Introduction

While there has been some criticism of cost-benefit analysis to justify government expenditure over the years there is no doubt it is still one of the best tools to support a business case for a new initiative. One of the strengths of cost-benefit analyses is that they present a structured approach to assessing alternative strategies for developing different initiatives and in this case, land and geographic information systems. It provides two basic indicators to help decision making - first the net benefits in monetary terms and second, a benefit to cost ratio. Both are good indicators for justifying a business case.

The more rigorous cost-benefit analyses also include discounting, sensitivity analysis and risk assessment to make the monetary estimates of the costs and benefits more realistic.

Since land and geographic information systems are at best a mixed good, a simple assessment of profitability in terms of profitability ratio, net present value, internal rate of return or payback period is usually conservative when assessing the value of such initiatives to a state or jurisdiction. Cost-benefit analyses however allow at least the documentation of the intangibles to support the decision making process that is often political and visionary in nature.

The cost-benefit analysis undertaken by a consultant for the Victorian Government in 1993 to determine the costs and benefits of developing the Government's approach to managing and using land and geographic information systems is an excellent example to review since the process was a success. Government ministers accepted the resulting vision and the cost-benefit analysis, with a result government departments have commenced implementing the broad strategy set out in the consultant's report.

The study into the State's geographic information systems was also timely. Without doubt Victoria had lacked political leadership and commitment in the management of spatial and land related data for nearly a decade. As a state, Victoria had slipped from being a leader in Australia, with strong international respect, to a position significantly behind the "pack". While there had been some very good individual initiatives in Government, overall the State had not capitalised upon the enabling information technologies for the management of spatial data.

However there were some significant constraints and limitations placed on the GIS Study which to some degree have limited its usefulness. For example the study was only concerned with the inner sector of government and not the outer sector, i.e. it was not concerned with local government or utility organisations which in one sense are the major users of spatial information. Needless to say it was not concerned with the private sector. In addition the terms
of reference did not permit it to look at institutional arrangements or administrative structures within government. This latter aspect has presented significant difficulties in implementing the strategy. Even recognising the restrictions, the study has proved successful in gaining the attention of government ministers and instigating a period of reform in the spatial information sector in government which hopefully will see the State of Victoria again achieving a position of leadership within Australia in this area.

**Choice of Consultants**

The Government of Victoria appointed an overseas consultant to undertake the GIS Study and associated cost-benefit analyses. Some of the benefits of bringing in independent consultants are that they have experience in the development of land and geographic information systems in other organisations. There is also an expectation that they have more up-to-date knowledge of the state-of-the-art technology or procedures which are best suited to a particular purpose.

A key in the appointment of an overseas consultant from the Victorian perspective was to reduce bias in the evaluation of the current status and alternative strategies that could arise because of possible hidden agendas or personal interests of the stakeholders. Another perceived advantage is that an overseas consultant would have been able to assume an independent unbiased role which is more likely to be accepted by the stakeholders, particularly if they are suspicious of each other or not sure of their own positions.

The appointment of the overseas consultant to this consultancy did not necessarily achieve all the objectives from the point of view of the stakeholders, but again it must be remembered that the study itself was a success overall in that it convinced the Government of the need for action and has continued to be a catalyst for change.

**Cost Benefit Methodology**

For a detailed review of the results of this GIS consultancy and associated cost-benefit study, reference should be made to the publications by the State Government of Victoria (OGDC, 1993). For a different view of the environment in which the cost-benefit analysis was undertaken, reference should also be made to the paper by Williamson (1992) titled "Cadastral Reform and The Politics of Land and Geographic Information Systems".

The cost-benefit study followed standard methodology. First a range of information products were identified in each organisation. Through detailed interviews, a description of benefits and costs was identified with the stakeholders. This information then provided the source data for the cost-benefit analysis. The data was fed into the cost model which then developed a cost-benefit ratio by discounting the costs and benefits at 7% per annum over a 6-year analysis period.

The consultant determined the parameters for each data set with staff in each agency. This included the cost of acquisition and creation of data, the size of the database and issues concerned with maintenance. From these investigations data costs were estimated.

Computer processing requirements were estimated by determining the requirement for GIS software functionality to create the required products. Together with the products and the frequency of production, hardware requirements were determined which took into account data availability, product priority, implementation requirements and institutional factors. This resulted in an estimation of hardware costs.

The data costs together with the hardware costs were added to information such as costs associated with current hardware, software, staff and accommodation. This then provided the cost component for a cost model.
For each information product, the respective agency staff were asked to give a description of the benefits, to quantify and schedule them, assuming full implementation. These constituted the benefit component of the cost model which was estimated by agency staff.

In general the benefits identified included qualitative and quantitative benefits. They included both internal and external benefits to the State. These included lower costs, time savings (fewer staff, more output, improved output, new products), increased demand for data, increased income, reduced liability (litigation or complaints), reduced expenditure (for example, in works contracted out), better decisions, improved resource utilisation, external benefits (to external agencies through provision of more timely and accurate information and introducing greater efficiencies from increasing the throughput in transactions due to shorter, less frequent meetings).

The consultancy cost about AU$1 million and took approximately 18 months.

Results of the Study

A review of the digital mapping and GIS situation in Victoria in 1991 showed that the State had spent approximately AU$130 million over the previous decade in this area. The difficulty facing the Government was that repeatedly the cost-benefit ratios which were expected to be of the order of 1:2.5 did not eventuate. In addition there were no agreed GIS priorities in the Government with regard to data acquisition, the priority of outputs, data standards, or appropriate structures for sharing spatial data. There were also very few staff with GIS skills in Government.

Overall there was a lack of policy level direction and coordination of GIS activities in the State with virtually no GIS planning and management experience within Government.

The study provided a vision for the Government and identified cumulative benefits of AU$312 million from an investment of AU$56 million discounted at 7% over a 6-year period. This gave a cost-benefit ratio of 1:5.5.

The study highlighted that spatial information is an asset and must be managed. It highlighted that there was a need for well coordinated planning of the State's geographic data resources. The study outlined a comprehensive plan for the development of 61 information products from 270 data sets to meet the information needs of 5 key areas of State Government.

The consultant recommended a number of actions which should be undertaken to achieve the vision set out in the consultancy report.

Evaluation of Study

The strategy adopted by the Government highlighted that there was a great shortage of educated and informed users about land and geographic information systems within government. There is recognition in the report that for the strategy to be successful there will have to be a major commitment to education and training, otherwise costly errors, public liability and the possibility of the destruction in the confidence of the system, might occur. The strategy highlighted that the availability of skilled people would probably be the greatest limitation on GIS use in government in the next decade.

It must be recognised that the GIS strategy developed by the consultant and the resulting cost-benefit analyses was looking at maximum possible benefits albeit in many cases a reasonably conservative position was adopted. However the benefits were based on the resolution of many problems and issues if the strategy was to return its maximum benefits. These included:

Legal issues
data security, access and privacy issues
introduction of unique identifiers for all parcels
charging policies for data and data access
determining the responsibility and public liability of data
obtaining access to different organisations and data sets
developing appropriate institutional arrangements to support GIS
the reconciliation of land assets within organisations
unification of state land tenures to improve efficiency and facilitate incorporation in GIS

Technical issues

development of appropriate spatial data transfer standards
development of data communications and communication protocols
developing individual data modelling and database design experience
resolving data accuracy issues
resolving data integration issues
resolving updating of digital cadastral database(s) issues
enhancement of the existing digital cadastral database
topologically structuring existing data sets

Application needs

specific GIS application development expertise
experience in customising and programming individual systems
improving decision making using GIS

Most people familiar with the development of land and geographic information systems will recognise that the above issues are common to the establishment of most systems in developed countries worldwide and are in general being faced by most governments in Australia as they develop state wide land and geographic information systems. Therefore the achievement of the stated benefits must be treated with caution if realistic benefits are to be quantified.

Recent Developments

To implement the GIS strategy in Victoria, the Government established the Office of Geographic Data Co-ordination (OGDC) and gave a priority to completing both the digital cadastral database and digital topographic database of the State. The digital cadastral database is now complete (although it now needs to be updated on a regular basis) with the digital topographic database planned for completion by the end of 1994. The OGDC is also giving a high priority to the establishment of a digital road network database for Victoria.

Recognising the issues and problems to be solved before the full benefits of the study can be achieved, the Victorian Government to its credit has made a major commitment to education, training, and research and development in the broad area of spatial information systems and technology.

Another important development has been the establishment of a branch of the OGDC called "Geographic Data Victoria (GDV)" which owns and manages the digital cadastral database for the State. Of interest GDV has been structured in a form such that it can be easily privatised.

Conclusion

The GIS consultancy and associated cost-benefit analysis to determine a GIS strategy for the State of Victoria must be considered a success since it has established a blueprint for the State on which to move forward and it convinced the Government to support a statewide GIS initiative.
However, the Study also highlights that cost-benefit analyses are never perfect. The benefits stated in the Study are predicated on solving many of the thorny issues which have been bedevilling the establishment of land and geographic information systems for over a decade. At the same time the GIS Study had some significant restrictions within its terms of reference which made it very difficult for the Study to be much more than a technological review of how to capitalise on the enabling GIS technologies within the Victorian Government. As such it is a very valuable exercise and provides many lessons on what to do and some on what not to do.

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