Achieving Business Success with GIS

BRUCE DOUGLAS Director, Corporate GIS Consultants, Australia



Achieving Business Success with GIS

Achieving Business Success with GIS

BRUCE DOUGLAS Director, Corporate GIS Consultants, Australia



Copyright © 2008 John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England

Telephone (+44) 1243 779777

Email (for orders and customer service enquiries): cs-books@wiley.co.uk Visit our Home Page on www.wiley.com

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except under the terms of the Copyright, Designs and Patents Act 1988 or under the terms of a licence issued by the Copyright Licensing Agency Ltd, 90 Tottenham Court Road, London W1T 4LP, UK, without the permission in writing of the Publisher. Requests to the Publisher should be addressed to the Permissions Department, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England, or emailed to permreq@wiley.co.uk, or faxed to (+44) 1243 770620.

Designations used by companies to distinguish their products are often claimed as trademarks. All brand names and product names used in this book are trade names, service marks, trademarks or registered trademarks of their respective owners. The Publisher is not associated with any product or vendor mentioned in this book.

This publication is designed to provide accurate and authoritative information in regard to the subject matter covered. It is sold on the understanding that the Publisher is not engaged in rendering professional services. If professional advice or other expert assistance is required, the services of a competent professional should be sought.

Other Wiley Editorial Offices

John Wiley & Sons Inc., 111 River Street, Hoboken, NJ 07030, USA

Jossey-Bass, 989 Market Street, San Francisco, CA 94103-1741, USA

Wiley-VCH Verlag GmbH, Boschstr. 12, D-69469 Weinheim, Germany

John Wiley & Sons Australia Ltd, 42 McDougall Street, Milton, Queensland 4064, Australia

John Wiley & Sons (Asia) Pte Ltd, 2 Clementi Loop #02-01, Jin Xing Distripark, Singapore 129809

John Wiley & Sons Canada Ltd, 6045 Freemont Blvd, Mississauga, ONT, L5R 4J3, Canada

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books.

Library of Congress Cataloging-in-Publication Data

Douglas, Bruce, 1952– Achieving business success with GIS / Bruce Douglas.
p. cm.
Includes index.
ISBN 978-0-470-72724-9
1. Geographic information systems—Management.
2. Information technology—Management.
I. Title.
G70.212.D68 2008
658.05—dc22

2007033358

Typeset in 10.5/12.5pt Times by Aptara Inc., New Delhi, India. Printed and bound in Great Britain by Antony Rowe Ltd, Chippenham, Wiltshire This book is printed on acid-free paper responsibly manufactured from sustainable forestry in which at least two trees are planted for each one used for paper production.

Contents

Preface			vii
Acknowledgements			
1	Intr	oduction	1
2	The Spatial Information Industry		7
	2.1	Background to the Survey	8
	2.2	Value of the SI Industry	9
	2.3	GIS Product Usage	13
	2.4	Spatial Applications	17
	2.5	Training	19
	2.6	Spatial Data	21
	2.7	Imagery	26
	2.8	Mobile Computing	28
	2.9	Regional SI Initiatives	29
	2.10) Summary	30
3	Intr	oducing the Elements of a GIS Strategy	33
	3.1	The Traditional IT Strategy Approach	34
	3.2	The SI Strategy Approach	36
	3.3	Influences of Disruptive and Distractive Technology	37
4	Dev	eloping the Business Focus	41
5	Dev	eloping the Data/Information Focus	47
	5.1	Introduction	48
	5.2	Metadata	48
	5.3	Data/System Architectures	49
	5.4	Defining the 'Data Gap'	53
	5.5	GIS Data Standards and Related Issues	59
	5.6	GIS Data Interoperability	61
	5.7	Summary – Data Interoperability	64
	5.8	Summary – the Data/Information Focus	64
6	Developing the Organisational Focus		
	6.1	Introduction	65
	6.2	Impact of Organisational Structure on GIS	66
	6.3	Achieving an Organisational Focus for GIS	67
	6.4	Business Process Mapping and Re-engineering	69
	6.5	Training and Support Issues	71

Index		155	
Glossary			
Clos	ing Remarks	151	
12.3	And the Worst is	149	
12.2	And the Best is (also) Web 2.0	148	
12.1	And the Best is Google Earth	147	
The	Best and the Worst	147	
11.7	Summary	145	
11.6	Benchmarking	144	
11.4	Indertaking a Post Implementation Review	143 144	
11.3	Defining the KPIs (Goalposts) for Successful Implementation	143	
11.2	Data Capture and/or Conversion	141	
11.1	Staff Training	139	
Implementing GIS		139	
10.3	The Final Stage of the Selection Process	136	
10.2	Selecting a GIS using a Tendering Process	121	
10.1	Introduction	119	
Seleo	cting a GIS	119	
9.5	Conclusion	117	
9.4	Business Case	117	
9.3	Broad Cost/Benefit Summary	113	
9.2	Broad Benefits	107	
9.1	Broad Costs	93 97	
Cost	/Renefit Analysis/Return on Investment	95	
8.4	Summary	93	
8.3	Developing the GIS Strategy	93	
8.2	Correlating against the CSFs	92	
8.1	Functional Requirements Specification (FRS)	91	
Developing a GIS Strategy			
7.4	Developing the Functional Requirements Specification	87	
7.3	System/Data Integration Issues	85	
7.2	IT Issues	83	
7.1	GIS Issues	75	
Developing the Application and Technology Focus			
6.7	Summary – Organisational Focus	73	
6.6	SWOT Analysis	72	
	ACHIEVING BUSINESS SUCCESS WITH GIS		
	6.6 6.7 Deve 7.1 7.2 7.3 7.4 Deve 8.1 8.2 8.3 8.4 Cost 9.1 9.2 9.3 9.4 9.5 Selec 10.1 10.2 10.3 Impl 11.1 11.2 11.3 11.4 11.5 11.6 11.7 The 12.1 12.2 12.3 Clos	ACHIEVING BUSINESS SUCCESS WITH GIS 6.6 SWOT Analysis 6.7 Summary – Organisational Focus Developing the Application and Technology Focus 7.1 GIS Issues 7.2 IT Issues 7.3 System/Data Integration Issues 7.4 Developing the Functional Requirements Specification Developing a GIS Strategy 8.1 Functional Requirements Specification (FRS) 8.2 Correlating against the CSFs 8.3 Developing the GIS Strategy 8.4 Summary Cost/Benefit Analysis/Return on Investment 9.1 Broad Costs 9.2 Broad Benefits 9.3 Broad Cost/Benefit Summary 9.4 Business Case 9.5 Conclusion Selecting a GIS 10.1 Introduction 10.2 Selecting a GIS using a Tendering Process 10.3 The Final Stage of the Selection Process 11.3 Defining the KPIs (Goalposts) for Successful Implementation 11.4 Implementing and 'Setting to Work' of the GIS 11.5 Undertaking a Post Implementation Review 11.6 Benchmarking 11.7 Summary Che Best and the Worst 12.1 And the Best is Google Earth 12.2 And the Best is (also) Web 2.0 12.3 And the Worst is Closing Remarks	

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 Systems¹ 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.



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.