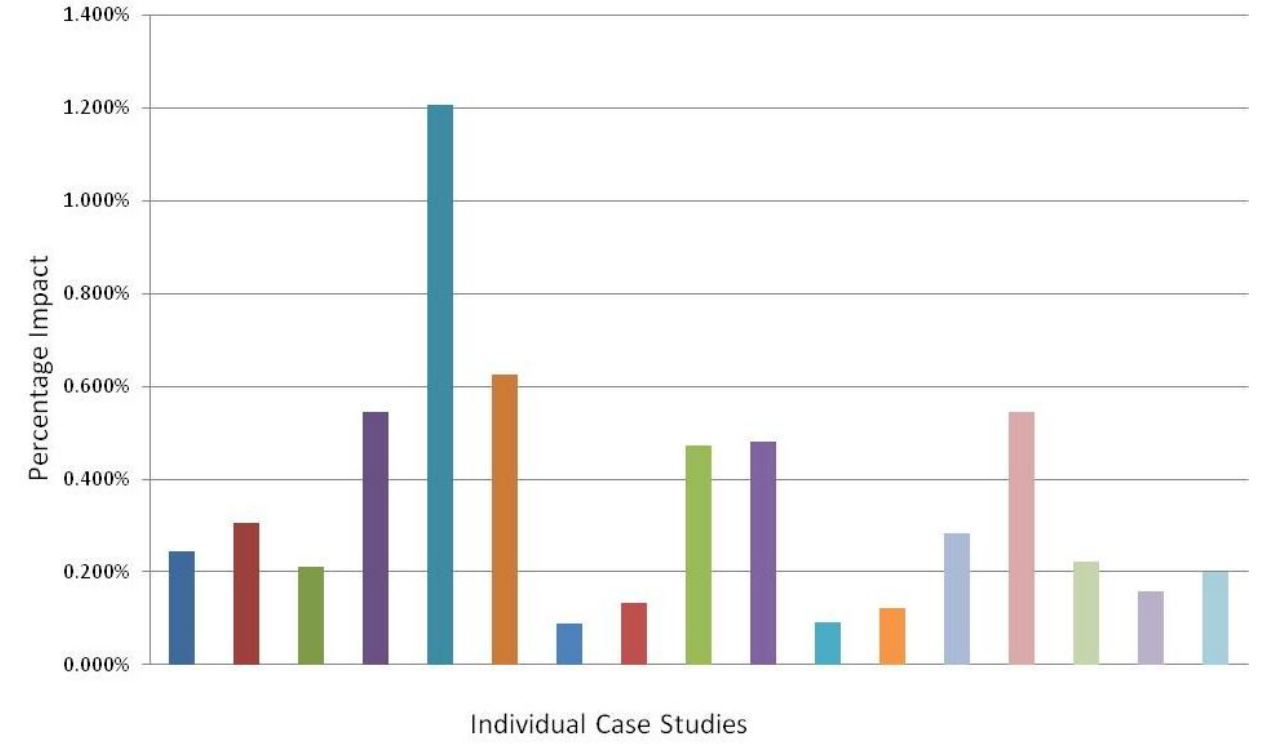


Data source: ConsultingWhere and ACIL Tasman

iv. To calculate the likely total net benefit to the organisation from the use of geospatial information, each organisation's total expenditure on geospatial projects was estimated. This assessment was based on information supplied by nominated officers or, where this was not available, by using average values for the appropriate type of organisation derived from the GI survey undertaken by LGA in 2009 (Local Government Association, 2009).

v. The attributable net benefit from each geospatial project was then compared to the total (i.e. overall) expenditure of the organisation, and the corresponding percentage was that organisation's productivity shock due to geospatial applications, see Figure 10.

Figure 10 **Distribution of productivity shocks from the case studies**



Data source: ACIL Tasman and ConsultingWhere

vi. The productivity shocks were averaged to produce our 'best' estimate of the productivity impact on local public services; the end result is a shock of approximately 0.35 per cent. This is based on an average project life cycle of 5 years.

vii. The in-built bias of the sample was considered. Taking into account our observation of the relative paucity of organisations where a rigorous approach has been taken and assessment of other comparable studies undertaken by ACIL Tasman, all case studies were assumed to be within the top one third of the likely total population. The shock of 0.35 per cent was therefore adjusted downward using a normal distribution approach to 0.233 per cent.

6.2.2 External benefits

External (knock on) benefits arise in other sectors of the economy as a result of improved and more efficient services provided by local public service providers.

Increased Labour Supply

Benefits identified as potentially available to all citizens, were identified as follows:

- Self Service Information - reduction in time spent finding information about the nearest council or health services by the use of web mapping can be linked to increased time available for leisure activities and greater productivity at work (e.g. customer interface improvements);
- Predictable service delivery - route optimisation software can be used to better predict the timing of delivery of services as diverse as special waste collection and home visits by social workers reducing waiting time for those receiving those services;
- Decreased time required for stakeholders in dealing with local public service bodies – reduced time spent by citizens during process interactions with local service providers, for example during planning consultations (e-planning) or property transactions (NLIS).

Other generic impacts are relevant to the business community. For instance, in Dudley MBC, environmental health, Non-Domestic Rates and Business Link registers were cleaned and matched to the Local Land and Property Gazetteer (LLPG) resulting in identification of several thousand new entries. The exercise allowed the authority to re-prioritise contact in relation to business rates and regulatory compliance, reducing enquiries to known businesses and focusing on those freshly identified.

The evidence of these benefits have been aggregated together to conservatively estimate a labour productivity shock of 1500 additional productive individuals within the economy. This is equivalent to each economically active person saving five minutes per year as a result of the efficiencies identified.

Sector Specific Shocks

The study also identifies benefits specific to particular sectors:

Construction – Although, the scope of the study precluded a detailed survey of the construction industry to verify the degree of the benefit derived by the industry, we have therefore built on our experience in previous studies in which we identified that construction was a major beneficiary of geospatial information, in particular with regard to large projects. Examples include time saved by the construction industry in planning and development approvals, better coordination with infrastructure services, such as transport, provided by local public service providers, less duplication of location based information and reduced transaction costs with local government.

For the current study we have developed a proxy of the productivity impact by assuming that the construction sector receives a proportion of its productivity improvement because of its dealings with, or benefits flowing from, the local public service providers who are using geospatial information. A range of earlier case studies in the construction area suggested that for specific, large scale projects the value of geospatial information could be particularly high (ACIL Tasman 2008). On aggregate, however, given that a majority of the activity in the construction sector under national accounts is provided by small tradesmen and firms, a productivity shock to the construction sector of around 0.75% was posited in our previous study (ACIL Tasman 2008).

It is unclear what proportion of this might have been attributable to local service provider-related geospatially enabled activity and, of course, the previous study referred to a different context. Unlike some of the construction activity surveyed in the previous ACIL Tasman reports, the construction industry activity in England and Wales is perhaps more focused on projects in highly developed or built up environments. On the one hand this may mean that planning applications, are more complex and the use of geospatial information could yield more efficiencies than in our previous studies. On the other hand, however, it can be argued that most individual construction projects will be of a smaller, discreet (i.e., not bundled) nature and serviced by smaller construction outfits in the UK than in our previous studies.

On balance, to err on the side of caution, we reduced our previous estimate to 0.6 per cent in aggregate for construction in the UK, and then to attribute only around one-tenth of the savings to dealing with local public service providers. This means that the productivity shock included in the modelling for this report was 0.06 per cent.

We estimated that under the business as usual case this shock might increase to around 0. 08 per cent by 2015 as greater awareness of geospatial systems leads to higher levels of adoption in the services that local public service providers deliver to the construction sector.

Under the ideal scenario we believe that improvements in interoperability and reduced restraints on the use of derived data could increase this shock to 0.10 per cent by 2015.

Business Services - conveyancing firms, which fall under the business services sector of the economy, are benefiting from use of the National Land Information System (NLIS) which enables them to enter online the geospatial information necessary to perform the searches required as part of domestic and commercial property transactions. In section 4.5.1, we outlined the process by which the benefits to conveyancers have been measured. The estimate average saving of £50 per transaction applied to 25% of the mean number of total property transactions over the last 5 years (1.1m) processed through NLIS equates to savings in the region of £14m per annum. On this basis, a shock of 0.0026 per cent has been applied to the sector in the GCE modelling.

Land Transport – the sector is wide and has many interactions with local public service providers, both as consumers and as suppliers of services through outsourcing. Within the constraints of the study, the only area where we were able to estimate impacts was the streetworks coordination case study (ELGIN). Here we were able to derive a rough estimate of savings of fuel costs alone of £9m per annum. This is represented in the CGE model input as a shock of 0.009%.

Utilities – we are convinced that better coordination of streetworks has a specific impact upon the sector since there are significant costs involved in arranging each public highway closure. This was confirmed by discussions undertaken on our behalf by Jacobs, the operators of the ELGIN study.

However, since we were not able to corroborate this assertion, we have not included any shock to the electricity, gas and water sector of which they form the major part.

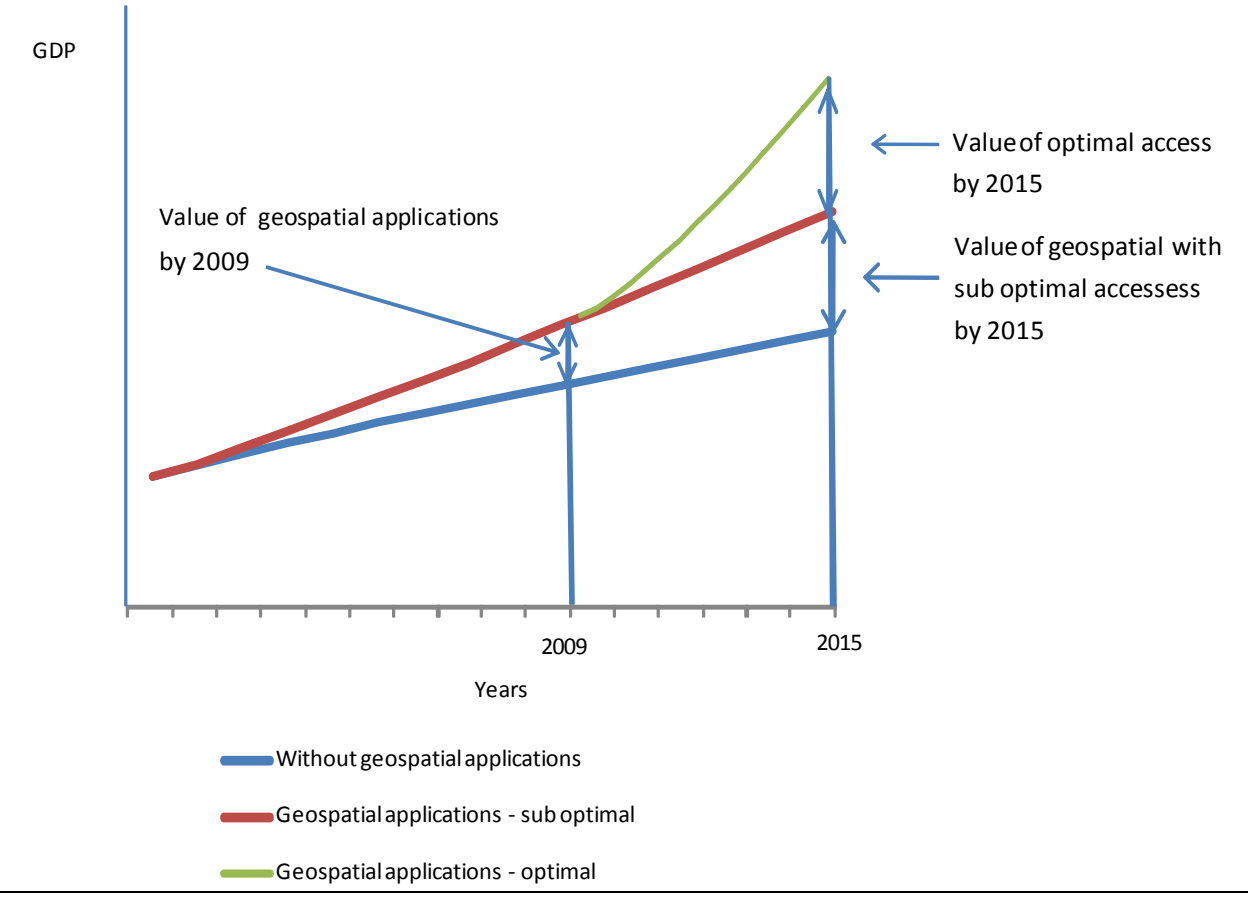
In our judgement all of the external shocks applied are of an extremely conservative nature on account of the limited evidence on which they are based. Other comparable studies of the impact of geospatial information at a national level have been more "bullish" in their estimates, however, in taking the view we have, we believe our approach is evidential and defensible.

6.3 Tasman Global modelling

6.3.1 Scenario description

In CGE analysis the outcomes of the policy simulation modelled are reported as deviations from the business as usual reference case. To eliminate the impact of price movements in the results, economic variables such as the change in Gross Domestic Product are reported as deviations from their real rather than nominal values (see Figure 11).

Figure 11 **Economic indicators with and without geospatial information**



Data source: ACIL Tasman

For this study, the business as usual reference case is the situation where the England and Wales economy grew as per historical records (the base case). This reference case is then compared to the alternative policy scenarios:

1. Without geospatial information scenario. In this scenario, the quantifiable productivity benefits identified from the case studies have been removed.
2. Business as usual adoption (base case) which represents the current situation in England and Wales. The difference between this and scenario 1 represents the accumulated impact of geospatial information in 2009 and also in 2015.
3. Ideal adoption scenario in 2015, in which the potential unrealised productivity benefits identified from the case studies have been added. The difference between this scenario and the base case with geospatial information scenario provides an estimate of the potential economic benefits that could arise by 2015 if the uptake of current geospatial information technologies is fully adopted across the identified opportunities.

The assumptions made for each scenario are summarised in Table 6.

The current period relates to the financial baseline of the study, financial year 2008-9, referred to for brevity as 2009. The future scenario relates to end of financial year 2014-5, referred to as 2015.

Table 6 **Shock Scenario Assumptions**

Scenario	Assumptions
2009	The productivity shocks are the accumulated impact on productivity of geospatial systems since GIS was first introduced into local government around 1990. The four waves of innovation are described in Section 3.1
2015 business as usual (BAU)	Under this scenario it is assumed that the current policies with respect to access to data and pricing of public data continue as at 2009. The scenario also includes an assumption that the current level of awareness of the benefits of geospatial information systems by politicians, local government executives and wider public service delivery managers evolve at the current rate. The geospatial adoption curves discuss in section 3.1.8 indicate we can expect the web wave to have reached completion and enterprise implementation to have reached approximately 50% implementation.
2015 ideal scenario	Under this scenario it is assumed that a significant shift in the institutional, access and pricing arrangements is achieved. This delivers efficiency gains and cost savings through improved sharing and reuse of geospatial information in local public service delivery, and therefore from better co-ordinated and more effective approach to the management, delivery, licensing and use of geospatial data and services. It also assumes that opportunities for use of innovative technology and programmes designed to raise awareness are implemented. An increased adoption rate, above the BAU case of 25% is assessed as realistic, based on previous observed "surges" in adoption as a result of removal of previous barriers. For example, from the introduction of the shared procurement of Ordnance Survey mapping under the Mapping Service Agreement.

6.3.2 Approach to estimating shocks

In our sample of seventeen projects, shown in Figure 10, the five smallest projects led to savings equivalent to less than 0.2 per cent of their Councils' expenditures, eleven projects were associated with net savings of 0.2-0.6 per cent of spend, and one project had higher impacts of around 1.2 per cent of expenditure. The last of these is unusual because the overall budget of the Council was relatively small –so the savings from the project, which were impressive, had a larger percentage

impact. This is broadly reflective of other studies undertaken using the same methodology in Australia and New Zealand (ACIL Tasman 2008, 2009).

Actual expenditure data, including data specific to the projects and each Council's estimated expenditure on geospatial projects, is not presented here for confidentiality reasons.

6.3.3 Productivity shocks for scenarios

The internal and external benefits discussed in Section 6.2 are summarised in Table 7.

Due to the complexity of estimating the productivity improvements by specific input, the productivity improvements have been implemented as total factor productivity improvements. In reality, many applications of the geospatial information technologies will have had a differential impact on the demand for labour versus the demand for capital as well as affecting the demand for a range of other inputs such as construction, business services and transport.

Table 7 **Shocks and scenarios**

Sector #	Sector Name	2009 shock	Notes	2015 shock BAU	2015 shock Optimal
1	**Local government**	**0.233%**	Based on case studies	**0.311%**	**0.331%**
2	**Primary care trusts**	**0.000%**	BAU conservative assessment of future potential at 25% of current shock in local government by 2015, based on staffing level and application range comparison.	**0.023%**	**0.029%**
11	**Construction**	**0.060%**	Based on evidence from comparative studies and apportioning the shock according to the proportion that local government makes up of the national economy.	**0.080%**	**0.085%**
14	Land Transport	**0.009%**	Based on reduction in road closure due to street works	**0.012%**	**0.013%**
18	Business services	**0.0026%**	Based on efficiency savings for solicitors resulting from NLIS.	**0.0035%**	**0.0037%**
PLUS Labour supply shock	*Extra FTEs made available*	**1500**	Accumulation of estimated efficiencies from improved citizen and business interaction with local service providers.	**2000**	**2124**

Data source: ACIL Tasman analysis

To isolate the economic impacts of productivity improvements associated with local public services uptake of geospatial information technologies within the England and Wales economy, all other settings in *Tasman Global* have been held constant across the scenarios (including population, labour supply, unemployment rates, tax rates, natural resource supplies and all other productivity improvements). In reality, some of these variables would also have been affected – for example, changes to real wages are likely to have changed participation or unemployment rates and even net migration rates.

Productivity shocks were estimated for two sectors of public service delivery for the English and Welsh economies – local government and the PCTs. In addition, knock-on shocks for the sectors were estimated on the basis of the case studies discussed above. Finally, a general shock to labour productivity was applied across the economy.

6.3.4 Model Outputs

Table 8 shows the changes in a range of macroeconomic variables, while Table 9 presents a detailed breakdown of the estimated changes in real GDP and real GNP.

Table 8 **Macroeconomic impacts of adoption of geospatial information technologies**

	Units	Quantifiable historical productivity scenario	Business As Usual (BAU) adoption scenario	Ideal adoption scenario
		2009	2015	2015
Real GDP	%	0.023	0.035	0.038
	2009 £m	322.6	560.7	598.8
Real GNP	%	0.023	0.035	0.037
	2009 £m	316.6	552.2	589.8
Real private consumption	2009 £m	61.4	133.8	142.5
Real investment	2009 £m	55.4	98.5	105.2

Data source: Tasman Global modelling estimates

Table 9 **Decomposition of changes in real GDP and real GNP (2009 £)**

	Quantifiable historical productivity scenario	BAU adoption scenario	Ideal adoption scenario
	2009	2015	2015
	2009 £m	2009 £m	2009 £m
Change in value added	24.35	15.64	16.68
Change in tariff revenues	0.50	0.97	1.06
Other tax revenue changes	44.23	88.65	94.60
Productivity effects	253.52	455.43	486.45
Total change in real GDP (income side)	**322.60**	**560.70**	**598.80**
Change in terms of trade	-4.92	-6.30	-6.64
Change in net foreign income transfers	-1.08	-2.19	-2.36
Total change in real GNP	**316.61**	**552.21**	**589.80**

Data source: Tasman Global modelling estimates

Table 10 shows the projected change in real output for Local Government, the PCTs and the Construction, land transport and business services sectors.

Table 10 **Projected change in real output for selected sectors**

	Quantifiable historical productivity scenario	Business as usual adoption scenario	Ideal adoption scenario
	2009	2015	2015
	2009 £m	2009 £m	2009 £m
Crops	0.5	0.9	0.9
Livestock	0.8	1.3	1.4
Fishing and forestry	0.1	0.2	0.2
Processed food	12.9	23.0	24.6
Coal	0.0	0.1	0.1
Oil	-0.1	0.1	0.1
Gas	0.2	0.7	0.7
Electricity	3.3	5.8	6.2
Petroleum & coal products	1.9	3.3	3.5
Iron & steel	2.8	4.0	4.2
Other mining	0.5	0.9	0.9
Nonferrous metals	1.7	2.4	2.6
Non-metallic minerals	4.3	6.7	7.2
Chemicals, rubber, plastics	20.7	31.3	33.4
Manufacturing	79.6	127.8	136.2
Water	0.7	1.3	1.4
Construction	33.7	54.2	57.8
Trade services	47.8	76.6	81.7
Other transport	17.9	27.5	29.3
Water transport	0.9	1.5	1.6
Air transport	1.9	3.6	3.8
Communication	10.9	17.2	18.3
Business services	92.5	151.2	161.4
Recreational and other services	10.0	17.4	18.5
Government services	30.7	50.4	53.8
Dwellings	0.2	0.4	0.4
Local Government	221.7	342.2	363.7
Primary care trusts	9.5	30.4	34.9
Other NHS	1.9	3.4	3.6

Note: Some sectors input to other sectors, so it is not valid to sum productivity values

Data source: Tasman Global modelling estimates

6.3.5 Quantifiable historical impacts of geospatial information

Real GDP

The use of geospatial information has resulted in significant productivity improvements in the adopting sectors of the England and Wales economy. These productivity improvements have resulted in improved use of scarce labour and capital and allowed the economy to increase overall output compared to what would have otherwise been possible. Based on our conservative estimates of the productivity improvements, *Tasman Global* modelling estimates that, in 2009, the real GDP of England and Wales was increased by 0.02 per cent, or £323 million (in 2009 £), as a direct result of the uptake of geospatial information technologies by local public service providers (Table 8 and Table 9).

Changes in real GDP can be analysed in more depth by decomposing the changes in value added, tax revenues and productivity effects (i.e. changes in income side of GDP). As shown in Table 9, around 79 per cent of the increase in real GDP was directly associated with the estimated productivity improvements and 14 per cent was associated with increased net tax revenues due to increased economic activity. The remaining 7 per cent of the increase in real GDP was due to increased real returns from factors of production which resulted from higher accumulated capital stocks and allocative efficiency benefits associated with the reallocation of factors around the economy. Note that the supply of land, labour and natural resources was assumed to be the same across all scenarios.

Real GNP and terms of trade

Although changes in real GDP is a useful measure for estimating how much the output of the England and Wales economy has changed, changes in the welfare of English and Welsh citizens are of equal importance. In *Tasman Global* changes in real welfare are measured by real GNP[47] which is synonymous with real gross national disposable income (RGNDI).

GNP is equivalent to GDP plus net foreign income transfers, and changes in real GNP is equivalent to changes in real GDP, plus changes in net foreign income, plus changes in terms of trade (which measures changes in the purchasing power of a regions exports). The productivity improvements associated with the adoption of geospatial information has clearly reduced production costs and boosted total production.

Real GNP in 2009 is estimated to have increased by 0.02 per cent, or £317 million, as a direct result of the quantifiable productivity improvements generated from the use of geospatial information technologies by local public service providers (see Table 8 and Table 9).

[47] More specifically, in *Tasman Global*, changes in real GNP are equivalent to changes in equivalent variation (using the Slutsky measure of income effects). See Pant (2007) for more details.

Other macroeconomic variables

Household consumption and investment are estimated to have increased by £61 million and £55 million, respectively as a result of the productivity increases associated with the historical adoption of geospatial information (Table 8).

Change in real output for selected sectors

The sectors where historical productivity shocks were applied increased their real output by a total of £375 million, comprising £232 million for local public sector services and the remainder (£143 million) in construction, land transport and business services (Table 10). The business services sector is one of the largest in overall size, so as well benefiting directly from improved productivity on conveyancing and legal services, it also benefits from lower costs resulting from a more efficient local public services and from higher economic activity generally. These factors account for the relatively large increase in productivity in this sector.

It should also be noted that Table 10 shows the increase in output in each sector. This is not the increase in "value added" as reported in the overall GDP increase because some of the outputs are inputs to other sectors.

6.3.6 2015 with and without barriers

The productivity gains associated with the historical uptake of geospatial information technologies by local public service providers are projected to continue to accrue over the next few years. Under our 'business-as-usual adoption' scenario, the overall economic impact on real GDP in 2015 is projected to be £561 million. Under the 'ideal adoption' scenario, it is estimated that real GDP in 2015 would be £599 million higher compared to the 'without geospatial information' scenario.

This means that the impact of removing the barriers would result in an increase in GDP of approximately £38 million.

In welfare terms (i.e. real GNP), the estimated productivity improvements associated with the 'business-as-usual adoption' scenario are projected to increase the real income of the residents of England and Wales by £552 million by 2015. Under the 'ideal adoption' scenario, real income in 2015 is projected to be £590 million higher as a result of the adoption of geospatial information technologies.

Real income of residents would therefore also be approximately £38 million higher if the barriers were removed.

6.3.7 Returns to government

The accumulated impact of geospatial applications in local public service delivery is estimated to have resulted in current revenue from tax being around £44 million higher than it would otherwise have been under the business as usual case, with revenues projected to be £89 million higher by 2015 (Table 9).

When discussing the impacts on the government sector, it is important to note that in addition to the increase in real revenues, the real cost of delivering government services has also decreased as a result of the application of geospatial information. In effect, the amount of goods and services that the government has been able to deliver is actually much higher than is implied by the change in revenues. For example, as presented in Section 6.3.5, the real output of the local public service delivery has increased by £232 million principally as a result of the productivity benefits associated with the accumulated impact of geospatial information.

With the barriers removed under the ideal policy scenario, taxation revenue is projected to be more than £94 million higher in 2015 than it would otherwise have been.

6.3.8 Environmental impact on emissions

Table 11 shows that the emissions intensity of the economies of England and Wales taken together was 453 tonnes per/£million or 0.013 per cent lower than it would have otherwise been. This is due to a reduction in the volume of fuel consumed.

Table 11 **Change in emissions of CO_2**

	Quantifiable historical productivity scenario	Business as usual adoption scenario	Ideal adoption scenario
	2009	2015	2015
Emissions intensity for England and Wales with geospatial information (tonnes/£million)	453.27	387.53	387.52
Emissions intensity for England and Wales – counterfactual	453.33	387.61	387.61
Change in emissions for England and Wales (%)	-0.013	-0.020	-0.021
Emissions intensity local public service providers with geospatial information (tonnes/£million)	18.01	17.84	17.84
Emissions intensity for local public service providers – counterfactual	18.02	17.85	17.85
Change in emissions from local public service providers (%)	-0.062	-0.086	-0.092

Note: Emissions intensity of England and Wales is declining as a result of economy wide emission reduction programmes.

Emission intensity of local government increases between 2009 and 2015 for each scenario as a result of assumptions in the GTAP data base about the composition of local government economic activity. However the with geospatial scenario results in lower emissions intensity compared with the counterfactual.

Data source: Tasman Global

By 2015 the emissions intensity of the overall economy is projected to fall to 388 tonnes per/£million which would be 0.020 per cent lower than without geospatial information. Under the ideal policy scenario, emissions intensity is forecast to be 388 tonnes per/£million or 0.021 per cent lower than it would otherwise have been. Given that the productivity improvements that we have identified from the case studies have been characterised as factor productivity improvements, this is likely to be a very conservative estimate.

Similarly the emissions intensity for local public service providers specifically, is projected to be 0.086 per cent lower in 2015 for the reference case and 0.092 per cent lower with the ideal case.

6.3.9 Non quantifiable impacts

The CGE modelling captures only the benefits attributable to accumulated productivity improvements from the use of geospatial information. In addition to this the case studies identified a large number of non-market benefits that would also accrue to society and England and Wales.

Environmental benefits were identified through better planning and management of infrastructure, better understanding of environmental dynamics and interactions between the built and natural environments, improved environmental management that follows in part from better capture, recording and access to data in geospatial information.

There were also non-productivity benefits arising in better general health and well-being of those in the community who depend on local public services. This results in minimising the impacts of time off work from illness and pandemics, improved health outcomes from more efficient front line health and social services and lower incidence of crime from better management of policing and preventative measures. Reduced suffering for patients and families is also an important benefit that was seen in some of the case studies.

Slightly lower emissions intensity and other environmental benefits accruing from reduced need to travel by vehicles operated by local public service providers or more efficient deployment of local public services, will also deliver better quality of live outcomes, lower environmental damage costs for a given level of regional and national economic activity and ultimately contribute to meeting international obligations to reduce emissions both in aggregate and in emission intensity terms.

Users of local public services also benefit from increased time for work, family or leisure activities. Increases in labour productivity have been accounted for in the economic modelling. However the modelling did not take into account the value to families and the community in general from more family time through the time saved as a result of better information on location of services, development approvals and general business transactions with local public service providers.

Finally, greater opportunity for participatory democracy or local governance by facilitating better and faster communications with stakeholders, ratepayers and citizens flows from more efficient

information on which planning decisions, development approvals and location information delivers intangible but nevertheless important benefits.

Overall these non-quantifiable benefits could be as large again as the productivity benefits identified above.

6.4 Benefits of Data Sharing using the National Land and Property Gazetteer (NLPG)

Progress with roll-out of the NLPG, since its inception in 1999, has been well documented[48]. This enabled the study team to analyse the cost and benefits of completing the sharing of this key geospatial database across relevant property-related local public services in some detail.

In view of the NLPG's importance to the local public services community, this section has been created to illustrate the potential value still to be realised from improved data sharing. It also helps to explain the cost-benefit methodology used throughout the study, which is summarised here and detailed in Annex B .

The financial information presented here is not additional to the shocks applied to CGE model, but simply analysed in more detail and from a different perspective.

Nine key services were considered as opportunities for shared addressing using the NLPG:

- Street naming and numbering.
- Planning.
- Building control.
- Council tax.
- Non-domestic rates (NNDR).
- Environmental control.
- Local Land charges.
- Electoral services.
- Property management.

The total number of services already participating in sharing the NLPG, and by inference those not, was estimated based on responses from the 201 authorities who responded to the LGA's GI Survey in 2009 (Local Government Association, 2009). This was considered a large enough sample to be representative of the overall situation across the community.

[48] http://www.nlpg.org.uk

Using the Rogers adoption curve and given the historical rate of adoption, the team assessed that it would be reasonable to expect in the optimal (ideal) scenario to reach a 95% implementation of the total potential NLPG sharing over the period from financial year 2008-9 to 2014-5.

The costs of establishing and running a fully rolled-out NLPG are derived from the Centre for Economic and Business Research report *It makes life easier: A study to evaluate the benefit of local and national land and property gazetteers* (CEBR, 2006). This report estimated the capital costs of rolling out the NLPG at £12.1 million and the recurrent annual costs of running a fully rolled-out NLPG at £15.2 million. These figures have been indexed to 2008-9 for the purposes of the study.

An additional cost has been added for data matching, based on actual charges made by Intelligent Addressing under their Mapping Service Agreement with local government, uplifted to take into account preparation work by the local authority and apportioned systems connection costs. The on-going staff effort in data cleansing is assumed to be covered within the recurrent running costs.

Investments in setup, made prior to 2004-5 are disregarded, since they will have been amortised under normal accountancy practice prior to the period under consideration.

The benefits are assessed from the sample set of case studies presented in section 4.8. These are applied according to the appropriate authority type to the numbers of services that remain to be linked to the NLPG.

From this information we were able to estimate an accumulated Net Present Value (NPV), after discounting at 4%[49], of £24.4 million. However, given the small sample of available case studies where benefits had been robustly evaluated and the lack of certainty of the implementation rate, a sensitivity of -20% has been applied to the benefits. This leads us to conservatively assess the range for the likely accumulated NPV of £15 million - £24 million over the period 2010 to 2015.

It should also be stressed that the accumulated net present value figure represents the added value of sharing the NLPG; it does not take into account how the geospatial information is then used within applications developed within the services sharing the information.

[49] Based on Treasury green book guidance

7 Summary of findings

7.1 Levels of adoption

This study found that geospatial applications have been implemented in local government in England and Wales in four waves of innovation commencing around 1990. The first wave, which began with the introduction of basic GIS on desktops, was followed by a second wave with the gradual linking of data bases providing local public service providers with wider access to internal data. A third wave commenced in 2000 with the introduction of web mapping, where most staff gained access to electronically stored maps accessible over an intranet and/or the internet. This wave is still working its way through local government organisations in England and Wales. A fourth wave, involving the integration of these technologies into mainstream enterprise systems and the interoperability of data across organisations is just getting underway. The value of geospatial information will only be fully realised once this wave has been completed. Furthermore, we can expect the benefits to accrue from enterprise deployment at a faster rate than has been observed to this point.

7.2 Productivity improvement

As a result of implementing these innovations in local public service organisations, significant productivity improvements are being realised – and the pace is increasing with each wave of implementation. The productivity improvements apply both internally, within the organisations in greater delivery efficiency of local public service delivery, and externally, as the users of those services, such as the construction sector as well as the general public, also benefit from the greater efficiency of these services.

The case studies reveal strong business cases in many application areas, including:

- Channel shift – through deployment of transactional web mapping systems.
- Improved transport efficiency – by wide application of route optimisation and better streetworks management.
- Better decision making – using geospatially-enabled local information systems.
- Reduced data duplication – using master datasets such as the NLPG.
- Empowering frontline workers – by speeding up analysis and enhancing mobile working.
- Helping identify social deprivation – through data integration and analysis.

Our research found that the average cost to benefit cost ratio of around 1:2.5, based on an average project life cycle of 5 years. The raw analysis suggests a figure closer 1:3.75 but we have reduced our assessment on the basis that our sample has a bias towards better managed projects. A detailed analysis of the value of NLPG data sharing shows internal net benefits over a 5 year period in the range £15 million - £24million.

We estimated that these applications have led to a 0.233 per cent increase in productivity in 2009 for local public service providers in the services covered by the case studies. We did not include any productivity improvement for the PCTs in 2009.

We also estimated that the improved services led to a 0.06 per cent improvement in the productivity of the construction sector and smaller impacts on land transport and business services sectors. A general increase in labour productivity equivalent to an increase of 1,500 full time equivalent staff across the economies of England and Wales as a result of the accumulated effects of improve citizen and business contact with local service providers.

The case studies also provided insights into the further increases in productivity that could arise by 2015. Drawing on the adoption curves, it was estimated that by 2015, further innovation could lead to a 33 per cent increase in these productivity estimates for local public service delivery for the reference case and an additional 25 per cent increase in take up for the ideal policy case.

7.3 Impact of productivity on the economies of England and Wales

These shocks when applied in the CGE model resulted in the following outcomes for the year 2009:

- GDP for England and Wales was £323 million higher than it would otherwise have been without the adoption of geospatial information applications
  - around 0.02 percent of GDP
- The delivery of goods and services by local public sector providers was £232 million higher than it would otherwise have been.
- Government revenue from taxation was £44 million higher than it would otherwise have been.

Projecting forward to 2015, the CGE modelling found:

- GDP for England and Wales would be £561 million higher than it would otherwise have been without the adoption of geospatial information applications.
  - The delivery of goods and services by local public sector providers would be £372 million higher than it would otherwise have been.
  - Taxation revenue would be £89 million higher than it would otherwise have been.

- With the ideal policy scenario GDP would be £599 million higher than it would otherwise have been without the adoption of geospatial applications.
  - The delivery of goods and services by local public service providers would be £399 million higher than it would otherwise have been.
  - Taxation revenue would be around £95 million higher than otherwise.

Better policies and action to deliver the ideal scenario, therefore would result in around £38 million in additional GDP for England and Wales.

  - And there would be further taxation revenue of around £6 million.

7.4 Impact on emissions of greenhouse gases

The modelling also showed that the introduction of geospatial systems in local public service delivery resulted in the emissions intensity of the economies of England and Wales being around 0.013 per cent less in 2009 than it would have otherwise have been. This is mainly attributable to fewer vehicle journeys.

Under a business as usual i.e. no change in policy scenario, the modelling projected that emissions intensity of these economies would be 0.020 per cent lower in 2015 than it would have otherwise have been. This percentage increases to 0.021 per cent with ideal policies. Due to the high-level characterisation of the impacts of the geospatial systems, these are considered to be very conservative estimates.

However, while these changes are relatively small, they are nevertheless important in contributing to a lower emissions trajectory to which the national government is committed, both in policy undertakings and through international obligations.

7.5 Other benefits

This study did not quantify a wide range of non-productivity related benefits that were identified in the course of undertaking the case studies. These include: environmental benefits arising as a result of better planning and management of infrastructure; more sustainable environmental management through better and more accessible data; improved health and wellbeing of citizens dependent on local public services; and small improvements in time available for citizens for leisure and family activities.

Finally, improved geospatial information enables greater involvement in local decision making and, consequently, more opportunity for participatory democracy at the local level.

8 Conclusions

Implementation of Geospatial Information has proven benefits to local public service providers, through its ability to save money and raises revenue; help join up, share and target services; help engage citizens and enable them do more for themselves.

The study has identified a number of specific applications where the business case is robust, intelligible and widely applicable. In challenging economic circumstances, it is both short sighted and wasteful not the take full advantage of this potential to make cashable savings.

With supportive government policies, awareness with decision makers and business case training for practitioners, there is also potential for these benefits to be significantly greater.

A Annexes

A.1 List of Contributors

Local Public Services	
Kris Warry	Swindon Borough Council
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Andrew Gill	Lancashire County Council
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James Harris	ELGIN
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Tony Marshall	Idox

A.2 Geospatial Application Classification

Strategy formulation	Business Intelligence
	Decision Support
	Performance Management
	Scenario Modelling ("what-if")
	Social Inclusion
	Pattern Analysis
Information Management	
	Records capture and management
	Procurement
Customer Relationship Management	
	Local Democracy
	Consumer Interaction
	Fault Reporting
	Public records access
	Customer profiling
Planning and Design	
	Site Assessment and Selection
	Urban and Rural Design
	Contingency planning
	Consultation
	Impact Analysis
Operations	
	Data capture and update
	Asset Management
	Facilities Management
	Works Order Management
	Emergency response
	Command and Control
	Asset Tracking
	Field force management
	Monitoring and Assessment
	Route Optimisation
	Vehicle Navigation
Support	
	Automated map production
	Insurance
	Tax Assessment and Collection

A.3 Background to economic modelling

This appendix provides more detailed discussion of the use of *Tasman Global* Computable General Equilibrium model in the study.

A.3.1 Sectoral breakdown

An important part of the Computable General Equilibrium modelling is the assignment of shocks to different sectors. These shocks then form the basis of a rebalancing of the overall economy and a new equilibrium level for items such as GDP, consumption and employment.

There are currently 60 sectors in the *Tasman Global* data base. For the purpose of this study these sectors were aggregated into 29 sectors as shown in Table A1. This aggregation was done in line with the nature of the shocks and the economic structure of England and Wales. A comparison of the sectors to the UK Standard Industrial Classification for Economic Activities (UK SIC) is also shown in Table A1. It should be noted that because of differences in classification between the UK SIC and *Tasman Global* databases an exact mapping was not possible. For instance, gas production and distribution are classified separately in the UK SIC but combined in the *Tasman Global* model.

Table A1 **Aggregation of sectors for shocks**

Sectors for shock recording in *Tasman Global* CGE model	Comparison with UK Standard Industrial Classification (2007)
Crops	Agriculture, forestry and fishing (A)
Livestock	
Fishing and forestry	
Coal	Mining and quarrying (B)
Oil	
Gas (including distribution)	
Other mining	
Manufacturing	Manufacturing (C)
Processed Food	
Nonferrous metals	
Nonmetallic minerals	
Iron & steel	
Petroleum & coal products	
Chemicals, rubber, plastics	
Water	Electricity, gas, steam and air conditioning supply. (D) Water supply and sewerage. (part of E)
Electricity	
Construction	Construction (F)
Dwellings	

Sectors for shock recording in *Tasman Global* CGE model	Comparison with UK Standard Industrial Classification (2007)
Trade services	Wholesale and retail trade; repair of motor vehicles and motor cycles (G)
	Accommodation and food services activities (I)
Business services	Financial and insurance activities (K)
	Real estate activities. Professional, scientific and technical activities. Administrative and support services activities (L,M,N)
	Activities of households as employers, undifferentiated goods and services producing activities of households for own use (T)
Recreational and other services	Arts, entertainment and recreation. Other service activities (R,S)
Air transport	Transport and storage. Information and communication (H,J)
Water transport	
Other transport	
Communication	
Local government	Waste management and remediation services (part of E) Public administration and defence.; compulsory social security (O) Education (P) Human health and social work activities (Q)
Primary care trusts	
National health service	
Other government services	

A.3.2 Model results

Tasman Global solves equations covering industry sales and consumption, private consumption, government consumption, investment and trade. The model therefore produces detailed microeconomic results, such as:

- output by industry;
- employment by industry; and
- industry imports and exports.

Tasman Global also produces a full range of macroeconomic results including:

- total economic output;
- total employment;
- gross national product (GNP);
- gross domestic product (GDP);
- gross state product (GSP);
- private consumption;
- public consumption;
- investment;
- imports; and

- exports.

The model can also produce details of greenhouse gas emissions, measured in thousand tonnes of CO_2 equivalent per annum.

All of these results (and more) are produced on a year-by-year basis. Frequently a 20 year projection is produced; however, this can be altered to fit the needs of the particular economic impact assessment being undertaken.

A.3.3 The Tasman Global Model

ACIL Tasman's computable general equilibrium model *Tasman Global* is a powerful tool for undertaking economic impact analysis at the regional, state, national and global level.

There are various types of economic models and modelling techniques. Many of these are based on partial equilibrium analysis that usually considers a single market. However, in economic analysis, linkages between markets and how these linkages develop and change over time can be critical. *Tasman Global* has been developed to meet this need.

Tasman Global is an analytical tool that can capture these linkages on a regional, state, national and global scale. *Tasman Global* is a large-scale computable general equilibrium model which is designed to account for all sectors within an economy and all economies across the world. ACIL Tasman uses this modelling platform to undertake industry, project, scenario and policy analyses. The model is able to analyse issues at the industry, global, national and regional levels and to determine the impacts of various economic changes on production, consumption and trade at the macroeconomic and industry levels.

A Dynamic model

Tasman Global is a model that estimates relationships between variables at different points in time. This is in contrast to comparative static models, which compare two equilibriums (one before a policy change and one following). A dynamic model such as *Tasman Global* is beneficial when analysing issues where both the timing of and the adjustment path that economies follow are relevant in the analysis.

In applications of the *Tasman Global* model, a reference case simulation forms a "business-as-usual" basis with which to compare the results of various simulations. The reference case provides projections of growth in the absence of the changes to be examined. The impact of the change to be examined is then simulated and the results interpreted as deviations from the reference case.

The database

A key advantage of *Tasman Global* is the level of detail in the database underpinning the model. The database is derived from the latest Global Trade Analysis Project (GTAP) database. This database is a fully documented, publicly available global data base which contains complete bilateral trade information, transport and protection linkages among regions for all GTAP commodities.

The GTAP model was constructed at the Centre for Global Trade Analysis at Purdue University in the United States. It is the most up-to-date, detailed database of its type in the world.

Nominally the *Tasman Global* database divides the world economy into 120 regions although in reality the regions are frequently disaggregated further.

Input – Output Tables

It is the input-output tables that underpin the database. The input-output tables account for the distribution of industry production to satisfy industry and final demands. Industry demands, so-called intermediate usage, are the demands from each industry for inputs. For example, electricity is an input into the production of communications. In other words, the communications industry uses electricity as an intermediate input. Final demands are those made by households, governments, investors and foreigners (export demand). These final demands, as the name suggests, represent the demand for finished goods and services. To continue the example, electricity is used by households – their consumption of electricity is a final demand. For an illustration of the input output table see Figure A1.

Figure A1 **Example of an input output table**

		CONSUMERS																
		1 crops	2 lstk	3 fishnchl	4 food	5 col	6 oil	7 gas	8 ely	9 p_c	10 i_s	11 omn	12 nfm	13 nmm		30 gov	31 Export	Final demar
	1 Land	452.91	547.73	0	0	0	0	0	0	0	0	0	0	0		0	0	1,000.64
	2 Labour	2,199.84	2,660.42	240.52	17,555.04	117.56	579.59	1,353.10	4,843.14	592.20	2,487.47	825.59	1,212.01	4,176.89		0	0	689,199.90
	3 Capital	582.31	704.23	355.50	10,266.56	53.75	7,629.51	3,176.96	9,087.12	216.26	512.55	448.19	270.35	1,585.38		0	0	390,127.50
	4 Natural resource	0	0	403.88	0	190.66	3,984.75	603.73	0	0	0	367.33	0	0		0	0	5,550.36
	5 crops	790.76	283.93	0.41	2,174.38	0.01	6.99	6.90	4.81	0.24	0.19	1.00	0.13	3.52		203.68	834.36	18,559.67
	6 lstk	5.56	88.49	0.03	5,056.97	0.00	0.00	0.86	0.52	0.06	0.05	0.81	0.07	0.37		1.32	665.60	9,284.42
	7 fishnchl	0.73	0.06	335.19	882.02	0.57	0.09	0.26	0.41	0.00	0.02	0.35	0.07	2.47		7.54	519.44	3,354.40
	8 food	1.60	1,293.35	105.86	16,564.54	1.07	22.03	32.43	50.01	9.37	9.44	8.35	10.70	26.55		72.83	10,851.60	174,545.50
	9 col	0.05	0.05	0.21	7.63	0.38	0.00	0.05	1,732.56	249.52	4.31	0.03	8.66	16.61		0.00	7.33	2,130.16
	10 oil	0.00	0.00	0.00	0.06	0.00	0.42	2.24	0.75	13,893.11	0.00	0.00	0.00	0.01		0.00	7,037.47	20,935.01
	11 gas	9.14	3.44	3.99	189.85	0.97	246.93	544.18	2,355.95	460.39	65.88	0.83	23.08	89.81		0.02	888.98	9,299.33
	12 ely	95.91	104.71	84.35	921.39	76.70	19.36	51.58	1,204.92	406.30	543.85	47.69	632.06	610.28		0.08	88.25	26,896.8
	13 p_c	106.17	41.50	47.09	681.18	0.03	0.04	0.08	242.82	3,333.41	844.64	308.82	134.47	428.98		0.30	4,167.52	66,857.48
	14 i_s	6.41	6.93	1.03	29.55	3.32	12.20	6.74	9.61	3.51	3,162.62	7.90	138.97	115.74		2.86	4,839.42	21,169.77
	15 omn	1.49	1.67	0.31	24.99	0.70	0.16	0.79	0.11	25.14	529.82	697.49	557.16	1,318.18	Columns removed	2.17	4,721.21	13,714.19
	16 nfm	3.15	3.37	0.45	74.14	1.11	2.64	2.46	10.92	1.71	253.78	1.40	1,966.46	50.60		0.00	4,493.91	17,538.93
	17 nmm	34.64	35.05	0.52	607.28	1.70	9.03	3.79	18.41	0.05	92.48	124.79	29.45	1,507.02		6.66	2,058.45	23,487.30
COMMODITIES & FACTORS	18 crp	1,134.14	331.69	37.30	4,390.37	11.50	87.19	20.12	55.82	138.26	191.10	137.21	203.08	799.21		87.73	39,047.81	154,063.80
	19 manu	303.79	299.65	284.06	6,856.48	226.66	626.57	531.66	1,966.94	64.16	1,763.77	434.72	1,160.40	1,361.31		236.29	104,304.60	658,870.00
	20 wtr	45.92	45.18	2.46	168.12	0.83	3.64	6.52	35.27	2.82	18.62	4.81	5.35	25.33		38.52	54.23	5,326.33
	21 cns	62.79	60.58	89.80	223.76	12.91	261.45	220.62	425.16	32.30	56.16	26.42	25.83	51.05		36.15	517.79	170,082.40
	22 trd	3,679.55	1,034.17	622.48	48,670.25	206.11	67.40	47.70	184.62	661.24	3,502.12	1,494.25	2,444.71	4,545.49		542.04	4,243.25	369,181.70
	23 otp	53.24	57.37	55.87	2,882.90	24.79	122.45	68.31	153.51	31.42	323.11	563.70	153.83	1,086.10		169.69	3,187.20	113,615.00
	24 wtp	1.58	1.92	20.10	60.29	0.86	2.89	2.95	26.35	7.30	41.29	14.72	14.63	33.24		12.07	2,101.28	9,513.78
	25 atp	2.87	2.97	0.46	77.02	1.26	86.60	9.23	2.65	8.55	50.12	23.99	24.49	49.23		26.65	9,071.36	36,987.54
	26 omn	79.97	74.69	11.81	534.54	1.92	40.55	62.31	179.80	12.82	40.45	16.47	26.41	113.32		74.85	3,513.31	66,962.85
	27 obs	990.31	564.06	89.42	6,990.43	68.55	953.70	519.22	1,877.43	124.12	492.69	343.11	232.65	797.68		540.03	61,463.16	610,474.30
	28 ros	69.89	67.71	31.59	93.30	1.06	12.62	22.64	59.50	2.29	21.40	7.64	12.23	40.13		4,931.26	4,462.52	85,829.40
	29 osg	90.64	90.46	23.01	610.84	2.14	18.63	43.10	207.26	16.10	52.99	8.21	31.63	63.34		279,997.70	4,881.78	410,909.90
	30 dwe	0.07	0.01	0.00	0.47	0.00	0.03	0.01	0.14	0.01	0.16	0.00	0.13	0.12		0.34	0.00	1,713.24
	Total costs	10,805.46	8,405.40	2,847.71	126,594.30	1,007.11	14,797.45	7,340.56	24,736.46	20,292.66	15,061.07	5,915.82	9,319.02	18,897.95		286,990.70	278,021.80	4,187,182.00

Source: if ACIL Tasman data

The other key feature of the database is that the cost structure of each industry is also represented in detail. Each industry purchases intermediate inputs (from domestic and imported sources) primary factors (labour, capital, land and natural resources) as well as paying taxes or receiving subsidies.

Factors of production

Capital, land, labour and natural resources are the four primary factors of production. The capital stock in each region (country or group of countries) accumulates through investment (less depreciation) in each period. Land is used only in agriculture industries and is fixed in each region. *Tasman Global* explicitly models natural resource inputs as a sector specific factor of production in resource based sectors (coal mining, oil and gas extraction, other mining, forestry and fishing).

Population growth and labour supply

Population growth is an important determinant of economic growth through the supply of labour and the demand for final goods and services. Population growth for the 112 international regions represented in the *Tasman Global* database is projected using ACIL Tasman's demographic model. The demographic model projects how the population in each region grows and how age and gender composition changes over time and is an important tool for determining the changes in regional labour supply and total population over the projection period.

For each of the 120 regions in *Tasman Global*, the model projects the changes in age-specific birth, mortality and net migration rates by gender for 101 age cohorts (0-99 and 100+). The demographic model also projects changes in participation rates by gender by age for each region, and, when combined with the age and gender composition of the population, endogenously projects the future supply of labour in each region. Changes in life expectancy are a function of income per person as well as assumed technical progress on lowering mortality rates for a given income (for example, reducing malaria-related mortality through better medicines, education, governance etc). Participation rates are a function of life expectancy as well as expected changes in higher education rates, fertility rates and changes in the work force as a share of the total population.

Labour supply is derived from the combination of the projected regional population by age by gender and the projected regional participation rates by age by gender. Over the projection period labour supply in most developed economies is projected to grow slower than total population as a result of ageing population effects.

Greenhouse gas emissions

The model has a detailed greenhouse gas emissions accounting, trading and abatement framework that tracks the status of six anthropogenic greenhouse gases (namely, carbon dioxide, methane, nitrous oxide, HFCs, PFCs and SF_6). Almost all sources and sectors are represented; emissions from

agricultural residues and land-use change and forestry activities are not explicitly modelled but can be accounted for in policy analysis.

The greenhouse modelling framework not only allows accounting of changes in greenhouse gas emissions, but also allows various policy responses such as carbon taxes or emissions trading to be employed and assessed within a consistent framework. For example, the model can be used to measure the economic and emission impacts of a fixed emissions penalty in single or multiple regions whether trading is allowed or not. Or, it can used to model the emissions penalty required to achieve a desired cut in emissions based on various trading and taxation criteria.

A.1 Tendring District Council Value for Money (VFM) Analysis

A problem with many cost-benefit analyses conducted to make the business case for implementation is that the subsequent realisation of the benefits is not monitored and documented.

As part of the study, the team visited Tendring District Council where the Value for Money (VFM) assessment of their E-planning project has been rigorously executed. In this annex we summarise the VFM information from Tendring as a "template" example that others can potentially reuse.

The savings come from two types of sources, described as labour and non-labour savings.

The labour savings are derived from a reduced requirement for planning staff to be deployed to answer personal enquiries from members of the public coupled with reduced administration workload. The statistics of public visits to the planning office and staff time expended upon providing assistance were monitored over a two year period before and after implementation. A reduction in total front-office enquiries from 36,000 per annum to 18,000 per annum was observed after the introduction of the web-based search service. As significant, was the 90% reduction of planning officers' involvement in general enquiries which are now be answered by front office administrative staff. The savings are described in detail in Table 2 and amount to £85,464.

The non-labour savings are derived from reduced space requirements, elimination of redundant facilities (in this case a microfiche system) and lower postage and packing costs. These are shown in Table 3 as totalling £19,100.

A further working table (Table A4) is included, showing savings made by reduced administrative staff requirements but converted to a new GIS custodian post. These are valued at £36,700.

A breakdown of the capital costs of the project are calculated to be £426,000 amortised over 10 years. On-going (recurrent) costs are estimated at £49,000 on licences and staff support. These figures are brought together with the savings identified and summarised in Table 5, showing an overall saving of £49,664.

Table A2 **Summary sheet**

VFM EFFICIENCY GAIN SUMMARY PAPER

Financial Year: 2009/10

Service: Planning

Value of Cashable Gain Achieved: £49,664.00 *(this is the total efficiency achieved less the cost of any associated investment / on-going costs if applicable)*

Brief Descripton of VFM Gain

This is a summary of savings net of investment that enables efficiencies to be realised.

Calculations

Total Cashable Efficiency: £141,264.00 *(before netting off any investment / on-going expenditure if applicable)*

Workings: Total efficiencies taken from individual working sheets (see following pages)

Was investment required to bring about / support the achievement of the efficiency? Yes ~~No~~

If Yes please provide cost of investment and expected life of the asset / equipment etc that was purchased / acquired

Cost: £426,000.00

Workings / Comments:

Hardware Servers Scanners SAN Storage PC Terminals etc.		£92,000.00
Software Public Access Web EDMS GIS etc.		£90,000.00
Back scanning of planning records		£168,000.00
Contract implementation	£61k	£61,000.00
Training		£15,000.00

Expected Useful Life of Investment: 10 years

Workings / Comments:

Amount to reduce efficiency by to take account of investment decision = £42,600.00 *(Cost divided by expected useful life)*

Are there any on-going costs that are being incurred that support the achievement of the efficiency? Yes ~~No~~

If Yes how much? £49,000.00 per annum which will need to be deducted from the efficiency achieved

Brief Description of the on-going expenditure being incurred:

Additional IT licence costs

Quality / Level of Service Provided

Was there any effect on the quality or level of service associated with this efficiency? ~~Yes~~ No

If No, is there any documents etc that can evidence this e.g. performance indicators?

National performance indicators plus reception enquiry log.

If Yes, please provide brief details:

Any further information / supporting documents

Table A3 **Labour cost savings**

TENDRING DC: VFM EFFICIENCY GAIN WORKING PAPER 1

Savings: Senior Planning Officer

Brief Descripton of VFM Gain

Following process changes, back office staff undertake validation work over and above general registration etc. that was previously undertaken by Senior Planning Officers. Senior planning officer time saving benefit equivalent estimated at 75% FTE of Senior Planner Grade 10. Senior planning officers time now greater spent on planning application and knock on benefits to public.

Calculations

Total Cashable Efficiency: £33,154.00 *(before netting off any investment / on-going expenditure if applicable)*

Workings: Time saved equivalent to 75% Senior Planning Officer (approx 10-12 officers time saved) plus on costs

Savings: Redeployment Back Office Administration

Brief Descripton of VFM Gain

Reprioritisation of resources - As a result of efficiencies resulting from e-planning, the redeployment 2x DC Admin posts to DC to provide admin support for processes administered by DC Officers undertaken and additionally to provide admin support for the Policy and Conservation Manager (none provided hitherto). Admin support work relating to Discharge of Conditions, Planning Appeals, Householder Enquiries and Pre-Application Enquiries has played a major part in the Service's improvement programme resulting in significantly increased customer satisfaction and has also resulted in time savings for DC Officers. This is estimated as being 10% FTE of a career planning officer Grade 5-9 based on mid point salary. The financial benefit also provides for an estimated 80% FTE Admin Officer Grade 1C-3 that would otherwise have to be found from staff recruitment should this have been necessary. calculation is £3,024 DC Officer time saving + £14,680 Admin Officer.

Calculations

Total Cashable Efficiency: £17,890.00 *(before netting off any investment / on-going expenditure if applicable)*

Workings: 10% Planning Officer + 80% Admin Officer plus on-costs

Savings: Front Office DC Officer

Brief Descripton of VFM Gain

Front Office staff saving DC Officers time as described above. The time saved from self service has enabled front office staff (together with improved training and experience) to absorb and deal with a significantly greater proportion of calls relating to planning applications, thereby reducing the amount of time spent by DC Officers having to visit reception to deal with general enquiries. It is estimated that front office staff now sheild DC Officers from approximately 90% of general enquiries. In addition the time saving has enabled front office staff to take on additional work arising out of the changed regulations for Land Charge Searches. This calculation is based on the estimation of an average saving of 50% FTE of a career planning officer Grade 5-9 based on mid point salary.

Calculations

Total Cashable Efficiency: £16,070.00 *(before netting off any investment / on-going expenditure if applicable)*

Workings: 50% Planning Officer plus on costs

Savings: Web Based Self Service

Brief Descripton of VFM Gain

The time saving as a result of the implementation of Public Access for Planning and digitisation of maps etc. is equivalent to 1 FTE Grade 1C-3 front office Admin Officer. With self service enabled there has been a halving of total enquiries from a 2006/07 average of 36,000 per annum to 18,000 in 2008. Some of this reduction will be attributable to the downturn in planning applications due to the recession but is in a greater part due to Public Access and associated change management procedures. The time saved has enabled front office staff (together with improved training and experience) to absorb and deal with a significantly greater proportion of calls relating to planning applications, thereby reducing the amount of time spent by DC Officers having to visit reception to deal with general enquiries (see below). It is estimated that front office staff now sheild DC Officers from approximately 90% of general enquiries. In addition the time saving has enabled front office staff to take on additional work arising out of the changed regulations for Land Charge Searches.

Calculations

Total Cashable Efficiency: £18,350.00 *(before netting off any investment / on-going expenditure if applicable)*

Workings: 1x Customer Service Asst. plus oncosts.

Table A4 **Breakdown of non-labour savings**

TENDRING DC: VFM EFFICIENCY GAIN WORKING PAPER 2

Savings: Conversion of Office		
Brief Descripton of VFM Gain		
Office conversion from filing room as a result of e-planning. Filing room at side of front office rebuilt as office accomodation for LSP Team (not planning related)		
Calculations		
Total Cashable Efficiency:	£1,800.00	*(before netting off any investment / on-going expenditure if applicable)*
Workings:	Retal income from LSP office.	

Savings: Eliminate DC Microfiche		
Brief Descripton of VFM Gain		
Elimination of microfiche of historic planning records as a result of e-planning. Mocrofiching no longer required for planning records as a result of investment in IDOX EDMS. Validated from historical microfiche costs. Planning paper file savings. Changes as a result of e-planning mean that year coloured file folders no longer required. Saving is next two year estimate based on the fact that redundant previous years coloured files not used and held in storage will now be used up prior to the purchase of mulit-use files purchase in 2011.		
Calculations		
Total Cashable Efficiency:	£9,300.00	*(before netting off any investment / on-going expenditure if applicable)*
Workings:	Elimination of DC microfiche budget. Cost of Planning file folders.	

Savings: Postage and Stationary		
Brief Descripton of VFM Gain		
Reduction in Postage and stationarry costs as a result of e-consultations by sending email consultation rather than posting out bulky mail. Historically 0% sent electronically to 99% in 2009/10. Validated by reduced franking machine postage replenishment costs.		
Calculations		
Total Cashable Efficiency:	£8,000.00	*(before netting off any investment / on-going expenditure if applicable)*
Workings:	Postage-franking costs Stationary costs - paper,envelopes,photocopies etc.	

Table A5 **Reinvestment in GIS Post**

TENDRING DC: VFM EFFICIENCY GAIN WORKING PAPER 3

Reinvestment in Corporate GIS Post		
Brief Descripton of VFM Gain		
Facilitated by revised procedures together with the investment in e-planning, of Grade 1C-3 back office Admin Officers working on back office functions relating to planning applications was reduced by 2 No. FTE. This enabled a minor restructure that resulted in a reprioritisation of budgets enabling aCorporate GIS Custodian Grade 4 post being created. This is a vital corporate post required to maintain the LLPG and LLPG registers as part of the Mapping Services Agreement, necessary for the Council to make use of Ordnance Survey mapping across all services.		
Calculations		
Total Cashable Efficiency:	£36,700.00	*(before netting off any investment / on-going expenditure if applicable)*
Workings:	2x Customer Service Asst. plus oncosts.	

B National Land and Property Gazetteer (NLPG): Data Sharing Cost Benefit Analysis

The annex provides a worked example of the cost-benefit approach used within this report.

The NLPG is a key dataset for local government. One of its important attributes is the ability to improve interoperability, reduce data duplication and increase data quality through a single source of data being used to serve multiple different services and applications. Of particular interest are the financial benefits to be gained by linking all property related services to the NLPG.

The analysis process is outlined below:

Stage 1: The base information is derived from the GIS survey local public service providers undertaken in 2009 by LGA (Local Government Association, 2009) which included a question related to NLPG data sharing[50]. The question and results are shown in Table B1.

The size of the survey sample for each authority type is known, as is the total number of existing authorities, as shown in Table B2. The sample size is representative with 201 replies from a total of 348 authorities of the types analysed.

Table B1 **To which property-related services is the national/local property gazetteer linked?**

Linked Services	District		London Borough		Metropolitan District		Unitary	
Street naming and numbering	94	77.00%	13	76.50%	7	46.70%	37	78.70%
Planning	101	82.80%	13	76.50%	13	86.70%	32	68.10%
Building control	98	80.30%	12	70.60%	12	80.00%	30	63.80%
Council tax	66	54.10%	8	47.10%	8	53.30%	23	48.90%
Non-domestic rates	55	45.10%	6	35.30%	6	40.00%	17	36.20%
Environmental control	84	68.90%	8	47.10%	7	46.70%	19	40.40%
Land charges	89	73.00%	12	70.60%	9	60.00%	30	63.80%
Electoral services	83	68.00%	11	64.70%	8	53.30%	32	68.10%
Property management	40	32.80%	6	35.30%	2	13.30%	18	38.30%

[50] Although county councils, national parks, police, fire and rescue and passenger transport organisations were included in the survey, as they do not have primary responsibility for the services considered they were excluded from the analysis.

Table B2 **Survey sample size and total population**

Description	District	London Borough	Metropolitan District	Unitary
Total Respondents	122	17	15	47
Total Authority Type	201	33	36	78

Stage 2: Using the Rogers adoption curve and given the historical rate of adoption, we could reasonably expect in an optimal (ideal) scenario to reach a 95% implementation over the period from financial year 2008-9 to 2014-5 (6 years). Using this assumption, the number of services that would be connected is as shown in Table B3. To facilitate readers in following the analysis, the summary of numbers of implemented and outstanding (unlinked) services is shown in Table B4.

Table B3 **Services not linked**

Services not linked	District		London borough		Metropolitan district		Unitary	
Street naming and numbering	36	18.0%	6	18.5%	17	48.3%	13	16.3%
Planning	25	12.2%	6	18.5%	3	8.3%	21	26.9%
Building control	30	14.7%	8	24.4%	5	15.0%	24	31.2%
Council tax	82	40.9%	16	47.9%	15	41.7%	36	46.1%
Non-domestic rates	100	49.9%	20	59.7%	20	55.0%	46	58.8%
Environmental control	52	26.1%	16	47.9%	17	48.3%	43	54.6%
Land charges	44	22.0%	8	24.4%	13	35.0%	24	31.2%
Electoral services	54	27.0%	10	30.3%	15	41.7%	21	26.9%
Property management	125	62.2%	20	59.7%	29	81.7%	44	56.7%

Table B4 **Summary of Connected / Outstanding Services**

Description	District	London borough	Metropolitan district	Unitary	Total	Percent
Services Connected (2008-9)	1170	173	173	395	1910	64.2%
Services Outstanding to Connect by 2015	549	109	135	272	1065	35.8%
Total Services	1718	282	308	667	2975	

Stage 3: The costs of implementing NLPG sharing for the outstanding services were calculated based on the assessment made as part of the CEBR report in 2006 of setup costs (capital expenditure) and on-going (recurrent) costs. They are indexed to financial year 2008-9 at a 2.5% inflation rate. An additional cost has been added for data matching, based on actual charges made by Intelligent Addressing under their Mapping Service Agreement with local government, uplifted to take into

account preparation work by the local authority and apportioned systems connection costs. The on-going staff effort in data cleansing is assumed to be covered within the recurrent running costs.

Investments in setup, made prior to 2004-5 are disregarded, since they will have been amortised under normal accountancy practice prior to the period under consideration. This is detailed in Table B5.

The benefits are assessed from the sample set of case studies presented in section 4.8. These are applied according to the appropriate authority type to the numbers of services that remain to be linked to the NLPG. See Table B6.

Table B5 **Costs of rolling out data sharing across outstanding services**

Costs Analysis				Comments
			Per Service	Comments
Capital: Setup Costs				
2006-7 Value	£12,900,000			CEBR Study: We estimate that the total set-up costs of the LLPGs across England and Wales stand at £12.9 million.
Indexed to 2008-9	£13,553,063			Inflated at 2.5% pa for 2 years
Initial Matching Costs	£10,413,699		£3,500	Based on MSA (2008-9 value) - communication from Tony Black (intelligent Addressing) on 12/07/2010 plus allowance for internal preparation work and apportioned systems cost.
Subtotal (Setup + Matching)	£23,966,761			
Accounting for Investment Amortised by 2008-9	£6,838,973			Based on average 5 year life cycle for depreciation of investment setup and initial matching costs for services prior to 2004-5 have been amortised.
Total Capital Costs	£17,127,789			
Recurrent: Cost of Running Full rolled out service				
2006-7 Value	£15,200,000			CEBR Study: The total annual staff costs are estimated at £13.0 million and the other annual running costs of the system at £2.1 million.
Total Recurrent Costs (Indexed to 2008-9)	£15,969,500			Inflated at 2.5% pa for 2 years
Remaining Services Cost Summary				
Services still to be rolled out		1065	35.8%	
	Total		Annual	
Total cost to roll out remaining services	£6,131,014		£1,226,203	Spread over 5 years (FY: 2009-10 to 2013-4)
Annual Running Costs (for roll-out connections)	£5,716,396		£1,143,279	Spread over 5 years (FY: 2010-11 to 2014-5)

Table B6 **Assessment of Benefits of roll-outing of data sharing across outstanding services**

Benefits for Outstanding Services		District	London Borough	Metropolitan Districts	Unitary	Total
	Average benefits (per Service)					
Number of Outstanding Services		549	109	135	272	1065
District	£12,500	£6,516,169				£6,516,169
London Borough / MD / Unitary	£22,732		£2,360,994	£2,915,367	£5,873,622	£11,149,982
Benefits Total						£17,666,151

Stage 4: The identified costs and benefits are input to a discounted cash flow model based on an average 12month implementation, so benefits are realised one year later than the investment is made. A Discount rate of 4% per annum is applied over the period of the investments (6 years) to calculate the value of the net benefits as at the beginning of the period. See Table B7.

Note: reducing the benefits by 20% to provide a lower bound estimate for the NPV of £15.6m – for brevity this table is not reproduced.

Table B7 **Net present value of benefits as at 2008-09**

Year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Benefits		£3,533,230	£7,066,460	£10,599,691	£14,132,921	£17,666,151
Capital costs	£1,226,203	£1,226,203	£1,226,203	£1,226,203	£1,226,203	
Recurrent costs		£1,143,279	£2,286,558	£3,429,838	£4,573,117	£5,716,396
Total costs	£1,226,203	£2,369,482	£3,512,761	£4,656,040	£5,799,320	£5,716,396
Net benefits	-£1,226,203	£1,163,748	£3,553,699	£5,943,650	£8,333,601	£11,949,755
Discounted net benefits	-£1,179,041	£1,075,951	£3,159,226	£5,080,657	£6,849,613	£9,444,065
NPV as at 2008-09	£24,430,470					

Note: Costs discounted to 2008-09 financial year at 4% discount rate

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