Achieving Business Success with GIS

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Contents

Preface

Geographic Information Systems (GIS) are a mainstream technology with a vital and growing use across all industries, including natural resources, oil and gas, military, environment, education, insurance, transport and logistics, land administration, utilities and many more. Geographic (or geospatial / spatial) Information Systems[1] are typically focused on storing data which has a geographic location, undertaking analysis of that data, integrating that data with other data types and presenting that data for decision support, usually in the form of a map.

GIS has been used since the late 1970s by an increasing number of organisations. However, in a large number of cases it remains under-utilised and often has not provided the business benefits originally envisaged. Of course, most software vendors would say that any such problems could be solved by buying their product – but this is not correct of course. To make 'GIS work' requires more than just a simplistic software approach – it requires understanding the business environment of the host organisation and how this technology can be used to address real business issues.

This book explores the *business* environment of making GIS successful. It does not discuss specific technology per se, but provides a business-focused rationale for using spatial technologies to address real business problems.

If the reader is seeking a book about the specific functionality of GIS software (or genres of software), then this is not the book for you. There are a number of excellent books available which examine the technology of GIS, delve into the different aspects of the software, look at polygon management, discuss layers, focus on Boolean logic, explain how linear topology and dynamic segmentation work, describe web feature services, discuss database concepts and so on. This book does not cover any of these technical issues, except in broad terms, and only then on the basis of how these issues might assist the GIS to successfully deliver business outcomes.

This book discusses business issues, that is, how to develop a GIS strategy, how requirements should be defined, how to select and implement the most *appropriate* GIS, the issues which need to be considered to ensure success when using GIS and issues relevant to the spatial industry. Above all, this book seeks to provide the mechanism so that spatial technologies support and enhance the delivery of business benefits to the organisation implementing the technology.

As management consultants in the spatial information industry, Corporate GIS Consultants are regularly involved in working with organisations (mainly government agencies and utilities) to determine whether the spatial information technology used in the subject organisation meets actual business requirements, and, if it does not, to determine what needs to be done so that it can meet these business needs.

While many organisations have used GIS for a number of years, and in some cases invested many millions of dollars in this technology, a high percentage have yet to gain

[1] GIS, Geographic, GeoSpatial and Spatial all generally mean the same thing and are used interchangeably in this book.

appreciable business benefits. This may be due to a number of issues such as the business needs not being fully defined in the first place, the impact of GIS on current / potential business processes not being fully understood, staff not being adequately trained, etc. An incorrect business focus on GIS may result in the usefulness of this technology being sub-optimal.

Why geographic or spatial? It is because a picture tells a thousand words. This is true for computer-based systems as well as paper-based systems. The human brain is excellent at processing images and drawing solutions from complex spatial patterns. Spatial systems can present complex numerical data as simple images which the human brain can more easily process to provide the basis for a better understanding of complex situations involving lots of data and, hopefully, to make better decisions.

This book is focused on helping readers to achieve business success with their GIS, and would therefore be just as appropriate to the business unit line-manager who may be responsible for the GIS as well as the student trying to understand how to make GIS successful. I trust that this book is useful.

Bruce Douglas

Acknowledgements

The development of this book has been a lengthy and sometimes painful process, particularly when one also has a day job. I would like to thank a number of friends and business colleagues who have provided assistance, support and encouragement for me to continue with this book.

In particular, I would like to thank Carole Lowe, my business partner and co-Director of Corporate GIS Consultants, for her support and assistance with the book, Jon Fairall from South Pacific Science Press for his suggestions on the content and structure of the book and Thierry Gregorius from Shell in The Netherlands for his detailed review of the book. In addition, many thanks to the publishers and their reviewers who thought that this book had some merit and should be published.

Bruce Douglas
June 2007

1 Introduction

GIS technology has been used in a variety of government and semi-government organisations since the late 1970s. However it has only been in the last two decades that GIS has become a technology which has permeated almost all facets of government, utilities and commercial organisations which have an interest in matters relating to:

- land (e.g. ownership, leasing/licensing, etc.);
- services on, under or over the land (e.g. utility services – pipes, drains, power networks, telecommunications, etc.);
- commercial activities on or about the land (e.g. mining, agricultural, land development, property, banking, real estate, transportation, environmental, planning, etc.); and
- other matters which relate to land and property (e.g. policing, emergency services, etc).

As such, GIS has become a pervasive technology in a number of organisations. Along the way GIS has also become mainstream and now sits alongside Finance Systems, Human Resource Systems, Asset Management Systems and Customer Management Systems in the Information Technology (IT) environments of government departments, utilities and private companies.

GIS now typically runs on Microsoft® Windows™ platforms on corporate networks and most desktops – a significant change from 5 or 10 years ago when GIS used to be very expensive technology running on isolated Unix-based workstations/networks used only by highly trained gurus. The demise of the use of Unix for GIS is shown in the following chart.[1] This can also be directly correlated with the use of the Windows™ operating system as the corporate desktop and the migration of most GIS software to this platform.

Since the 1970s, GIS has been used to computerise basic land parcel information, but has since grown over the last couple of decades to include a plethora of applications, such as using GIS for:

- managing assets and services;
- managing land-related information;
- managing customers for service delivery (whether it is for delivery of water services or postal items);
- integrating information from other (often disparate) systems;
- inclusion into Police and Emergency Services computer-aided dispatch systems;
- modelling transportation systems; and
- monitoring and management of environmental and forestry issues.

[1] Source: GIS/Spatial Best Practice Surveys, Australia and New Zealand, Corporate GIS Consultants 2000–2006.

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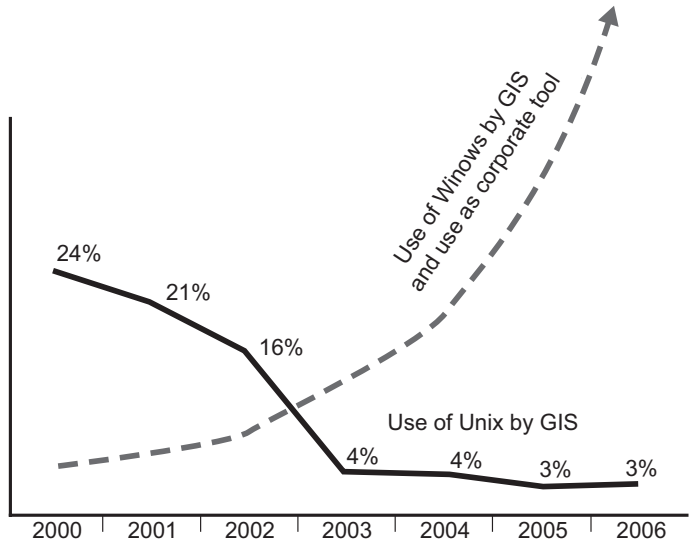

As a technology, GIS is principally focused on:

- capturing/converting/storing spatial or geographic data (sometimes also called geospatial data), i.e. data which has a location on, over or under the surface of the earth;
- undertaking analysis of that data;
- integrating that data with other data types; and
- presenting that data for decision support, generally in the form of a map, perhaps with associated tables or charts.

Therefore a GIS can be defined as a computer system that stores, manages, displays, analyses and reports on information which has a 'where' component, i.e. a location, because a number of decisions undertaken by staff in land-related organisations often refer to 'what', 'where', 'how much', 'what does this relate to' and 'how does this relate to my other data'. The inclusion of the 'where' component into the decision-making process can be a powerful tool for providing a better understanding of the issues at hand and the implications of specific decision paths.

GIS environments most often consist of two major components: the spatial or graphic data which represents real-world entities; and the aspatial or textual data which describes the attributes of those real-world entities. This data is then accessed by software which can relate each item of both the graphic and textual data to each other to provide information to the user.

Because spatial data is just that – spatial – a key feature of a GIS environment is that each spatial entity intrinsically knows the relationship of itself to other spatial entities. For example, the relationship of a street to a bus stop on that street can be derived from the GIS without the need to have a specific relationship defined in the database that relates the particular bus stop to the specific street.

Case example

Spatial systems do not need to have relationships built to link data as do traditional IT systems which link data by 'common keys' in a textual database.

On a recent very large project (70 developers) to implement a national GIS, we found that some of the IT developers were designing and developing a method to build relationships between spatial data in a traditional Relational Database without understanding that they had a very sophisticated GIS system which did just that. Needless to say, I stopped them from doing this and arranged for them to have the requisite training so that they understood how spatial systems worked.

A GIS typically contains a considerable amount of spatial data, often referenced to a 'map base' containing data on topography, property, roads, railways, parks etc. to provide a map context to the data being used. The map base is usually a mathematically defined representation of the surface of the earth, typically represented as a map projection stored as Cartesian coordinates such as easting and northing or Latitude and Longitude coordinates.

The most obvious advantage of representing 'where' data in a GIS can be derived from the visual representation of data presented in map form. When this is also combined with other information about the data item, such as what the entity is, how much it costs, what it relates to, etc., more powerful relationships can be determined. For example, the location or spatial distribution of socio-economic data (e.g. income) can be a very useful tool in planning for the provision of government services, etc.

As such, the inherent spatial relationships within the map data can provide powerful benefits that might not be initially obvious, such as:

- finding the relationship of different data themes – e.g. '*show me the spatial distribution of car ownership compared with bus route locations for these suburbs*';
- finding items at a given location – e.g. '*show me all the planning constraints on a property at this location*';
- finding locations where certain conditions are met – e.g. '*show me where all the contamination is within 100 metres of this watercourse, particularly that contamination that has not been remediated within the last 5 years*';
- identifying trends and spatial patterns – e.g. '*show me all water pipes that have failed more than twice in the last 2 years and correlate this information with telemetry data pertaining to pipe pressure*';
- scenario modelling – typically used to assess or distinguish between a set of proposed options, for example assessing the merit of installing new infrastructure as opposed to upgrading existing infrastructure.

So GIS can be a powerful tool to represent and analyse spatial data. But in order to do this, the GIS must have a lot of data captured, and that data must be relevant to the queries being run (i.e. a query involving planning constraints must use the latest planning data) and must be as correct/accurate as possible.