What if GIS was in short supply or disappeared?

- The DAY GIS Stood Still

Spatial information in the New Zealand economy – August 2009. The use and re-use of spatial information is estimated to have added $1.2 billion which is 0.6% of GDP.

Similar studies done by non-GIS economists and consultants.

Cy Smith and King County put up $10K each to do a study for a local government agency.

Who should do the study? Financial Analyst? University?

Goals and objectives

- ✓ **What was the net financial benefit to King County of developing, implementing and utilizing GIS – since inception?**
- ✓ **What is/was the current annual ROI from GIS?**
- ✓ **What is an appropriate scientific methodology for determining GIS ROI?**

Greg was at the same time working on his maturity survey.

What if you find out there is no return on investment?

Benefit-cost analysis (BCA) and Cost-benefit analysis (CBA) will refer to estimating, calculating, and/or forecast a future financial benefit from some expenditure of financial or equivalent resources

Return on Investment (ROI) will refer to documenting with as much accuracy as possible the actual past or present financial benefit from some expenditure of financial or equivalent resources

BCA Example: should we get ArcGIS Indoors?
Forward looking

BCA Example: should we get ArcGIS Indoors?
Forward looking

Lightbulb moment: perhaps we have trouble selling the importance of the Office the GIO and position of the GIO because there is no direct benefit to the ITS, the office that hosts the GIO.

- If GIS went away at ITS it may just mean one less headache for leadership rather than a loss of a valuable resource.

1 - How organizations achieve their goals and objectives

- Except for enterprises whose business is to provide GIS services or technology, investment in GIS assumes that it will help the entity that employs it to achieve its goals and objectives through ongoing operation. This is true also of typical government agencies.
- Organizational goals are tied to a portfolio of business products and services that are provided to customers.
- Boeing primarily sells aircraft and aircraft-related services to its customers. Why would Boeing do anything that does not support achieving these goals?
- Public agencies might be responsible for providing public health services, regional transit, sewerage systems, property assessment and taxation, public safety, courts, etc.
- A company or public agency achieves its goals by employing or otherwise acquiring a variety of resources or assets that are needed to cost-effectively provide the services within its portfolio.

Think about how GIS benefit your agency – your organization. In our case – our State.

For it's the benefits should perhaps be communicated to the agencies "we serve" at the IGO, and have those agencies demand GIS resources from ITS

How can GIS compete effectively in the agency budget process, to obtain a reasonable allocation of the jurisdiction's financial resources to enable it to support its end-users?

- Tip: maintain your own GIS expense information, even if this is part of the overall budget
- Concept of Best Run Governments. Organizations that promote this are aware of GIS Benefits
- Compare Counties with and without Open Data philosophy. Other studies have shown significant differences in benefit to its citizen
- Starbucks or Costco without GIS would be different/ worse

3 - The societal benefits of GIS

Articulating the societal benefits of GIS:

Non-financial

- ✓ Open government
- ✓ Best-run government
- ✓ Open data
- ✓ Better decision support
- ✓ To comply with mandates – GIS use may be mandated
- ✓ Competitive advantage
- ✓ Citizen expectations
- ✓ Employee expectations
- ✓ Others….?

3 - The societal benefits of GIS

Articulating the societal benefits of GIS:

Financial benefits within organizations

- ✓ As a decision support tool
- ✓ Related to the cost of performing agency functions that have a geographic component…
- ✓ All cities do routine geospatial related workflows….

al benefits across society

savings to access data (normal business hours v 24 x 365)

bles more competitive business (imagine Starbucks, UPS, Costco, etc. without GIS)

ss to data for free?

ss to data for a fee?

- ✓ GIS as public infrastructure
- ✓ Others….?

OBSERVED GENERIC MUNICIPAL TASKS

1. AQUIRE/DISPOSE PROPERTY
2. PROCESS/ISSUE PERMITS
3. PERFORM INSPECTIONS
4. ISSUE WORK ORDERS
5. ISSUE LICENCES
6. CONDUCT STREET NAMING
7. MANAGE MAILING LISTS
8. REVIEW/APPROVE SITE PLANS
9. REVIEW/APPROVE SUBDIVISIONS
10. PERFORM STREET ADDRESSING
11. PERFORM EVENT RECORDING
12. DISPATCH VEHICLES
13. PERFORM VEHICLE ROUTING
14. CONDUCT TRAFFIC ANALYSIS
15. ALLOCATE HUMAN RESOURCES
16. SITE FACILITIES
17. CONDUCT AREA DISTRICTING
18. MANAGE/SURVEY FACILITIES
19. MANAGE INVENTORIES
20. MANAGE RESOURCES
21. ADMINISTER ZONING BYLAWS
22. PREPARE OFFICIAL/SECONDARY PLANS
23. CONDUCT ENGINEERING DESIGN
24. CONDUCT DRAFTING
25. MAINTAIN TOPOGRAPHIC DATA BASE
26. MANAGE DRAWINGS
27. DISSEMINATE PUBLIC INFORMATION
28. CONDUCT DEVELOPMENT TRACKING
29. RESPOND TO PUBLIC ENQUIRIES
30. CONDUCT TITLE SEARCHES
31. BILL/COLLECT TAXES AND FEES
32. MANAGE DATA BASES/SYSTEMS

- Jack D's list of tasks that GIS could do. Created to show need to create ArcInfo

The basic problem remains –

GIS budgets consume a significant portion of a typical agency's total financial resources.

A recent Puget Sound / Seattle area study of local agency GIS budgets found a range of 0.101% to 0.513% and an average of 0.258% of total budget for GIS.

GIS budgets are a target for reduction or elimination to free up resources for other programs – can't we just use Google Maps for our GIS?

How does GIS justify its share of the agency budget – today and throughout the future?

We need to be able to articulate and document the benefits of GIS – including the financial benefits!

4 - Fundamentals of future GIS benefit-cost analysis

Benefit–cost analysis, is a systematic approach to estimating the strengths and weaknesses of alternatives. It is used to determine options which provide the best approach to achieving benefits while preserving savings in, for example, transactions, activities, and functional business requirements.

CBA has two main applications:

- *To determine if an investment (or decision) is sound, ascertaining if – and by how much – its benefits outweigh its costs.*
- *To provide a basis for comparing investments (or decisions), comparing the total expected cost of each option with its total expected benefits.*

-Wikipedia

- If there is money… do we digitize more data or buy a new truck?

4 - Fundamentals of future GIS benefit-cost analysis

Major project or new implementation focus

Can usually assume that existing GIS infrastructure and resources are already in place and a 'sunk cost'

Determine the cost of the project:

- Develop a scope of work
- From the scope of work develop a work-breakdown structure
- From the WBS, develop a level of effort and associated cost estimate
- Include non-labor costs
- Calculate a contingency budget and management reserve budget

Work with the client to develop and document a statement of expected benefits:

- Future labor savings
- Increased productivity
- Other cost savings
- Other revenue generation

Calculate the break-even point/date and the expected net financial benefits after a defined period

- Its worthwhile to spend some time to give a breakdown of costs for a project instead of a ballpark figure.

4 - Fundamentals of future GIS benefit-cost analysis

Natural Resources Habitat Database Inventory Project
Project Goal: Acquire Baseline Habitat Data for Change Analysis
Cost Estimate

Task	Description	Assumptions	Unit Cost	Est. Hours	Labor Cost	Other Cost	Cost Estimate	Risk Level
0	Project Management	12 week project	$ 95	24	$ 2,280		$ 2,280	L
1	Data Acquisition	Contact 10 external agencies & acquire data	$ 80	80	$ 6,400		$ 6,400	M
2	Data Analysis	Identify data redundancy & fit/gap analysis	$ 80	40	$ 3,200		$ 3,200	M
3	Acquire Data Server	Off the shelf per client specifications	$ 80	8	$ 640	$ 2,000	$ 2,640	L
4	Create Non-Redundant Datasets & Load Server	Assume Data from 8 Agencies	$ 80	40	$ 3,200		$ 3,200	M
5	Map Habitats	Assume 10 Habitat Categories	$ 60	160	$ 9,600		$ 9,600	H
		Sub Total:		352	$ 25,320	$ 2,000	$ 27,320	
		Contingency:					$ 3,278	
		Management Reserve:					$ 1,366	
		Total Project Estimate:					$ 31,964	

4 - Fundamentals of future GIS benefit-cost analysis

GIS benefit-cost analysis recommendations…

1. For client GIS service requests – require a brief 'benefits statement' – financial and non-financial.
2. For major GIS projects – in the GIS Use Case, include a section on financial benefits
3. If your GIS has a project priority-setting process, include BCA analysis as part of the selection criteria
4. For both custom maps and applications, include an abstract that describes the intended use of the GIS product
5. For major projects and on a periodic basis, document and socialize actual financial benefits achieved from GIS

- November 2021. Cost Benefit Geographic Information Systems. Baltimore County
- Don't have a GIS consultant do the ROI study. Oregon used Professor of Public Affairs at Duke university. He had four students do the study. They did no have GIS background.
- Society for Benefit studies
- Oregon/ King County spend $20K

The King County GIS ROI Study

Zerbe Methodology:

- 'With versus without' research design.
- What would have happened if KCGIS applications had not been implemented and how is King County better off having them?
- Literature review and qualitative interviews will identify key benefits associated with GIS applications (e.g., increased productivity).
- Questionnaire will allow assessment of the extent to which these benefits have been realized across different groups of users of GIS applications, as opposed to what these users would have done in the absence of GIS applications.
- By comparing the 'with and without' scenarios, we can assess and monetize the added value of the GIS applications to compare to the costs of implementation, maintenance, and/or additional training.'

The King County GIS ROI Study

Scope of Work:

1. Literature Review
2. Qualitative Interviews (n = 30)
3. Quantitative Survey (n = 200)
4. Final ROI Report
5. Revised Interview/Survey Instruments for future studies

- The published their methodology.

The King County GIS ROI Study

- Results of the ROI Study

Year	Capital Costs	GIS PM Office Costs	KCGIS Center O&M Costs	Agency GIS Unit Costs	Agency GIS End-User Staff Costs	Annual Total GIS Costs
1991	$ 100,000	$ 104,000			$ 6,000	$ 210,000
1992	$ 100,000	$ 104,000			$ 6,000	$ 210,000
1993	$ 729,667	$ 104,000			$ 6,000	$ 839,667
1994	$ 2,173,667	$ 416,000		$ 400,000		$ 2,989,667
1995	$ 3,756,667	$ 416,000		$ 500,000		$ 4,672,667
1996	$ 2,512,000		$ 1,373,000	$ 600,000		$ 4,485,000
1997	$ 528,000		$ 1,760,000	$ 8,204,352	$ 703,300	$ 11,195,652
1998	$ 98,500		$ 1,477,000	$ 8,204,352	$ 2,003,300	$ 11,783,152
1999	$ 207,833		$ 1,099,000	$ 8,204,352	$ 2,919,800	$ 12,430,985
2000	$ 182,833		$ 1,134,000	$ 8,362,432	$ 2,926,300	$ 12,605,565
2001	$ 182,833		$ 1,077,000	$ 8,362,432	$ 2,926,300	$ 12,548,565
2002			$ 2,430,000	$ 5,675,072	$ 3,153,150	$ 11,258,222
2003			$ 2,777,000	$ 4,483,149	$ 4,961,720	$ 12,221,869
2004			$ 3,082,000	$ 4,479,987	$ 7,323,206	$ 14,885,194
2005			$ 3,148,000	$ 4,641,229	$ 6,865,133	$ 14,654,362
2006			$ 3,470,000	$ 4,584,320	$ 6,702,160	$ 14,756,480
2007			$ 4,058,000	$ 3,944,096	$ 6,869,797	$ 14,871,893
2008			$ 4,107,000	$ 4,339,296	$ 6,892,954	$ 15,339,250
2009			$ 3,884,000	$ 4,315,584	$ 6,578,260	$ 14,777,844
2010			$ 4,269,000	$ 3,975,712	$ 6,396,945	$ 14,641,657
Total:	$10,572,000	$1,144,000	$39,145,000	$83,276,365	$ 67,240,325	$ 201,377,690

Table 8: Yearly GIS Costs as Provided by King County GIS Center

5 - Return on investment basic concepts

KCGIS GIS ROI Study Results

Results: We find that GIS technology appears to be an efficient, highly beneficial investment for King County. The full report presents various figures, but the most conservative estimate presented finds that the use of GIS has produced approximately $775 million in net benefits over the eighteen year period from 1992 to 2010.

It is clear that the use of GIS by the County has been hugely beneficial. An analysis of the survey responses indicate that overall the use of GIS – compared to not having the GIS technology -- had a net benefit of approximately $180 million for the year 2010 alone. This estimate assumes that the quality and usefulness of GIS reports remains at the same level as pre-GIS. In reality, we expect that the value of GIS-produced outputs is almost certainly higher than comparable outputs the County produced in years prior to the implementation of GIS technology. Nevertheless, on the assumption that the marginal value of output has decreased (a linear, downward sloping demand curve) we find a lower bound estimate of net benefits of $87 million per year in 2010.[2] The benefits were broken down into benefits received from: (1) cost-savings due to more efficient production of original output; and (2) benefits generated from increased productivity beyond the original production level.

The King County GIS ROI Study

Output	Δ $/unit (Change in cost per unit produced)	Δ Q (Change in number of units produced)	Benefits from cost savings = Qpre-GIS * Δ$/unit	Benefits from increased productivity = (1/2)*ΔQ* Δ$/unit	Total benefits = Benefits from cost savings + Benefits from increased outputs
Data Collection and Data Management	*	2,230.17	*	*	*
Mapping	$25,111	272.00	$6,428,427	$3,421,379	$9,849,806
Spatial Analysis	$48,962	334.00	$587,548	$8,176,717	$8,764,265
Maps or Spatial Analysis in Support of Public Relations, Communications, or Website	$35,188	-4.50	$422,258	-$79,173	$343,085
Activities and Asset Monitoring	*	152.00	*	*	*
Planning	*	2.00	*	*	*
Emergency Response, Road Closure Notification	*	6.00	*	*	*
Custom Data, Mapping and Application Requests	-$8,797	1.25	-$175,941	-$5,498	-$181,439
Other	*	0.00	*	*	*
Total Benefits for DOT/Year			$7,262,292	$11,513,425	$18,775,718

Table 12: Benefits for Department of Transportation

ArcNews

Esri | Summer 2012 | Vol. 34, No. 2

$776 Million Saved During 18 Years

King County Documents ROI of GIS

Home to Microsoft, Amazon.com, and Starbucks, King County, Washington, has a population close to two million people. GIS is critical to serving these citizens. Today, King County's GIS program supports an estimated 1,000 county employees in 42 agencies who use GIS data and applications in their daily work.

An economist at the University of Washington

6 - Fundamentals of calculating actual return on investment

Applying the with vs. without methodology:

Return on investment analysis is an estimate. The following options describe how, with increased effort, data collection, and data validation, the reliability of the data analysis can be enhanced.

1. Base option: Compile cost data (required for every option). Also – document and analyze the benefits data compiled from the benefit option selected.

2. Basic benefits data option: A small team of core agency GIS staff and users brainstorm the number and characteristics of users across the city and estimate themselves the cost efficiencies realized from using GIS.

3. Enhanced basic benefits data option: A small team of core agency GIS staff and end-user department managers/supervisors brainstorm the number and characteristics of users across the city and estimate themselves the cost efficiencies realized from using GIS.

4. Documented benefits data option: A survey interview instrument is administered face to face to knowledgeable managers or supervisors of key GIS user agencies within the Agency. This would include identifying personas within each agency and typical GIS-user practices and with v without efficiency estimates. N = 5-25?.

5. Validated benefits data option: The data compiled in options 1 and 4, above is used to develop an online GIS usage questionnaire to be sent to all GIS end-users within the City. N = 50-250+ ?

ULTING
S+

7 - Practical considerations of using GIS ROI as a decision support tool

1. Do you do this yourself? Or use outside help?
2. Invite external peer review
3. Consult with your agency finance / budget office
4. Once your ROI is established, estimate future ROI goals
5. Estimating external financial benefits
6. Articulate the impact on ROI of reducing the current GIS cost component
7. Look for ways to reduce the cost of what your GIS program does now to generate resources for future GIS enhancements – ideas?
8. Think about and calculate the implementation status of GIS within your agency
9. Incorporate CBA/ROI thinking into GIS project use cases and service requests
10. Do you articulate the benefits of GIS in terms of hours/FTEs saved?
11. Who 'owns' the ROI?

8 - Methods of displaying and comparing results

Assuming that your GIS program demonstrates significant ROI, how do you publicize this?

1. Your website
2. Conference presentations and
3. Circle back to your senior management and the finance/budget officers you consulted
4. Circle back to everyone who participated in and contributed to the study
5. At budget development time, weave your ROI message into your budget requests
6. Report to your elected officials – written or council meeting report/presentation
7. Work with your PI officer – press release? News interview?
8. Other ideas?

GIS MANAGEMENT CONSULT
SERVICES

Reference Information

Additional resources….

The Geospatial Management Competency Model for Successful GIS Managers

- ✓ Performance management
- ✓ Financial management

The GIS Capability Maturity Model for GIS Managers (To be offered soon)

- ✓ EC 21, 22, 23 – budget and finance

Fundamentals of GIS for Elected Officials and Senior Management (To be offered soon)

ROI fundamentals:

- ✓ King County GIS ROI Study (An Analysis of Benefits from Use of Geographic Information Systems by King County, Washington, R. Zerbe, D. Fumia, T. Reynolds, P. Singh, T. Scott, and G. Babinski): https://www.urisa.org/clientuploads/directory/Documents/Journal/Vol27No1.pdf, pp. 13-27.
- ✓ Zerbe Multnomah County GIS ROI Study (as reported by FGDC): https://www.fgdc.gov/grants/2011CAP/projects/G11AC20055
- ✓ A Primer for Understanding Benefit-Cost Analysis: https://nsgic.memberclicks.net/assets/docs/Library/Zerbe-ROI-PRIMER-JAN-2011-1.pdf

Activity based costing: https://en.wikipedia.org/wiki/Activity-based_costing