

Use of Geographic Information Systems (GIS) in Regional Policy for Sustainable Development - Best Practice



1 Introduction

There have been significant developments in Europe in both the adoption of sustainable development principles in the regional planning and development process, and in the use of Geographic Information Systems (GIS) methodologies to enable and facilitate those processes.

Sustainable development is increasingly part of Government policy in the United Kingdom and throughout the European Union. It has been defined by the Sustainable Development Commission in the UK as:

'Providing a framework for redefining progress and redirecting our economies to enable all people to meet their basic needs and improve their quality of life, while ensuring that the natural systems, resources and diversity upon which they depend are maintained and enhanced both for their benefit and for that of future generations'¹.

The potential of GIS to provide consistent, quantitative information in an accessible format has it well-placed to be a key tool in evidence based sustainable development policy-making. For success, three inter-related elements are required:

- Appropriate **Data Provision**, where environmental data is available alongside social and economic data in spatial formats. This includes simple datasets that classify and describe, as well as more complex datasets that identify the quality of features and the management required, - and that can subsequently be used for monitoring and evaluation.
- A **Technological Framework** within which data can be stored, analysed and presented. These are the roles of GIS, database and internet technologies.
- A **Planning Framework** for sustainable development decision-making within which the data can be evaluated, stakeholders consulted, and decisions made. This is the role of the wider spatial planning process.

This report identifies key features of best practice in the use of GIS in sustainable regional development in Europe, with the aim of comparing the current use of GIS in regional policy and development in Wales with exemplars from the rest of the UK and the EU.

2 The Situation in Wales

The National Assembly for Wales has a legal duty to pursue sustainable development in all it does. This is built into its constitution through Section 21 of

¹www.sd-commission.gov.uk/whatis.htm

the Government of Wales Act 1998. This challenges Wales to be at the leading edge of developing sustainable development processes. One of the key pillars required for the successful development of these processes is a GIS framework that is able to integrate all the data required to make sustainable development decisions, whilst communicating and presenting the information in an accessible, clear and consistent method. This framework will draw in issues including data standards, metadata, and joined up working.

LANDMAP, a national landscape information system, gathers, organises and evaluates holistic landscape information into a nationally consistent dataset, - for landscape assessment and decision-making in regional planning and for other land management purposes.

LANDMAP is innovative in focussing very much on evaluating the environmental resource, not just classifying it, an important principle for effective sustainable development planning.

Data provision: the development of GI in Wales has benefited from the early adoption of digital mapping and GI methodologies, particularly in central and local government. A pivotal example is the development of agricultural and environmental information within **WENDI** (Wales Environmental Data Interface). WENDI was set up initially within the then Agriculture Department, as a spatial dataset of agricultural and environmental data. Increasingly, it has been extended to encompass social and economic data, in spatial format, about the Welsh rural economy.

Information from WENDI has been a key contributor to the **Wales Spatial Plan**, which sets the Welsh Assembly Government's view on the spatial perspective of sustainable development. It provides a framework for collaborative working and an opportunity to strengthen geography in policy and decision-making. *LANDMAP* will contribute to wider spatial planning by giving Local Planning Authorities and National Park Authorities clear information to support sustainable development.

More recently the focus of sustainable development has been expanded to encompass the more specific needs of certain areas of the economy, such as rural areas. The **Wales Rural Observatory**² can provide specific environmental, social and economic data in spatial formats for rural areas in particular, to feed into the spatial planning process.

A new project, sponsored by Cymru-Ar-Lein, has been recently launched by **BigBarn**. The project is aimed at wholesale food buyers to encourage them to source local products. By entering a postcode or place name, users can locate their local food producers.

² www.access-funds.co.uk/archive/2002/oct/Rural_communities.htm

In addition to the projects identified here there is considerable other work going on in Wales, in particular within local government. It has not been possible to list all of these activities, but information on activity within local government can be found from the specific Local Authority, or the Local Government Data Unit - Wales³.

3 The Situation in the UK

Sustainable development has now become a strategic objective of Government throughout the UK. The Sustainable Development Commission was set up in October 2000 to lead and inspire the take-up of appropriate processes.

Wider spatial and sustainable development planning in England is the responsibility of Regional Assemblies rather than central government, and the responsibilities of the devolved administrations in Scotland and Northern Ireland. Progress in developing full spatial plans varies from place to place.

There are two initiatives in England that show comparable characteristics of WENDI and *LANDMAP* in Wales:

- **MAGIC** (Multi-Agency Geographic Information for the Countryside) is an initiative set up in 2002 by the Department of Food and Rural Affairs (Defra), with a similar objective to WENDI, but in providing a web-based geographic information system about the English countryside for Defra and partners. It covers major environmental datasets (National Parks, SSSIs, Woodland Grant schemes, Scheduled monuments and ESAs) and aims to deliver a GI solution that addresses key strategic tasks, and helps shape rural and countryside policies by providing access to a single source of information.
- At a regional level in England, **LaMIS** (Land Management Information System) is an initiative coordinated by Hampshire County Council that mirrors *LANDMAP* to a degree in seeking to provide online access to environmental data and interpretive information at a local level, but specifically for farmers and land managers to assist in strategic land management planning. A longer term view of LaMIS however is that it does provide a vehicle for delivery of sustainable development processes at a regional and local level, with developing social and economic datasets supplementing existing environmental ones.

In Scotland **Kmap** (Knowledge Map) is an initiative by Scottish Enterprise to provide the enterprise agency with a range of geographic information products

³ www.lgdu-wales.gov.uk

and services to inform its strategic planning objectives. It operates as an extranet and brokerage service.

Alongside departmental initiatives within England, Wales and Scotland there have been developments of major spatial datasets for the whole UK. An example of these is **CIS** (the Countryside Information System), a sample based dataset of spatially referenced information about the UK Countryside.

Also of importance is **NLIS** (the National Land Information System), which allows rapid access to information on all land and property for England and Wales. A key feature of the project is the setting up of the National Land and Property Gazetteer (NLPG) which, through BS7666 defines a common standard for referencing property names, addresses and boundaries. This is an important showcase for the development and adoption of a standard before implementing a national project.

At a more local level in Scotland, **Stirling Planning Authority** have developed an award-winning approach to development planning that seems to encapsulate many of the key principles of sustainable development, and incorporates many innovative features. The focus is very much on the planning process, with:

- Data provision by developers in GIS formats
- The use of 3-D modelling of alternative development scenarios
- The use of multi-media for the presentation of planning proposals and consultation with key stakeholders and the general public.

The approach addresses both those involved in, and affected by, sustainable development. It has all the key elements of the use of GIS in sustainable development planning, and **whilst purely a local initiative at present, has many features of wider relevance.**

4 The Situation in Europe

Throughout Europe there are two levels of interest for sustainable development, the European Commission itself, and individual Member States.

The European Commission has set out a strategy for sustainable development in Europe as part of its own policy development framework⁴. This includes expectations for Member State governments, and governments in the accession states.

A common focus of GIS development at a regional and pan-European level has been on producing Standard Data Infrastructures (SDIs). The UK is unusual in

⁴ A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development, COM(2001)264 Final, May 2001

having such a well developed GI industry yet no formal national SDI. An SDI is defined as:

‘Framework of policies, institutional arrangements, technologies, data and people that enables sharing and effective usage of geographic information’⁵.

As regards data provision, at a central pan-European level, the European Commission has been concerned for some time with providing standard datasets of environmental, social and economic data to assist and enable EU policy development.

Key harmonised datasets, in standard GIS-compatible formats include environmental datasets such as:

- CORINE (a dataset of land use information across the EU, derived largely from remotely sensed imagery)
- **LUCAS** (a dataset of spatially referenced information about the European countryside, gathered from coordinated and harmonised field surveying across the EU and ultimately the accession states)
- EFIS (a prototype European Forest Information System)
- **Eurolandscape** (a pan-European landscape dataset, that models, analyses and evaluates aspects of the landscape)
- Pan-European Database of Rivers, Lakes and Catchments, set up by the Joint Research Centre (JRC) to contribute to the development of the Water Framework Directive.

These sit alongside spatially referenced socio-economic datasets such as the European Regional Statistics database (Regio), the database of administrative boundaries (SABE), and the Geographic Energy and Transport Information System (GETIS), all within the overall EU GIS framework of GISCO.

European Union initiatives include **INSPIRE** (Infrastructure for Spatial Information in Europe), implemented by Eurostat, the Statistical Office of the European Communities. This is an important initiative aimed at the creation of a harmonised spatial information infrastructure across the EU. Initially focussing on environmental policy needs, it will be extended to other sectors such as agriculture and transport in future. **GINIE** (Geographic Information Network in Europe) is a network that will develop the European Geographic Information Strategy based on the EUROGI Strategy.

In Wales the AGI Cymru GI Strategy – Action Plan for Wales and Cymru Ar-lein look to follow the focus of these wider pan-European GI strategies.

Initiatives that focuss on the information needs of specific multi-national parts of Europe can be seen in examples such as the Blue Plan and Coastwatch.

⁵ Craglia, M., *et al* (2003). SDI Developments in Western Europe. GI in the Wider Europe.

The Blue Plan aims to provide relevant data and proposals for action for Mediterranean countries to help implement sustainable socio-economic development.

Coastwatch is a recently established information service for European coastal environments, covering Earth Observation data, spatial environmental datasets (both marine and land-based), and spatially referenced socio-economic data.

The European Commission is also active in providing guidelines and encouragement for sustainable development initiatives to be taken up at national or regional level. Significant among these is **Moland** (Monitoring Urban and Regional Land Use Development) an initiative developed by the JRC, for monitoring urban and regional land use development throughout Europe.

A number of pilot studies have been completed, one of which, in Greater Dublin, has used satellite imagery and standard EU datasets such as Corinne within a GIS framework to develop indicators to compare the environmental sustainability of land use developments. An urban and regional growth model has been calibrated to forecast the likely impact of spatial plans and policies on future land use development in the area.

Moland is designed to provide planning authorities with a tool - to evaluate and compare alternative planning and policy scenarios - that is equally applicable at European, national and regional level. **It contains many of the elements of best practice essential to effective sustainable development planning.**

Eurogise is a similar initiative, set up to:

- Provide guidelines on how local authorities can best develop their GIS capability in spatial and regional planning
- Promote the integration of spatial data within and between public bodies.

Pilot studies have taken place in Scotland (Forth Valley), Greece, Finland, Netherlands, England and Ireland.

MULINO (Multi-sectoral, Integrated and Operational Decision Support System for Sustainable Use of Water Resources at Catchment Level), launched in 2001, provides specific, GIS-based guidance to local authorities on managing water resources, as an input to the Water Framework Directive.

Two examples of sustainable development processes, taken from accession countries, include the National and Regional development and Spatial Planning Information System in Hungary (TelR), and the Regional Spatial Information Project (RSIP) in the Silesian Region of Poland.

TelR combines both spatial datasets on environmental features, land cover and topography with spatially referenced social and economic datasets on

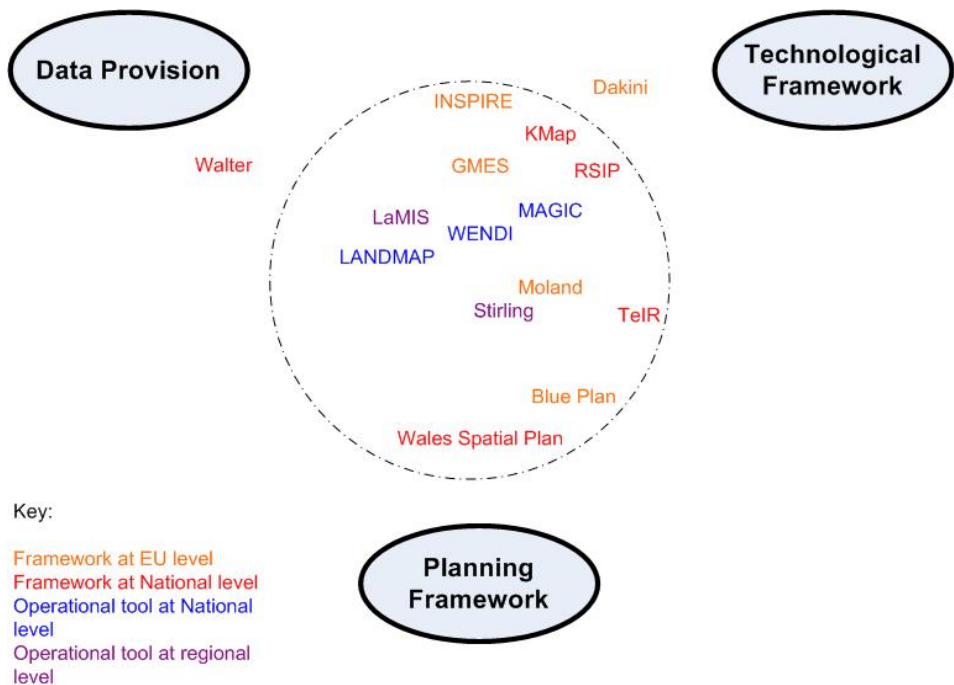
population census, employment and incomes. The system is web-based, and access is encouraged to a variety of users over the Internet. The system caters for simple, pre-designed statistical maps as well as having the ability to query for more complicated analyses.

RSIP is an example of the implementation of an INSPIRE-based spatial information network in Poland, jointly set up by central government and the regional government in Silesia. It addresses key themes of harmonising data, common data standards, user requirements and organisational structures.

Finally, outside of the area of sustainable development, but important in taking forward some of the key elements of best practice are initiatives such as Dakini.

Dakini is a cross-border, geo-spatial web-server for schools, funded by Interreg IIIa, holding map-based datasets of environmental and socio-economic data, as well as digital elevation models. It covers Kent and Sussex along with Nord Pas de Calais, Seine Maritime and Somme. It **provides an excellent example of cooperative working across national borders.**

Fig. 1 Diagrammatic representation with respect to the three elements important to sustainable development from a GIS perspective.



The dotted circle represents the primary area of sustainable development

5 Best Practice

Looked at objectively, one can see a progression in the development of GIS initiatives related to sustainable development. In the early days of Walter, concerns were focussed almost entirely on **data provision, data quality, and issues of data sharing and joint working**. As time has passed, some of these issues are being addressed and some of them resolved, and concerns have moved on to **methods of data presentation, stakeholder consultation and the planning process**.

The objective of this CCW commission for Environment Systems and ADAS was to identify and report on elements of best practice in the use of GIS in regional policy in Europe. We have already identified and described many of the initiatives that contribute to the development of best practice. Best practice itself has been defined as 'practices that are acknowledged as being suitable solutions to given tasks or problems'⁶, and there are many evaluations of case studies that seek to describe best practice. A number of key areas of best practice have been taken from the AGI Cymru Geographic Information Strategy - Action Plan for Wales. Here we summarise some of those key elements, and relate them to the project objectives of addressing sustainable development and landscape assessment.

The adoption and use of common data and metadata standards

It was realised at an early stage in the development of GIS processes that data standards, and metadata standards were important. The use of common data standards enables and assists the effective transfer of data between different users and applications. It is one of the key enablers of data exchange between organisations.

This is especially so of visual landscape data, for which there have been many different approaches to survey methodologies, classification and evaluation criteria. **It is a testament to the success of LANDMAP that it is developing a standard approach to the previously very subjective qualitative process of landscape assessment.**

A positive approach to data standards is a feature of the development planning work of **Stirling** planning authority in Scotland, in **bringing together data supplied by developers on development proposals in a common standard and format to other environmental data**, such that evaluations and modelling of alternative proposals can be more easily made.

⁶ Consultation Paper for the National GI Strategy for Wales 2003-2008, Cymru Ar-lein/AGI Cymru 2003

A key feature of many European Commission initiatives has been the harmonisation of data across the EU, and the development of all the main **pan-European environmental, social and economic datasets in standard spatial formats** to input to EU policy development. **INSPIRE** will be a key initiative in developing a standardised approach to both the provision of harmonised data, and the development of a GIS framework for the delivery and utilisation of the data.

Joint working, encouraging the exchange of data and encouraging wider access to data

Joint working, data exchange and wide access to data are all key features of the successful use of GIS in regional planning and sustainable development. Two examples of spatial information systems beginning to support sustainable development in the UK, MAGIC in England and WENDI in Wales, both rely heavily on the cooperative working of the many partner organisations involved, - both in working together to provide data in standard formats, and to allow wide access to that data.

There are of course issues relating to confidentiality of data, and it is important that relevant data protection and privacy legislation such as The Data Protection Act⁷ in the UK is respected and observed.

Access to data can be made easier by the use of standard data catalogues and web-based access facilities. Leading GIS initiatives such as **KMap** in Scotland provide extranet access and a data brokerage service to key datasets over the Internet. LaMIS in England provides access to local environmental and land management data on-line. BigBarn has developed an excellent end user application that presents information spatially to the general public.

Joint working can of course occur at all levels: regionally, between local authorities, nationally between government departments, and internationally between neighbouring countries. Important and leading examples of the latter can be seen in the Dakini project, with cooperation between educational authorities in SE England and NW France, with cooperation, data sharing and joint working between areas.

The promotion of a 'collect once, use many times' philosophy

An important part of cooperative working practices is the **avoidance of duplication of effort in data provision, data storage and data analysis.**

⁷ www.dataprotection.gov.uk/

Standard approaches to using data and implementing efficient data management systems are being provided by key European initiatives such as Moland and MULINO. Both seek to provide guidance and identify best practice for local authorities throughout the EU to make efficient use of data and facilitate GIS technology, - the former for urban and regional planning, the latter more specifically for managing water resources.

The provision of value-added data

A key feature of GIS initiatives in the field of sustainable development is the provision and use of wide-ranging environmental, social and economic datasets. **WENDI was initially set up to manage and serve environmental and agricultural data, but has more recently been developed to encompass a broader range of socio-economic data.**

Datasets are being developed to include not just descriptions and classifications, but information on the **quality of environmental features, risks, threats and management requirements**. This is a key and innovative feature of *LANDMAP* in Wales.

The innovative use of technology

Technology is not an end in itself, but simply a means to enable better decision-making and facilitate sustainable development processes.

- GIS provides that process in all of the case studies identified. Specific examples of best practice in the use of GIS and other technologies include the use of GIS within the Moland pilot study in Dublin as an urban and regional modelling tool to **evaluate alternative planning and policy scenarios** through the development of cellular modelling tools. The use of 3-D visualisations and fly-throughs by Stirling planning authority, again to model and **evaluate alternative development proposals**, particularly effective when considering landscape issues
- The use of multi-media presentations, again by Stirling local authority to **communicate proposals and policy developments to a wider audience** of stakeholders and the general public

Wide consultation and stakeholder participation

A key feature of many of the case studies of the use of GIS in sustainable development and wider spatial planning has been the focus on communication, consultation and encouraging stakeholder participation. Whilst not specifically

related to the data itself, or the use of GIS, this process is made easier and more efficient by the effective utilisation of key datasets and appropriate technology. The Wales Spatial Plan is encouraging participation and consultation at the national level on spatial policy issues; LaMIS on the other hand encourages participation by individual landowners and managers on issues at a very local level.

In other parts of Europe, the **Blue Plan for the Mediterranean countries** and the **Hungarian Regional Development and Spatial Planning System** perform very similar functions.

Communication is an important part of this consultative and participatory process, and key examples of the use of technology to support effective communication strategies have already been identified.

The integration of diverse datasets

The increasing use of GIS for sustainable development policy-making enables the bringing together of a wide range of datasets, often originally collected for different purposes, and at different scales, but all of which are **critical to the sustainable development process**. One of the challenges for the GI Industry will be to:

- Successfully handle this diverse set of data (which could include, for example, data on property, planning, census, economic, environment, agriculture and transport),
- Be able to consistently, accurately and transparently integrate and present the derived information to decision makers.

The projects described, and best practice highlighted all share elements of successful integration and communication of a diverse range of geographic information.

Example projects

Category 1 – Providing a framework at EU level⁸

1.1	MOLAND	www.moland.jrc.it
1.2	INSPIRE	www.ec-gis.org/inspire/
1.3	Global Monitoring for Environment and Security (GMES)	www.gmes.info
1.4	The Blue Plan	www.planbleu.org
1.5	GINIE	www.ec-gis.org/ginie/
1.6	Dakini	www.dakini.eu.com
1.7	EUROLandscape	www.eurolandscape.jrc.it
1.8	COASTWatch	www.coastwatch.info/
1.9	LUCAS	http://europa.eu.int/comm/eurostat/

Category 2 – Providing a framework at national level

2.1	Wales Spatial Plan	www.spatialplan.wales.gov.uk
2.2	Kmap	www.k-map.co.uk
2.3	TeIR	www.teir.vati.hu
2.4	LANDMAP	www.ccw.gov.uk/landmap
2.5	CIS	www.cis-web.org.uk

Category 3 – Providing an operational tool at national level

3.1	WENDI	www.wales.gov.uk
3.2	EUROGISE	www.eurogise.org
3.3	NLIS	www.nlis.gov.uk
3.4	MULINO	http://linux.feem.it/web/loc/mulino/index.html
3.5	BigBarn	www.bigbarn.co.uk

Category 4 – Providing an operational tool at regional level

4.1	Stirling Planning	www.scotland.gov.uk/library5/planning/saqprf-20.asp
4.2	LAMIS	www.lamis.gov.uk
4.3	RSIP	n/a

⁸ Projects described can appear in more than one category. For example LANDMAP can be placed in category 2, 3, and 4.

Mae'r adroddiad hwn yn adnabod rhai o bŵer nodweddiol ym 1990 a'r 2000. Mae'r adroddiad hwn yn adnabod rhai o bŵer nodweddiol ym 1990 a'r 2000. Mae'r adroddiad hwn yn adnabod rhai o bŵer nodweddiol ym 1990 a'r 2000.

- Mae'r prif elfennau'r arfer gorau y tynni'r sylw atynt yn cynnwys:
- Mabwysiadu safonau data a meta data cyffwrdd a'u defnyddio
 - Cydwethio, annog cyfrnewid data ac annog mynediad ehangach at ddata
 - Hyrwyddo athroniaeth, casglu un waith, defnyddio sawl gwaith
 - Darparu data gwerth ychwanegol
 - Defnyddio technoleg mewn modd dyfeisgar
 - Ymgynghori eang a chyfranogiad budd ddeiliaid
 - Integreiddio setiau data amrywiol

Dau o'r prif enghreifftiau o'r DU ac Ewrop y tynni'r sylw atynt yw:

1. Awdurdod Cynllunio Sirling. Mae Systemau Gwybodaeth Ddaearyddol yn gwbl ganolog i waith cynllunio datblygu cynladwy yr awdurdod ar lefel leol. Mae yna hefyd sawl elfen allweddol sy'n berthnasol ar lefel ehangach, gan gynnwys:

- Datblygwyr yn darparu data mewn fformat Systemau Gwybodaeth Ddaearyddol
 - Defnyddio modelau 3-D o senarios datblygu amgen
 - Defnyddio dulliau aml-gyfrwng i gyflwyno cynigion cynllunio ac wrth ymgynghori a'r prif fudd-ddeiliaid a'r cyhoedd yn gyffwrddol.
- Mae ei ffocws yn bendant ar y rheiny sydd ynghlwm â datblygu cynladwy, neu'r rhai sy'n cael eu heffêithio ganddo.

2. Mae Moland, cynllun y Comisiwn Ewropeaidd (Montiro Datblygu Defnydd Tŷ Trefol a Rhanbarthol) wedi'i gynllunio fel arf i alluogi awdurdodau cynllunio i werthuso a chymharu senarios cynllunio a pholisi amgen, sydd yr un mor berthnasol ar lefel Ewropeaidd, cenedlaethol a rhanbarthol.

Cwblhawyd sawl astudiaeth beilot. Roedd un ohonynt, yn Nulyn a'r cyffiniau, yn defnyddio delweddau lloeren a nifer o setiau data amrywiol ond safonol yr UE megis Corine, mewn fframwaith Systemau Gwybodaeth Ddaearyddol, er mwyn datblygu dangosyddion i gymharu cynladwyedd amgylcheddol datblygiadau defnydd tŷ. Mae model twf rhanbarthol a threfol wedi'i raddnodi er mwyn ceisio rhagweld effaith bostol a chynlluniau gofodol ar ddatblygu defnydd tŷ yn yr ardal yn y dyfodol.

¹ Mae GIS wedi dod yn arf allweddol mewn creu polisi datblygu cynladwy. Mae'n tynnu ynghyd setiau data amrywiol mewn ffrâm gofodol. Mae'n cynnig fframwaith technolegol o fewn y data, y mae modd ei gyrcu a'i ddadansoddi, gan alluogi gwneud defnydd effeithiol o'r fframwaith cynllunio fel arf ymgynghori a gwneud penderfyniadau.



Noddir gan
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Yr arfer gorau o ran defnyddio Systemau Gwybodaeth Ddaeryddol mewn Polisiau Datblygu Cynladwy Rhanbarthol