Project Management Best Practices for Successful GIS Implementations

Erik Shepard, Ph.D., PMP
Miner & Miner, a Telvent company
Statistics

- Only 16.2% of information technology projects complete on-time, on-budget and with full scope
- 31% of information technology projects are cancelled before they are completed
- Costing over $81 billion annually
- GIS is an information technology… plus
GIS Is Even More Than An Information System

- In addition to standard challenges of implementing an information system, GIS has additional components
  - Increased storage requirements
  - Drawing performance and spatial query performance requirements
  - High degree of integration in a single GeoDatabase
  - Long transactions and versioning
- Equals increased risk
PMBOK

- Project Management Institute (PMI) developed the Project Management Body of Knowledge (PMBOK) to codify project management best practices
- Applicable to any sort of project, but heavily oriented toward information technology projects
- Application of PMBOK techniques can reduce risk
A project is a temporary endeavour undertaken to create a unique product, service, or result.

- Temporary
- Unique
- Progressive Elaboration

Projects vs. Operations
- A GIS Implementation is not the same as ongoing operations

Projects are a means of achieving an organization’s strategic plan
Project Management

• Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements
  – Identify requirements
  – Establish clear and achievable objectives
  – Balance competing demands for quality, scope, time and cost
  – Adapt specifications, plans and approach to stakeholder requirements
Triple Constraint

Scope

Quality

Time

Cost
Triple Constraint

Scope

Quality

Cost

Can’t change one variable without affecting at least one of the others
Risk

• Projects are managed within the context of uncertainty
• Uncertainty = Risk
• If uncertain (risk) event occurs, can have negative or positive effect on project outcome
• Want to manage to reduce uncertainty – to make sure negative effect doesn’t happen or positive effect does
Stakeholders

- Identify and manage stakeholders
- Key stakeholders on every project include:
  - Project Manager
  - Project Team
  - Sponsor
  - Influencers
  - Customer/User – Could be External, but could also be another department, e.g. Operations, Planning, etc.
Projects are often divided into logical phases, together constitute life cycle.

Phase is concluded when deliverable is completed (may be actual deliverable, or simply design documents).

Many types of life cycles:
- Waterfall
- Rational Unified Process
- Design-Develop-Deploy
Project Evolution

- Risk is highest at the beginning of the project
- Stakeholder Influence is highest at the beginning of the project and decreases rapidly as project proceeds
- Cost of change is lowest at the beginning of the project and increases rapidly as project proceeds
Project Process Groups

• PMI defines 44 Project Processes in 5 Project Process Groups
  – Initiation
  – Planning
  – Executing
  – Monitoring and Controlling
  – Closing
• Not All Processes Will Be Executed
Initiation

• Project Charter
• Preliminary Scope Statement
Planning

- Project Management Plan
  - Scope of Work
  - Schedule
  - Budget
  - Change Management
  - Quality Assurance / Quality Control
  - Human Resources
  - Communications
  - Risk Management
  - Procurement Plan
Executing

- Deliverables
- Change Requests
- Mid-course Corrections
- Work Performance Data
Monitoring and Controlling

- Change Request Approval or Rejection
- Corrective and Preventive Action Decisions
- Project Management Plan Updates
- Performance Reports
- Forecasts
- Deliverable Approval
Closing

- Lessons Learned
- Archive Project Documents
- Contract Closure
Project Processes

- Planning is heavily emphasized – constitutes 21 of 44 processes
- Monitoring and Controlling constitutes additional 12 processes
- 33 of 44 processes – \( \frac{3}{4} \) of all Project Management effort - is in planning and controlling
- Doing the actual work isn’t the hard part
A Closer Look at Planning

- Project planning takes into account many factors
- Some may not apply ... choose the pieces that do
- Plan up-front for how scope, schedule and budget will be managed
- Plan up-front for communications methods, quality assurance, change management, etc.
- Takes the guesswork out later
A Closer Look at Controlling

- Collect performance data during execution
- Analyze the results and make decisions during controlling
- Have a Change Management Board to approve changes to the project plan
- When the project plan changes, make sure to update the Project Management Plan
Critical Path Method (CPM)
Estimating Time

- **PERT Estimates**
  - Estimate Optimistic (O)
  - Estimate Pessimistic (P)
  - Estimate Most Likely (ML)
  - PERT Estimate = \( \frac{O + 4*ML + P}{6} \)

- **Example:**
  - \( O = 1 \) day, \( P = 3 \) days, \( ML = 1.5 \) days
  - PERT Estimate = 1.67 days
Earned Value Project Management

- Statistics can be used for monitoring cost and schedule
- Compares planned and earned value
- For best results should be done for each milestone in a project – can be applied to the whole project if milestones are not feasible
- Need to know percent completed and percent scheduled for milestone
Earned Value Project Management

- **Budget At Completion (BAC)** – Budget for the entire milestone
- **Actual Cost (AC)** – Incurred cost to complete work on milestone
- **Earned Value (EV)** – Budgeted amount for work actually completed on milestone
- **Planned Value (PV)** – Budgeted amount for work scheduled to be completed on a milestone
Earned Value Project Management - Costs

- Cost Variance (CV) = EV – AC
- CV is the difference between actual costs and planned costs
Earned Value Project Management - Costs

- Cost Performance Index (CPI) = EV/AC
- CPI < 1.0 → Cost Overrun
- CPI is the ratio between planned costs and actual costs
- If planned costs are less than actual costs, CPI less than 1 ... you’re over budget
Earned Value Project Management - Schedule

- Schedule Variance (SV) = EV – PV
- SV is the difference between planned actual costs and scheduled costs
Earned Value Project Management  
- Schedule

- Schedule Performance Index (SPI) = $\frac{EV}{PV}$
- SPI < 1.0 $\rightarrow$ Schedule Overrun
- SPI is the ratio between planned actual costs and planned scheduled costs
- If planned actual costs are less than scheduled costs, SPI less than 1… you’re late
Earned Value Project Management
- Schedule

• Schedule performance is measured in terms of dollars
• Money has a time value
• A dollar today is worth more than a dollar tomorrow
• All things being equal, being late costs money … even if you don’t overrun actual costs
Earned Value Project Management - Forecasting

- **Estimate To Complete (ETC)**
  - Re-estimate remaining tasks – most accurate, but most work
  - $ETC = BAC - EV$ for atypical variances
  - $ETC = (BAC - EV) / CPI$ for typical variances

- **Estimate At Completion (EAC)** = AC + ETC
Earned Value Project Management - Forecasting

- Variance At Completion (VAC) = BAC - EAC
- To-Complete Performance Index (TCPI) = (BAC – EV)/(BAC – AC)
Earned Value Project Management - An Example

- Milestone with BAC = $100, 50% completed and 75% scheduled, AC = $60
  - EV = $50, PV = $75
  - CV = $10, SV = $25
  - CPI = 0.83, SPI = 0.67
  - ETC = $60.24, EAC = $120.24
  - VAC = $20.24, TCPI = 1.25

CV = $10, SV = $25
Risk Management

- Project Management is about minimizing risk and obtaining acceptable and consistent results.
- Risk Management is not about preventing risk... it’s about having a plan to deal with it when it occurs.
Risk Management

- Identify all possible risks
- Determine probability of risk occurring and impact if it does ... use probability and impact matrix

<table>
<thead>
<tr>
<th>Probability</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.80</td>
<td>0.200</td>
</tr>
<tr>
<td>0.50</td>
<td>0.125</td>
</tr>
<tr>
<td>0.20</td>
<td>0.050</td>
</tr>
<tr>
<td>0.250</td>
<td>0.500</td>
</tr>
<tr>
<td>0.600</td>
<td>0.375</td>
</tr>
<tr>
<td>0.400</td>
<td>0.250</td>
</tr>
<tr>
<td>0.100</td>
<td>0.150</td>
</tr>
<tr>
<td>0.750</td>
<td>0.500</td>
</tr>
</tbody>
</table>
## Risk Management

### Impact Scales

<table>
<thead>
<tr>
<th></th>
<th>&lt; 0.25</th>
<th>0.25 – 0.5</th>
<th>0.5 – 1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope</strong></td>
<td>Minor decrease</td>
<td>Major decrease</td>
<td>Unusable</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>10% +</td>
<td>25% +</td>
<td>40% +</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>15% +</td>
<td>25% +</td>
<td>30% +</td>
</tr>
<tr>
<td><strong>Quality</strong></td>
<td>Minor impact</td>
<td>Major impact</td>
<td>Unusable</td>
</tr>
</tbody>
</table>
Risk Management

• Rank risks according to impact scales
• Plan response strategy for each risk
• For major risks, strategy might be to avoid if possible (including additional expense to avoid)
• For minor risks strategy might be to “ride it out”… cost to avoid may be higher than impact
• Know these strategies before risk occurs
Quality Assurance / Quality Control

• Define success early

• For conversion projects, use statistical samples to establish quality

• For performance, use benchmarking

• Develop and use a test plan with specific test use cases to establish functionality completion

• Test early, test often.
• The methods in the PMBOK apply to any project, particularly focused toward IT projects
• Can be applied to GIS with appropriate scope, quality control metrics and risk management plan (i.e. the specifics of these things define the type of project)
• Project Management is a science – it is repeatable
Questions?