# National Mapping – Funding the Public Good

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**Key words**: national mapping, funding arrangements, public good

## SUMMARY

Ordnance Survey of Northern Ireland® (OSNI®) is recognised as a leading national mapping agency. It has a strong reputation for positioning itself as a public good body - but it has also managed in the last 12 months to reach financial break-even, a state that it sees as allowing it to focus even more on its public good role. The paper will explore the role and context of national mapping agencies, and what has enabled OSNI to develop a track record of success as such an agency, producing data and products valued by its customers and also being at the heart of the Northern Ireland GI strategy and related policy making. Several world-leading developments have been a part of this picture and lessons learned from the work will be shared.

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## 1. INTRODUCTION

National mapping agencies in the British Isles, as in many parts of the world, were formed and began to map the landscape for national defence and taxation purposes. The creation of accurate mapping was a time consuming, manual process, with the product being a paper map.

In the last decade, the computerized processes put into place to facilitate digital map production have matured and come together to enable rich combinations of spatial data to be created and manipulated. Processing power and communication bandwidth also now allow these datasets to be shared in real time. This, coupled with developing governmental philosophy and practice in funding national mapping, has created a time of profound change for national mapping agencies. The uses for their data are increasing – recognising that 80% of public sector data is spatially-related - but the barriers to entry to mapmaking activity are falling.

This paper explores the changing role and context for national mapping agencies and the consequences of developments in funding models; it then uses Ordnance Survey of Northern Ireland as a case study of a successful national mapping agency and examines how it is responding to and shaping its environment.

## 2. NATIONAL MAPPING AGENCIES (NMAs)

### 2.1 The role of NMAs

It is appropriate to consider first the function of a national mapping agency and how this sits within the functions of government. Walter Smith (1979), then Director General of Ordnance Survey Great Britain, suggested that government has two primary roles: to ensure order (mandatory) and to encourage material and other progress (optional). The former, national defence, brings in a key role of national mapping and hence an argument for government to ensure that mapping is completed for the whole of the country. This logic applies for occasions other than war: the explosion on Pan Am flight 103 over Lockerbie in December 1988, for instance, required mapping to support the rescue activity. The needs for such 'just in case' occasions are akin to defence needs. To meet them, Smith argued, mapping needs to be up to date, homogeneous, and continuous in spatial extent.

Aside from this defence and emergency requirement, national mapping in many countries began in a systematic way to support land registration functions and/or property valuation. Both functions are central to the national economy, the former providing the secure title to land which de Soto and others have argued is a vital prerequisite for national economic

development. Property valuation is generally a precursor to levying property-based taxes, and accurate and complete valuations are therefore essential if such revenue-raising is to be seen as fair and equitable.

In an era of specific use, paper-based map outputs, national mapping agencies tended to remain rather tightly focused on meeting these key governmental requirements, in line with the role of government summarised by Smith. However, a move to digital mapping technology and techniques has created a new era. Now, the data collected for one purpose can, with minimal marginal cost, be made available for a plethora of other purposes. Different datasets can be combined in ways which create additional value – meaning that the topographic data required to support valuation and ownership matters can also easily be converted into forms which can underpin management of rural land for effective agriculture, guide emergency services (and any other vehicles) to individual addresses, or allow planners to model the impacts of various development scenarios.

In this way, the inputs to a national mapping agency can be used in a wide range of outputs of use and value to many applications and users. The customer base is vastly expanded. All of this brings opportunities for national mapping agencies, but also challenges in meeting the varying needs of different customers, and in ensuring that funding models adequately reflect the enlarged range of uses.

## 2.2 Funding Models

As elaborated in the previous section of this paper, the range of uses for national mapping agency outputs has increased the debate about appropriate funding models for the agencies. There are different approaches taken in practice in different countries, and these in all likelihood reflect different responses to the arguments of economic theory. This section considers these issues, starting with an overview of the relevant theory.

### 2.2.1 Theory

As developed by Adam Smith and later economists, the Independent Economy Model sees trades in the market place as the heart of the economy. As each trader maximises his/her wealth through trades, the result is optimum performance of the economy. The role of the government is to ensure the integrity of the trades and (if Hayek's (1982) argument is accepted) to restore entitlements to trade. It should therefore interfere as little as possible, because it is incompetent (in that it can never monitor every single trade) and may well act (knowingly or not) on behalf of one trader, thus defeating the self-equilibrium of trades at the point of greatest efficiency for the whole economy.

What does this say about government's proper role in national mapping? Hayek (1982) includes, in his understanding of the need to protect the integrity of the trades, the establishment of the rule of law and the protection of private property. He separated the need for governments to raise taxes to ensure optimum activity in areas where the market could/would not do so, and the role of legislation (which should be minimised, given that the

government is not competent to coerce the market). Mapping is an integral part of a land registration system, necessary to protect private property. It is also a public good (it is specifically listed as such by Hayek), meaning that its users will realise that it will make no difference to the results whether they themselves agree to contribute or not. This becomes even more the case with map data in digital form which can be duplicated very easily and cheaply. Therefore, the unregulated market will not provide national mapping. Hayek and his fellow thinkers thus believe that governments should ensure that national mapping exists (certainly cadastral, potentially topographic as well). However, that is not to say that the government should itself produce the mapping – it would suffice if the government used tax revenue to pay the private sector to produce it to an agreed specification.

Keynes (1932) and his followers recognise an additional role for government to that of ensuring the integrity of trades. This is to manage the economy at a macro level, supporting trades at the micro level, examining aggregates of economic activity and intervening to ensure that the economy settles at full utilisation. From this recognition flows the need for government to take over the provision of services that the market will not itself provide (if the provision is in the interests of the nation as a whole). In the provision of mapping, the market is likely to concentrate on profitable areas such as urban centres and small scale maps for which data collection is cheap and sales are numerous, at the expense of more remote areas and large scale mapping. However, mapping of the whole country at a variety of scales is needed, for the 'just in case' occasions outlined above, and also for purposes such as land registration, planning etc.

This Mixed Economy model places greater emphasis on government involvement in matters such as the planning process than does the Independent Economy Model, emphasising that traders are interested overwhelmingly in maximising profits for themselves, a process which may not be appropriate for all goods and services if the whole economy is to function optimally in the long as well as the short term. Therefore, Mixed Economists believe that governments should intervene in the market place to ensure mapping of the whole country. Again, this does not mean that the government itself should operate a mapping agency - as was the case with Independent Economists, Keynesians would accept the merits of the private sector carrying out the work with government as the client.

The fact that the same series of mapping can satisfy a large number of differing needs emphasises the key role of government in ensuring that the market works efficiently by pooling needs (if necessary, by first agreeing a common specification that will meet the needs of all of the purposes). Only the government has sufficient knowledge and impartiality to develop and complete an appropriate specification.

### 2.2.2 Practice

Approaches taken in practice have ranged from 'free data' (for instance for data produced by the US Federal Government) to 'user pays' to the extent that all costs of a national mapping agency are covered by revenue flows from its data (the UK and New Zealand are examples of such models). In the United Kingdom, for instances, governments of different political

persuasions have considered how its national mapping agencies should be funded. From 1966, Ordnance Survey Great Britain started charging for more than the costs of printing, paper and distribution – elements of the data collection costs were passed on to users. This continued through the following decades, with the organisation charged with recovering increasing percentages of its costs (with separation of types of activity between core and commercial a stage in this process). In 1999, Ordnance Survey Great Britain became a Trading Fund, charged with operating as a largely commercial entity whilst remaining in public ownership. This model has been extended a little further in the Republic of Ireland, with its national mapping agency (Ordnance Survey Ireland) now a State owned company and its staff no longer civil servants (Ireland, 2001).

The approach in the United States has been different. The authorities there have maintained a 'cost of supply' policy. This was reiterated in a Presidential Order of April 1994 (Clinton, 1994), which emphasised the critical role of geographic information in promoting economic development and environmental protection and therefore the need to avoid duplication of effort. A Federal Geographic Data Committee (FGDC), chaired by the Secretary of the Interior, exists to promote the coordinated development, use, sharing and dissemination of geospatial information on a national basis.

Rhind (1995) summarises the following arguments for and against charging:

| ***In favour of charging*** | ***Against charging*** |
|---|---|
| It establishes the 'real need' for the goods | Tax payers have already paid for the activity |
| It encourages private sector competition | The cost of collecting the money is large |
| It allows tax cuts [hardly an ideological argument!] | The benefits of widespread use of free data include higher corporate profits for value adders, leading to increased tax revenues |
| The multitude of tax payers shouldn't subsidise the smaller number of users | Citizens have a right to access to government data |
| Governments are more likely to stand elements of the cost if users pay for their share | |
| The quality of data produced is higher because it has to attract a price | |

Rhind makes clear that he believes in charging.

This is an example of where practical reality may lead one to diverge from the purity of economic theory. The present author was content with the theoretical model as a student in the mid-1990s, but his experiences on different continents have led him to accept the practical arguments that charging for government-produced geographic information allows value to be established, and therefore the need for certain levels of funding to be understood.

Government remains the largest customer of national mapping agencies, and the appropriate sharing of costs between it and other customers is a key topic. Another key element is that of the need for security of funding – the need for national coverage of mapping, there in case of emergency, has already been discussed: such provision requires confidence in medium-term funding availability. The author would contend that such security of funding allows a national mapping agency to focus more confidently on its role in supporting the national good.

## 3. ORDNANCE SURVEY OF NORTHERN IRELAND (OSNI)

### 3.1 Background

This second part of this paper considers the arguments of Section 2 in the context of a particular case study. Ordnance Survey of Northern Ireland (OSNI) traces its history to the 1820s, when the British government determined that a complete, detailed survey of the island of Ireland was required to underpin property-based taxation. Soldiers from the Royal Engineers undertook this work, which by 1846 saw all 32 counties mapped at the scale of 6" to the mile (1:10,560 scale). The following decades saw this improved to 25" to the mile (1:2,500) coverage. The mapping techniques available at the time were labour intensive, and revision cycles were lengthy.

With the partition of the island in 1922, Ordnance Survey activities in Ireland were separated, with Ordnance Survey Ireland (OSi) in Dublin taking responsibility for mapping what is now the Republic of Ireland, and OSNI being formed in Belfast to look after mapping the six counties of Northern Ireland. This it continues to do today, having embraced a wide range of new technologies and moved to a fully digital mapping flowline, whilst still fulfilling its duties as a national mapping agency. The Agency employs approximately 175 people, with field surveyors being dispersed around five regional offices. The Agency in 1999 became part of the Northern Ireland Department of Culture, Arts and Leisure (DCAL). Its products include large-scale topographic mapping data, address datasets, orthophotography, and road network products.

### 3.2 Performance

OSNI has in recent times been consistently tasked with recovering increasing percentages of its cost from its revenues. The figure below shows its success at doing so, increasing from 25% cost recovery in 1995 to over 100% for the first time in 2007. Whilst the predominant change has been the increase in revenues, such changes in cost recovery have also required careful control of costs. The high costs in 2002/03 were due to an early retirement scheme.

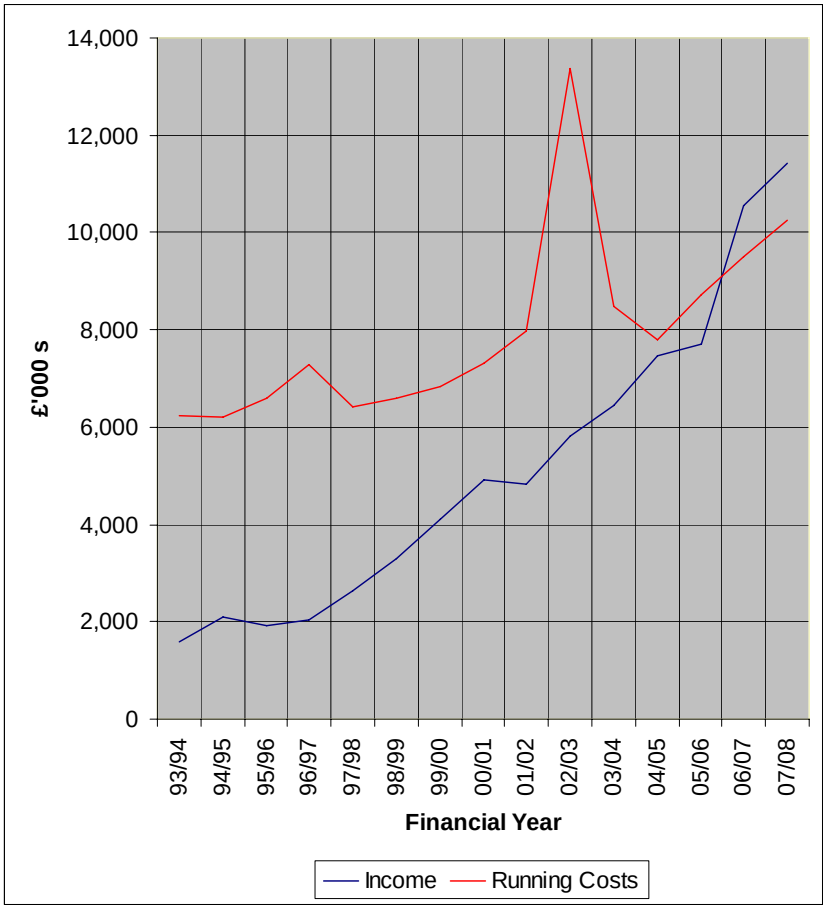


**Figure 1** – OSNI income and costs 1993-2008

This financial performance has been achieved at the same time as considerable improvement in the currency and quality of OSNI's topographic database. Until 2003, OSNI completed mainly cyclic revisions of real world change, using 5, 7 and 10 year cycles in different areas. This meant that considerable numbers of houses and other real world features were not captured in the database at any time. A new map revision policy, introduced after wide consultation, brought in a mix of continuous and cyclic revision, with a 5-year cycle (10-year in rural areas) supplemented by revision of developments as they occur, with an Agency target in 2006/07 to complete survey of 90% of clusters of 10 houses or more, within 6 months of notification. Such a programme is essential for key users such as the Land Registers of Northern Ireland. The current backlog of unsurveyed properties, during the transition period from the old revision policy, is estimated to be somewhere between one and two years development, with this to be reduced to around six months development in the next year.

In its revision policy change, and in its range of activities, OSNI has been primarily driven by the needs of its customers, with technological developments a key component in allowing it to realise such substantial advances in performance over short time periods.

### 3.3 Current Funding Arrangements

As shown in Figure 1 above, OSNI is funded on a 'user pays' model. The revenues flow from a broad range of users, reflecting earlier comments about the much broader range of uses supported and enabled by digital mapping.

A key change for OSNI was the signing during 2006 of two significant agreements. The Northern Ireland Mapping Agreement (NIMA), funded by a series of central financial transfers, allows access, free at the point of use, to a wide range of OSNI data by all Northern Ireland Civil Service organisations, public sector health and education bodies, local authorities, and Non-Departmental Public Bodies. A parallel agreement – the Northern Ireland Office Mapping Agreement (NIOMA) - allows the same arrangements for the constituent parts of the Northern Ireland Office (responsible for matters such as policing and criminal justice). These central agreements are already enlarging the range of public bodies using OSNI data, broadening the pre-existing public sector user base. OSNI's current focus is on supporting public sector organisations to recognise and realise the benefits of OSNI data in policy development and service delivery, working with a range of private sector partners who are developing integrated solutions (to support this mix, OSNI has publicly stated that it will not compete directly for sales of digital products to business customers outside the mapping agreements block).

Other key revenue streams for OSNI include

- The sale of a range of paper mapping products.
- Licensing the use of OSNI data and mapping into a range of businesses (for instance, solicitors and architects).
- The sale of site-centred, plot (or download) on demand large-scale mapping in the ACEmap® product. This is used, for instance, in the submission of planning applications, and the land title registration process. The product is available through OSNI's Map Shop in its Head Office in Belfast and a number of local authority offices. In the summer of 2006, OSNI launched a world-leading eCommerce system allowing users to view, select, pay for and download digital data, including in the ACEmap format, to supplement the other channels.
- Licensing data through Value Added Resellers who create products and services incorporating OSNI data. These range from road atlases to in-car navigation systems.

Such a range of channels to market ensures the wide accessibility of OSNI data.

### 3.4 Organisational Purpose

The signing of NIMA brought OSNI to full cost recovery for the first time in its history. This allowed the organisation to reconsider the next phase in its development, having had a strategic focus for the last few years to reach financial break even. In many ways, the greater security of funding (through a multi-year deal) allowed OSNI managers to focus to a greater extent on the organisation's public good role. This is encapsulated in an updated organisational Mission "to place OSNI's data at the heart of a vibrant Northern Ireland",

supported by a Vision "to be widely recognised as leaders in collecting, managing, combining and promoting the use of spatial data to benefit the citizens of Northern Ireland". The organisation is focussed on getting its data embedded throughout Northern Ireland – this drives a range of business strategies. Such embedding requires OSNI to be a leading organisation in the activities articulated in its Vision.

Some years ago, OSNI began using the Balanced Scorecard for its strategic planning and implementation. A little later, it included use of the Strategy Map tool in the process. This suite of tools has proved extremely powerful in driving the necessary activities to support achievement of the Mission and Vision into the various work areas in OSNI, and into each member of staff's Personal Performance Agreement. OSNI's current Strategy Map is shown in Figure 2.

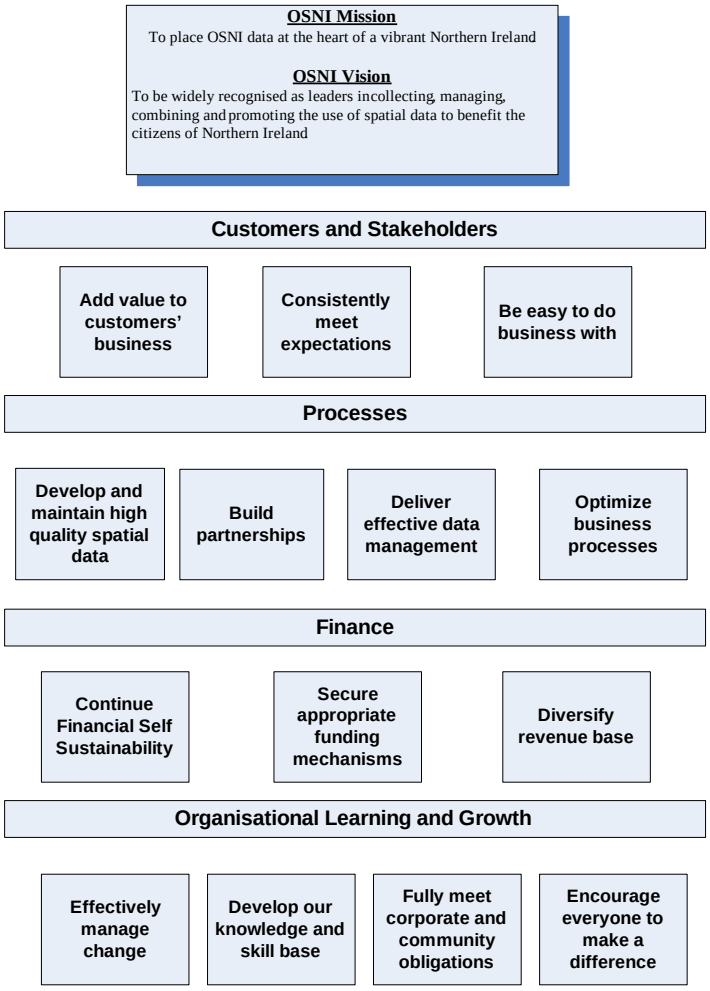


**Figure 2** – OSNI Strategy Map

The organisation exists to add value to its customers' business – this is the basis on which current and potential customers decide whether to invest (systems, skills….) in the use of OSNI data. The organisation also needs consistently to honour its commitments, and to be

easy to do business with. This activity focussing on customers and stakeholders is supported by the maintenance of high quality spatial data, enabled by effective data management. Building partnerships – with customers, technology, suppliers, Value Added Resellers, etc – is vital to OSNI's success in a networked world. And the need for maintaining cost recovery has not gone away, meaning that all business processes have continuously to be refined. In the finance area, maintaining financial self sustainability (with revenues remaining at least equal to costs) is crucial to the continuing development of the organisation. The diversification of the revenue base is both required for financial security, but also flows from the Mission to have OSNI data very widely used. And appropriate funding mechanisms – recognising OSNI's public sector basis whilst operating in a businesslike manner – are important. To deliver on all of the above requires ongoing staff commitment, which in turn requires OSNI effectively to manage change, ensure its skill base meets its future needs, and continue to encourage all of its staff to continue to make a difference. Last but not least, OSNI has corporate responsibilities as an organisation (health & safety and so on) and as part of the Northern Ireland Civil Service.

This suite of priorities then work through into 10 corporate performance targets – spread across the Scorecard quadrants – for 2007/08, which then cascade into work areas and personal objectives.

### 3.5 OSNI's Place in Northern Ireland

OSNI's Mission sees the organisation as an underpinning element in Northern Ireland's success. This emphasises its public good role. It is borne out and re-emphasised by the findings of some recent research that £7 billion of Northern Ireland's economy (around a third of its GDP) requires OSNI data to be available (OSNI, 2005).

This has been recognised through the development of a Northern Ireland Geographic Information Strategy (OSNI, 2002), branded MOSAIC. This was developed using a very wide range of stakeholders. Phase 1 of MOSAIC was the development of a strategy. This was done by marooning a considerable number of people on a County Fermanagh island for three days. The stories of that period still abound in all customer sectors! Phase 2 was the development of pilot projects in different sectors. One that has already made a difference is in the utilities sector, where the various companies are sharing data on where their pipelines and cables are – the quote that keeps coming back is that the process of determining the extent of cables in an area used to take a utility six weeks; it now takes six minutes.

This work has been overseen by a multi-sectoral Steering Group of influential individuals. The Steering Group in turn reports to an Oversight Board managing a wide-ranging public sector reform programme. Geographic information is in this way recognised as a key element in improving the effectiveness and efficiency of public sector activity.

A key technological base for the wide use of geographic information from a broad use of data custodians, is a Northern Ireland GeoHub which is currently being built by a consortium of Fujitsu, 1Spatial and ESRI. At go live later in 2007, this will be a flexible repository for

spatial information, a portal through which data availability and quality (through ISO-compliant metadata) can be determined, and a tool allowing certain levels of data combination and analysis. More sophisticated analysis will require users to invest in their own Geographic Information Systems, but the GeoHub will graphically demonstrate the power of geographic information in many, many activities. It will also fulfil many of Northern Ireland's responsibilities under the European INSPIRE Directive.

Other elements of OSNI's central place include a change intelligence recording system, STAR, which has been made available to a number of OSNI's key customers (allowing them to highlight ground change of importance to them, and therefore influence OSNI's map revision programme). Another key element has been the development of a Northern Ireland address dataset, Pointer. This is best of breed in the British Isles, and is populated through collaborative working by local authorities, Royal Mail, the Valuation and Lands Agency and OSNI.

### 3.6 Current Developments

Technological and social developments continue to drive OSNI forward. The world-leading eCommerce system is proving very successful in meeting customer needs for online, round the clock access to OSNI products. A development in 2007 will be the incorporation of a historic mapping layer. The 6" and 25" maps referred to previously have all been scanned in a collaboration between OSNI and the Public Record Office of Northern Ireland. The data will be available to view and download through the eCommerce system. Associated points of interest layers will allow Value Added Resellers to create environmental analysis and other systems. This is another example of how OSNI wants to make the value of its data available through a wide range of channels.

Other developments planned for 2007 include adding further robustness to OSNI's database management systems, and implementing an external accreditation arrangement for the organisation's Mapping and Charting staff.

Another key piece of work currently being scoped is a systematic review of the positional accuracy of OSNI's large scale topographic data. This has been gathered over many decades, using a variety of survey techniques. The intention now is to bring it all to a consistent accuracy standard through a positional improvement programme, ensuring that the data fully matches the results of modern positioning techniques such as GPS. In alignment with its public good role, OSNI is currently exploring with key data users such as Land Registers and the utilities, how the programme can be progressed in such a way that their data holdings are simultaneously moved in a manner which retains their consistency with OSNI's base data.

### 3.7 The Future of OSNI

With ongoing political developments in Northern Ireland, a Review of Public Administration was completed in 2006 (UK, 2006). This proposed a significant reduction in the number of public bodies.

One component of this is the creation of a Land and Property Services Agency (LPSA) through the merger of OSNI, Valuation and Lands Agency (VLA), Land Registers of Northern Ireland (LRNI) and the Rate Collection Agency (RCA). This will be completed in April 2008. Staff and managers of the four Agencies are already working together, and recognise the value that can be realised through working more closely together, integrating activities and removing duplication. This applies in support tasks (such as maintaining one set of accounts rather than four) and technical tasks. A joint Working Group between OSNI and VLA staff has recognised the significant potential of joining up OSNI's field survey and the data collection undertaken by VLA valuers. This work is also proceeding in close conjunction with the Building Control sections of local authorities, not only adding efficiency to the overall process but also reducing the number of public sector staff needing to visit the ground to survey new houses or extensions. This joining up is summarised in the LPSA Mission: "To deliver the integrated mapping, registration, valuation and rating services essential for Northern Ireland" and its Vision "Transforming land and property services and information for the public good".

OSNI's merger into the LPSA will allow it to realise more with the same resource, and will place it even more centrally in the Northern Ireland Civil Service, and beside the vital land administration functions of title registration and valuation. This latter element underpins the collection of £1 billion of domestic and non-domestic rates in Northern Ireland each year.

## 4. CONCLUSIONS

OSNI is, by many different definitions of the measure, a successful national mapping agency: it is meeting its customers' needs effectively. It has done this within a Government policy of 'user pays', reaching the point of financial break even in 2007. Using this model has provided OSNI with security of funding (through multi-year agreements with key customers), which in turn has allowed it to concentrate a significant part of its efforts on its public good role, for instance through its leading of the development and implementation of a Northern Ireland Geographic Information Strategy. The author firmly believes that revenue generation by a national mapping agency is a means to an end – that end being the fulfilment of its role in supporting a Government's key objective (as usefully summarised by Smith (1979)). In this way OSNI is 'squaring the circle' of the differing theoretical positions on funding models for national mapping agencies. The Agency is well-placed to continue this focus in the Land and Property Services Agency.

## REFERENCES

Clinton, W. J., 1994, Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure. Executive Order, April 1994.

Hayek, F. A., 1982, Law, Legislation and Liberty, Volume 3. Routledge and Kegan Paul.

Ireland, 2001, Ordnance Survey Ireland Act. Government of Ireland.

Keynes, J. M., 1932, The End of Laissez-Faire. In Keynes, J. M., Essays of Persuasion. Harcourt Bruce and Co.

OSNI, 2002, A Geographic Information Strategy for Northern Ireland.
OSNI, 2005, Assessment of the Economic, Social and Cultural Benefits of OSNI. Consultancy report by PA Consulting.
Rhind, D. W., 1995, Making a Business out of Government's Spatial Data. Proceedings of the Cambridge Conference of National Mapping Organisations.
Smith, W., 1979, National Mapping: A Case for Government Involvement. Conference of Commonwealth Surveyors, Cambridge.
UK, 2006, Better Government for Northern Ireland. UK Government.

## BIOGRAPHICAL NOTES

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Between 1986 and 1999 he worked for the Ordnance Survey of Great Britain. His positions during those years included geodetic and topographic survey, strategic planning and pricing, sales and marketing, as well as a number of management consultancy inputs in Swaziland and Lesotho and technical consultancies supporting land reform in Eastern Europe. Iain is a Chartered Surveyor (MRICS), a Fellow of the Irish Institution of Surveyors (FIS) and a member of the Chartered Institute of Marketing (MCIM). He was between 1998 and 2006 the head of the RICS delegation to the International Federation of Surveyors (FIG), and is Chair of the FIG Standards Network. He is also a member of the Management and Editorial Boards of the journal Survey Review. He has published a range of articles and papers on geodetic surveys, business and management practices, sales and marketing, and standardisation.

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