

Interim Project Report - NSDI CAP Grant Category 5

MetroGIS Quantify Public Value Study

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Project Title: Measuring Public Value of Geospatial Commons: A MetroGIS Case Study

Organization: Metropolitan Council

390 Robert Street North

St. Paul, Mn 55101

<http://www.metrocouncil.org/about/index.htm>

Principal Investigators: Randall Johnson, 651-602-1638, randy.johnson@metc.state.mn.us

Francis Harvey, 612-229-7707, fharvey@umn.edu

Listing of Collaborating Organizations:

1000 Friends of Minnesota

c/o Sally Wakefield

651-312-1000, ext 207

www.1000fom.org/contact:

Hennepin County

c/o Gary Swenson

(612) 543-0797

www.co.hennepin.mn.us

MetroGIS

c/o Randall Johnson

651-602-1638

www.metrogis.org

Metropolitan Council

c/o Rick Gelbmann

651-602-1371

www.metrocouncil.org

Executive Summary (250 words)

This study proposes development of a methodology capable of quantitatively measuring public value (QPV) created when organizations actively participate in a geospatial commons. The territorial focus is Hennepin County, Minnesota; the 32nd largest county in the United States by population, and the local government jurisdictions within it. The study involves interviewing representatives of all forms of government, non-profit, utility, industry, and academic interests serving the seven-county, Minneapolis-St. Paul metropolitan area - the MetroGIS community.

Understanding public value created, when public producers of geospatial data openly share their data, is a key issue in discussions surrounding spatial data infrastructure (SDI) development and continued support. The scope of this prototyping effort has been limited to parcel data (spatial and tabular), in particular, that which adheres to standards that support interoperability. The proposed QPV methodology builds upon a Return on Investment (ROI) methodology developed by the Geospatial Information & Technology Association (GITA). The proposed modified method will not only account for direct benefit to the producer, Hennepin County but also public benefit created through reuse and chaining of data by others who use these data.

The major tasks/milestones are as follows:

- 1) Jun to Aug. 2010: Conduct ROI Analysis for Hennepin County Internal Operations
- 2) Sept. to Dec.: Define Extended ROI Methodology [aka - Quantify Public Value (QPV) Methodology 1]. Purpose: Document Enhancements Needed for SDI Environment
- 3) Jan. to Mar. 2011: Apply QPV 1 Methodology to Hennepin County
- 4) Apr.: Refine QPV Methodology
- 5) May-Jun.: Draft Final Project Report, Documenting Findings

Project Narrative

All tasks that the study team expected to complete during the study's first quarter (July to September 2010) were accomplished to the extent possible. Due to the lack of quantitative information required to complete the GITA ROI methodology, the worksheets for the Hennepin County ROI remain incomplete or with numbers based on assumptions. The issues encountered are explained below. Guidance concerning next steps is requested herein from NSDI grant administrators.

Authorized expenses incurred during this quarter totaled \$14,000, for a total to date of \$19,129.73 of the \$50,000 (38.2 percent) grant awarded to the project. Our In-Kind contribution increased \$19,539.40 this quarter for a total of \$35,656.84 toward our \$39,250 obligation, or 90.8 percent of our commitment has been met. (See Attachment 1 for a copy of Form 425.)

Major outcomes accomplished during this reporting period included:

Administrative:

- a) Prepared and submitted 2nd Quarter Project Report in July.
- b) Updated public facing project [website](#).
- c) Maintained a database for tracking in-kind time contributions.
- d) Set up internal protocols required to receive grant funds and to process payments.
- e) Set up protocols for reimbursement of expenses by scientific advisors to ensure standardized reporting and clarity on expectations. (The reporting form is available upon request.)
- f) Initiated discussions with GITA leadership to seek advice for addressing issues encountered when attempting to administer the GITA ROI methodology and communicating these matters to the FDGC.

Project - Task 1 (Complete):

Task 1 was the principal focus of the Study Team's work during this 3rd quarter reporting period. This task involved attempting to document Return on Investment (ROI) to Hennepin County's internal operations from the use of geospatial technology to produce, manage and use parcel data. The following major tasks comprised this effort:

- a) W4Sight Consultant Team interviewed Hennepin County staff members from all major divisions who produce, manage, and use geospatially-enabled parcel data. The purpose of these interviews was to obtain information needed to complete the ROI worksheets developed by GITA and to discover any issues that might exist deploying this methodology in a local government setting. The interview process is summarized in the Task 1 Summary Report (Attachment 2).

Issues/obstacles: An underlying issue to consider in Task 3 is the limited degree to which organizations appear, from our experience with Hennepin County, to collect and account for expenses related to the use of parcel data. Accounting and budgeting focus on measures that respond to mandated functions; functions that utilize data, without considering necessitated costs (processing of data for functional needs) nor alleviated costs (reductions in data acquisition costs). This poses a challenge for reliably determining costs and benefits of SDI benefits. While we have an idea for overcoming this issue – forward only looking analysis, this may be a formable limiting factor in the quantitative assessment of SDI related costs and benefits (see Task 2, below).

- b) W4Sight Consultant Team consolidated, formatted, and reported information obtained during July 19-21 interviews via 3 reports: a) Interview Summary Report – 14 pages; b) Quantitative Analysis Report - 13 pages; and c) Comprehensive Interview Summary Report – 97 pages. These documents contain sensitive operational information and, as such, are declared to be confidential working papers with access restricted to the Study Team. The Interview Summary Report and Quantitative Analysis report contain substantive gaps in information that could not be effectively addressed through reliance on rational estimates or assumptions regarding costs and benefits. The study team believes this lack of available information severely compromises ability on everyone's part to accurately analyze the actual situation. The information presented in all three documents

has been generalized in the Task 1 Summary Report to address the reasons for the confidential designation.

Issues/obstacles: Notwithstanding widespread anecdotal information gained through the interviews of a strong positive return on investment, numerous detailed data elements required to populate the GITA ROI worksheets are not available. Hennepin County does not track employee time and costs in a manner that supports the required information. Our findings are exemplified by the following comment:

“I am a bit apprehensive in providing data that is essentially a collection of guesstimates plucked out of thin air, as our GIS users do not track how much they use GIS in general, let alone what individual data layers they may or may not be using, but hopefully it will help to at least flush out the process for this project.” Donovan Koxvold, GIS Coordinator, Hennepin County - Department of Environmental Services

Subsequently, some of the required data inputs were attempted to be created through estimates, others not attempted because multiple assumptions are involved. Hence, the team concluded it prudent to declare these documents confidential working papers. Advice is sought as to a means to share the detailed Hennepin County survey results with the FGDC in a manner in which the confidential nature of this information cannot be comprised via a FOIA request.

- c) W4Sight Consultant Team attempted to populate the GITA ROI model worksheets with information obtained during the interviews, supplementing information gathered via the pre-interview survey conducted the previous quarter.

Issues/obstacles: At this point in the study, the Study Team is of the opinion that a much simpler ROI model will only be possible compared to the level of detail possible following the GITA ROI model. The combination of the data not being available and the need for outside assistance to populate the GITA ROI model worksheets is not sustainable if Hennepin County’s cost accounting system is representative of other government units.

- d) W4Sight Consultant Team, with the consultation with the Study Research Coordinator, generally documented what worked and what did not when attempting to populate the GITA ROI model worksheets with information collected during the interview process.

Issues/Obstacles: Our study team sought advice from GITA leadership (Bob Samborski, GITA President, and two individuals who were members of the GITA ROI development team – Dave DiSera and Nancy Lerner). All confided that the since our study objective (public created via data sharing) does not involve development/implementation of a specific deliverable (e.g., application, dataset, system enhancement), the GITA ROI methodology was not a good fit for our needs. Specific examples of issues that arose are documented in the Task 1 Summary Report. They also offered advice for how our study team could accomplish our objectives utilizing a revised process. (See Task 2 below.)

- e) The Study Research Coordinator was the lead drafter of the Task 1 Summary Report. (Att. 2.)

Issues/obstacles: The results of our Task 1 efforts – inward looking value to Hennepin County’s operations from geo-enabling parcel data - are more qualitative and less quantitative than the study team had anticipated. We, however, remain confident that our objective to develop the outward looking component - a prototype quantitative model to measure public value created in a geospatial commons/SDI environment - can be accomplished with the budget available.

Project - Task 2 (In progress):

- a) The Study Research Coordinator confirmed interest from nine individuals, and possibly from a tenth, who are scientific experts on Spatial Data Infrastructures (SDI) from across the globe (academic community and managers of successful initiatives). Their role is to build on the lessons learned from the Task 1 approach and partial results and offer enhancements to the ROI model to not only account for direct benefits to the producer, Hennepin County, but also account for public benefit created through reuse and chaining of data by others who use these data. Their feedback will also be used to catalyze discussion on principals, objectives, and methodologies needed to accomplish the desired extended ROI methodology – “Quantify Public Value (QPV) model”.

- b) Architects of the GITA ROI methodology have offered our Study Team advice for proceeding without utilizing the GITA ROI methodology and yet producing the deliverable we are seeking. This advice involves applying the following high-level methodology and focusing on those organizations (for-profit, non-profit, utility) which do not currently have access to parcel data (“forward only looking”):
 - (1) Through interviews develop an understanding of the business activities of organizations that represent these stakeholder interests.
 - (2) Through interviews assess the decision support processes currently used to support these business activities.
 - (3) Largely as a follow-on activity of the study team, assess how access to parcel data produced by Hennepin County could/is affecting the efficiencies of the organizations interviewed and/or their constituencies in the Hennepin County geographic extent.

Project-Task 3 (Scheduled to Begin January 2010):

The Study Administrative Coordinator made substantive progress on developing a listing for comment by regional advisors of interview candidates who represent academic, non-profits/neighborhood advocacy organizations, for-profit, first responders, and utility interests, as well as, other government interests that serve the geographic extent of Hennepin County, and:

- a) Whose operations do/could benefit from access to parcel data produced by Hennepin County.
AND
- b) Who believe their value added data/web service/ application(s) do/could improve the cost - effectiveness of:
 - (1) Hennepin County operations.
AND/OR
 - (2) Operations of one or more taxing jurisdictions that serve Hennepin County’s citizens.

Guidance Requested from FGDC:

Our inability to populate the GITA ROI worksheets for Hennepin County in Task 1, due to circumstance beyond our control, raises two matters for which guidance from the NSDI grant administrators is requested:

- a) Notwithstanding our inability to complete the GITA ROI worksheets, substantive understanding of public value creation regarding of geo-enabling parcel data was gained via our Task 1 efforts. And, as such, our team believes there is value in moving forward and conducting the proposed Task 3 (outward looking) analysis even though the results may not be able to be quantifiably measured against Hennepin County’s internal operational costs and benefits. Creation of public value is the main focus – which is not limited to value realized by Hennepin County. Yes, the team had hoped to develop a quantitative “before and after” scenario for Hennepin county (e.g., no access versus access to parcel data by others) but a mixture of qualitative and quantitative results may be the best that can be accomplished. To this end, we believe continuing the study would result in understanding critical to the proposed deliverables. **We hereby request confirmation that this study is permitted to continue, given that the GITA ROI worksheets were not possible to populate due to circumstances beyond the study team’s control.**
- b) Task 1 was originally proposed to be complete by September 1. However, due to the issues encountered with populating the GITA ROI worksheets work on Task 1 slipped some 5 weeks. As such, an extension to the originally proposed project schedule may be required. We can’t be more specific until Task 2 is completed. **If needed, is a time extension possible?**

Other information requested in / for the interim project report:

1. Draft ROI Case study and related documents

2. Photographs, graphics, or illustrations) is either premature or not possible to provide at this time.

ATTACHMENT 2

Task 1 Summary Report: MetroGIS QPV Study

(See Next Page)

Francis Harvey

[in collaboration with Danielle Scarfe, W4ASight, and Randall Johnson, MetroGIS]

Quantify Public Value Project

FGDC CAP Award 2010-11

21 October 2010

QPV TASK 1 SUMMARY REPORT

Overview

The major activity during this phase was Task 1, the Return On Investment study, following the GITA ROI approach and materials provided to the QPV project team. Following on preparation and completion of the GITA-ROI training workshop in early May, 2010, the approach was applied, as planned, to collect and analyze data connected to parcel-related activities within the Hennepin County Government. After establishing contact, staff from W4Sight sent emails and made phone calls to Hennepin County staff to collect relevant information. This data collection prefaced by a series of ten interview sessions over three days (July 19-21) at the Hennepin County Government Center to finish the data collection and meet with county staff. Valuable data was collected, but substantial limitations arise from the coarse granularity of information on the use of parcel data maintained respective the considerable detail called for by the GITA ROI approach. With only partial cost and benefit data for 7 of 8 county agencies interviewed, we are unable to produce reasonable estimates of benefits and costs even using interpretative interpolation. The dearth of concrete facts limits our ability to state any aggregated cost or benefit numbers with reliability. The findings of this Task 1, the analysis results, and assessment leave a number of open issues.

Project Goals and Task Objectives

As we have come to formulate through meetings, presentations, and discussions, the over-riding goal of the project can be expressed in the question: **What is the geo-enabled value of parcel data?** This is a more specific formulation of the project objective defined in the proposal. The adjective "geo-enabled" bundles key issues that reflect the importance of developing quantifiable indicators of spatial data infrastructure benefits and costs for policy makers, first, and other audiences, especially the broad range of stakeholders involved in regional data sharing consortia.

Task 1 is intended to provide a basis for other project activities, including analysis of the GITA ROI approach. During this task, we undertook with the expert assistance of W4Sight the fundamental analysis of Hennepin County stakeholders working with parcel data following the GITA ROI approach. The objectives were to apply this approach and analyze the parcel data-related benefits and costs within Hennepin County.

Task Activities

Primary contact in Hennepin County is the GIS Office Manager, Gary Swenson, who assisted in the first selection of internal departments for interviews. Some of the selected staff are members of the Hennepin County Technical Advisory Group and are considered frequent users of the GIS parcel data relative to the development, maintenance, and/or use. Members of the Technical Advisory Group, represent their respective departments and provide a network of technology experts, which promote and strengthen GIS technology countywide through inter-departmental communication, collaboration, cooperation, and joint research. The group researches and produces recommendations on GIS technical standards, protocols, and best practices.

The Task 1 interview exercise began by collecting general information through the distribution of a pre-interview questionnaire. Each invited interviewee was asked to complete this pre interview survey to provide the researchers with insight important to effectively conducting the in-person interviews. The pre-interview questionnaire was emailed to each of the ten prospective interviewees on May 25, 2010. W4Sight followed up with each individual until the questionnaires were returned. Using the pre-interview questionnaire results, Hennepin County staff defined their department purpose, general parcel data usage, parcel based products and services, any parcel inquiries, and parcel-related business activities. Insights as to exposure to GIS technology and competency levels were revealed. Detailed responses were provided for the following departments: Taxpayer Services, Assessor, Sheriff, Transportation, Environmental Services, Emergency Preparedness, and Housing Community Works & Transit. The following departments were represented in the survey by multiple business units: 1) Taxpayer Services: Survey/Graphics, GIS, and Property Tax/Property Identification 2) Public Works: Emergency Preparedness, Environmental Services, Housing, Community Works & Transit Leasing and Land Management, Housing, Community Works & Transit Land Acquisition and Transportation.

Onsite interviews with key Hennepin County staff followed on July 19-21. Interviewees possessed varying levels of GIS knowledge and skill sets. Staff varied from heavy to occasional users of GIS technology and most used the parcel data only as reference for their business activities. However, despite these variations, all county staff interviewed agreed that the parcel data plays an important fundamental and integral role in the execution of their daily business activities and that their work processes would be negatively affected if the parcel dataset were not accessible, accurate, and complete.

The onsite interviews were critical to obtaining more detailed information about the parcel-related GIS activities in Hennepin County, however quantitative information consistent with the GITA ROI methodology about the number of county staff who use the parcel data and their frequency of use was difficult to obtain. The exception was the Taxpayer Services Department's Surveyor Unit, which provided very detailed information about hours spent on multiple creation or update activities related to parcel data. Alternatively, representatives of the

other business units were able to provide only estimates of their percentage of time using or referencing parcel data. These variations in data collection precluded accomplishing a complete ROI assessment.

Task Outcomes

The purpose of Task 1 was to assess, following the GITA ROI approach, the existing return on investment achieved internal to the County through its Parcel/GIS operations. The Quantitative Analysis conducted uses data gathered from the interview process related to labor costs, infrastructure, and revenues. Benefits were attempted to be determined through a variety of means, mainly different calculations using measures collected during interviews. However, much of the statistical data recommended in the GITA ROI model was either not accessible or not possible to obtain during the task. During the interview process, county staff were not able to provide comprehensive or accurate statistics on the number of people in their department using the parcel data, the amount of time they spent using it, or in what way parcel data are being used.

This missing critical information resulted in major gaps when attempting to complete the ROI. The study team concluded that in order to clearly define the limitations of the information gathered, general assumptions would need to be generated to realistically assess benefits and costs related to the current parcel/GIS environment at Hennepin County.

This section summarizes the study team's assumptions and offers qualitative, not quantitative, insight into benefits and costs. It is important to recognize that these assumptions must be considered when developing the proposed Quantify Public Value (QPV) replicable methodology.

Assumptions

- Metrics to determine parcel usage and business improvements associated with its use are not available for analysis. The majority of County staff were only able to provide percentages of this time for the current use of GIS and/or the parcel data.
- The automation of the parcel data has been a great benefit for its users by eliminating the need for paper maps and filing.
- The completeness, currency, and accuracy of parcel data have led to better business decisions by county departments.
- The public receives better service through access to parcel data on the county's external interactive mapping application.
- Public inquiries to the County departments have dropped since parcel data has been put online.

- The use of parcel data is considered to be a critical and integral part of county business activities.

Costs

- Connectivity issues with the SDE server with parcel data causes division/division/units to copy the parcel data onto their own department servers or personal computers.
- Many of the division/division/units keep parcel data or data that are derivatives of parcel data on their individual computers or servers. This does not allow other departments to take advantage of this derivative data.
- Many other datasets that would be useful when overlaid on the parcel data are not currently available on the external website. Publishing of this data would significantly reduce public inquiries (i.e. crime locations, flood zones, etc).
- Lack of knowledge of the accuracy of parcel data currently maintained by the county surveyor has lead to some redundant parcel data development.
- Integration of RecordEase with GIS does not exist causing decreased productivity when trying to relate parcels to documents stored in the RecordEase application.

Benefits

- Parcel data is used by many departments for reference or development of "proximity" datasets.
- Ease of accessibility to data is very beneficial to business activities for all departments with parcel-related activities, creation of exhibits for internal or public use, and answering public inquiries.
- Parcel data is the cross-departmental default standard for geocoding all GIS data.
- Research time related to Parcel Identification Numbers (PIN) and/or address ownership records has been cut immensely through deployment of the County's internal/external web-based parcel application.
- Use of parcel data in the public website has decreased public inquiries to most departments (i.e. Property Tax/Property Identification Unit used to receive 3-4 calls per day, now may receive one call per day).
- Analysis with parcel data and actively merging it with other datasets allows for better decision making and in some cases generates revenue or saves the county in land acquisition costs (i.e. avoidance of auctioning forfeited land that will be needed later for a Capital Improvement Project).

- The use of geo-enabled parcel data has eliminated the need for the production and use of paper map books.
- Geo-enabling parcel data has allowed for speed and development of professional-looking map products.
- The use of parcel data in the GIS-based Assessor Mobile (PKG) applications has improved efficiency in the 60,000 plus appraisals completed each year. GIS-based applications include: 1) Inter/Intranet Property Map, 2) Mailing Labels, 3) Community Works & Transit Desktop application (which was given only to certain staff and other still need it), 4) Assessor map, 5) Assessor Mobile (PKG), and 6) Tax Forfeit Mapper. The interviews did not provide sufficient indication how each application is benefiting activities.
- For example, the Assessor appraisal field staff have been reduced in number, parcels appraisal contracts have risen, and coordination and communications have improved with the use of the their Mobile Field Inspection application.
- Improved coordination and communication within divisions/units, cross departmentally, and with external agencies through the use of parcel-related mapping (and use of exhibit maps). Examples are as follows:
 - Appraiser parcel completion maps have assisted in determining where appraisers are needed and assists to efficiently and quickly redistribute field staff when necessary.
 - Sales ratio mapping using parcel data identifies where city appraisers may not be meeting legal guidelines which prevents lawsuits later.
 - Parcel ownership information and location is used to assist in the warrant and parole searches as well as in preparation for serving warrants.
 - Parcel valuation data is mapped to incident areas are used to estimate damage for disaster declarations (federal funding). Ease of this process allows for faster acquisition of those funds.
 - GIS activities are used in the planning and design of the county transportation routes and parcel information provides proximity information.

Benefits and Costs Analysis

At this point, no conclusive benefits and costs analysis is possible. Our team could not conduct the analyses or reliably attempt calculations due to the lack of data. Subsequently, our team has initiated communication with Nancy Lerner, Dave DiSera and Bob Samborski, who each played substantive roles in development of the subject ROI methodology, to share with them obstacles we encountered and seek their advice for subsequent phases of this study.

Our thoughts concerning application of the GITA ROI approach to the study of

a large and complex county level organization are characterized as follows. Based on the work of Hennepin County staff with parcel data, our study results provide evidence of \$132,500 benefit for two positions in the surveying/ graphics unit. However, this is a 'gross' benefit. The 'net' benefit, following the GITA approach, would have to consider the actual improvements in staff productivity or reductions in time spent on tasks due to spatial data investments. The total costs for developing the parcel data, software and hardware costs, are \$54,264. To reiterate: these two numbers, by themselves, do not allow a comparison, nor should we attempt partial analysis with roughly only 1/3 of the data required, but they do start to allow us to anecdotally grasp the scope of costs and benefits of Hennepin County's efforts to geo-enable parcel data.

Reflections and Considerations for Other Tasks

The GITA ROI approach seems well-suited for capturing costs, existing benefits, and potential benefits of geographic information project activities and immediate, institutional mission related costs. In our, admittedly limited, experience in Hennepin County, the approach is less suited for identifying benefits and costs of use of parcel data across multiple agencies with largely independent GIS-related activities.

After starting the data collection in June, by the middle of September 2010, much of the basic expense data for the ROI still needs to be collected and fit in along existing work activities. Indeed, because of the hierarchical organization and project-level accounting of the county administration, the identification of those portions of work specifically involving parcel data proved to be extremely difficult in many cases and impossible in some for the interviewees. To clarify, this is not a weakness of the GITA approach, but it is an inherent and unavoidable challenge of applying a method most frequently used to assess projects with definable scopes to the complex activities of civil servants and the many uses of parcel data. Exhibit 1 summarizes key issues identified by our study team in the application of the GITA approach. Exhibit 2 summarizes the GITA approach cost/benefit calculation and difficulties encountered to quantify costs and benefits in a large public administration.

For the study tasks that follow, particularly the development of the prototype QPV methodology (Task 3), it appears that to establish benefits and costs, our team will need to develop a methodology that better takes into account organizational culture and complexity of arrangements, a focus of our study. First, consideration should be given to development of a long-term and low-impact study to establish the number of hours that county staff work with GIS technology and parcel data. Second, a survey should be conducted via an online mechanism that management promotes as valuable for the county. Clear instructions, tested for the environment in which to be developed, should be provided to assist the respondents complete the survey. Third, follow up on the studies with questions for identifying the proportion of activities involving parcel data used in the past and present and include a series of questions about costs of

sharing geographic information and efforts to achieve cost avoidance. Our proposed Task 3 is the best opportunity for pursuing possibilities to include these aspects in a methodology designed for large and complex data collaboration activities within and beyond the organization that produces the subject data. Lastly, our Task 3 is proposed to involve development of a framework to help quantify the elusive quality of public value connected to use of geo-enabled parcel data, a complex task which is proving to be a challenge to articulate in a robust methodology.

Exhibit 1 - Issues to consider in application of the GITA ROI approach

Drawing on our partially completed ROI study, we can surmise several points for guiding further work on refining the proposed Quantify Public Value (QPV) methodology.

Missing data, accounting and budgeting

Obtaining data on proportional staff time spent on GIS activities can be very complicated and time-consuming to determine, even approximately. In addition, costs and benefits are hard to determine as most financial data is associated with positions, not with project time spent working with data. Estimates of time to acquire data cannot be too conservative in large multi-agency organizations. Project management should define a milestone when to freeze activities and await the availability of data.

Calculation of costs and benefits

At this point in time, we conclude from experiences that it may be advisable to arbitrarily set a Year 0 and determine the impact of investments and changes by determining costs and calculating benefits for the following years. For instance, Year 0 could be the year prior to a large internal re-organization, and the ensuing years would follow as Year 1, Year 2, etc, up to the current year. After costs have been accounted for (so-called sunk costs) they should not be considered in the ROI determination, although their value may be still not be assessed when the ROI analysis begins.

Analysis

The value of the analysis depends on the data that are able to be collected. While costs and benefits can be assumed, guessed, and estimated, it is important to document the reliability and source of the data as well as provide discussion with an overview of the general and specific reliability of calculations and data.

Exhibit 2 - Suggested cost-benefit calculation

The projects for which cost-benefit analysis are conducted in most cases involve some calculations. Each is prone to particular biases. However, a key calculation, because of its simplicity, is the determination of annual benefits.

As we understand this calculation from material produced by GITA documenting their ROI model (p. 28f of the workbook), annual benefits are determined by subtracting the annual internal labor cost, and any one-time labor costs for that year from the total benefits (TB) for the year.

$$AB = TB - AIL - OLC$$

Costs for longer periods can be distributed to individual years. The simplest way is to divide the cost by the number of years, but other approaches, based on known factors or understood factors can be used to distribute the costs.

The results of the annual benefits calculations can be aggregated to provide information about total benefits. This can be done by multiplying a single year's costs by the project life, or determining the benefits for each year of the project's life and calculating the total.

As application of the methodology in our case (MetroGIS QPV Study) does not involve a "project" but rather an operational, cross-sector system of data sharing, for which our team is attempting to define current not future benefit, completing the calculation for future costs and benefits is not possible with the data and information obtained from Hennepin County staff., nor is it likely we shall have this data within the scope of the project.