Update on the Proposed Municipal GIS Capability Maturity Model

2010 Washington GIS Conference
Tacoma
April 20, 2010

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The Ubiquitous Municipal GIS

- GIS has become a common component of city & county government
- All large and most medium sized cities & counties have established GIS operations
- Many small sized jurisdictions have a GIS
- 31 of 39 Washington Counties have public web mapping capability implying GIS operations of some sort
- Dozens of Washington cities are known to have GIS operations

Variations in Municipal GIS Operations

What causes variation in municipal GIS Operations?

- ❑ Each municipality is unique
- ❑ City and county business focus often varies
- ❑ Population
- ❑ Nature and level of economic development

Variations in Municipal GIS Operations

What causes variation in municipal GIS Operations?

- ❑ GIS development history and funding
- ❑ GIS operational budget and staffing
- ❑ GIS strategic plan
- ❑ Municipality’s institutional expectations
- ❑ GIS operational vision – or lack of vision?

When is GIS Development 'Done'?

There are many ways to answer:

- When the GIS capital project was completed?
- When the GIS strategic plan has been completed?
- When a GIS staff is in place?
- When municipality data has been developed?
- Other indicators? applications, products, users, etc.?
- Each of these indicators focus internally

When is GIS Development 'Done'?

There are many ways to answer:

- With an external focus?
  - Best practices
  - Benchmarking
- With a theoretical focus?
  - Ideal design
  - Academic state of the art
- With a capability focus?
- With a maturity level focus?

What is a Capability Maturity Model?

- A tool to assess an organization's ability to accomplish a defined task or set of tasks
- Originated with the Software Engineering Institute
  - Objective evaluation of software contractors
  - SEI published *Managing the Software Process* 1989
  - SEI CMM is *process* focused
- Other applications of the capability maturity model concept:
  - System engineering
  - Project management
  - Risk management
  - Information technology service providers

Why Develop a GIS Maturity Model?

To provide a means for any municipal GIS operation to gauge its maturity against a variety of standards and/or measures, including:

- A theoretical ideal end state of GIS organizational development
- The maturity level of other peer GIS organizations , either individually or in aggregate
- The maturity level of the subject organization over time
- The maturity level of the organization against an agreed target state (perhaps set by organizational policy, budget limitations, etc.)

A State GIS Maturity Model

The 2007-2008 Georgia GIS Maturity Assessment

- Model developed by:
  - Danielle Ayan, GISP, Georgia Institute of Technology
  - M. Ouimet, Texas GIS Coordinator
- "Intended as an overview of geospatial health and maturity across a state"

A State GIS Maturity Model

The 2007-2008 Georgia GIS Maturity Assessment

Seven categories assessed:

- Geospatial coordination & collaboration
- Geospatial data development
- GIS resource discovery & access
- Statewide partnership programs
- Participation in pertinent national initiatives
- Geospatial polices, guidelines, & best practices
- Training, education, & networking opportunities

Multiple components within each category

A State GIS Maturity Model

The 2007-2008 Georgia GIS Maturity Assessment

Self rating scale for each component:

- (1 pt) Fully Implemented
- (0.75 pts) In Progress - Fully Resourced to Complete
- (0.5 pts) In Progress - Partial Resources Available
- (0.25 pts) Planned - Resources Assigned
- (0 pts) Not Planned - No Resources Assigned
- Not Applicable

A State GIS Maturity Model

The 2007-2008 Georgia GIS Maturity Assessment

Sample self-ratings:

Statewide Partnership Programs	
	25. State partnership programs exist that are authorized to enter into state contractual and financial agreements with multiple parties to develop geospatial data.
	26. The state has established master purchase agreements and enterprise license agreements for geospatial data development, licensing and software. Comment: GTA has stated that they are researching a ELA agreement, but nothing is promised for the next fiscal year.
	27. The GIS Coordination Council has a program to develop program alliances and reciprocal agreements with other organizations that have a common mission or business interest (i.e., an optional partnership). Comment: The GISCC has been effective in the past at facilitating basemap development for the state of Georgia via program alliances and joint funding agreements.
	28. The GIS Coordination Council has the ability to manage grants and partnership programs either directly or indirectly through an administrative agency (i.e., a fiscal partnership).

A State GIS Maturity Model

The 2007-2008 Georgia GIS Maturity Assessment

GEORGIA'S GIS MATURITY ASSESSMENT SUMMARY

- (1 pt) Fully Implemented
- (0.75 pts) In Progress - Fully Resourced to Complete
- (0.5 pts) In Progress - Partial Resources Available
- (0.25 pts) Planned - Resources Assigned
- (0 pts) Not Planned - No Resources Assigned
- Not Applicable

Success in Satisfying Needs	Sufficient Geospatial Progress	Category
32%	○	Geospatial Coordination and Collaboration
25%	○	Geospatial Data Development
22%	○	GIS Resource Discovery and Access
47%	○	Statewide Partnership Programs
50%	○	Participation in Pertinent National Partnership Programs and Initiatives
6%	○	Geospatial Policies, Standards, Guidelines and Best Practices
19%	○	Training, Education, and Professional Networking Activities

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A Proposed Municipal GIS Capability Maturity Model

- Maturity for the proposed model indicates progression of an organization towards GIS capability that maximizes:
  - Potential for the use of state of the art GIS technology
  - Commonly recognized quality data
  - Organizational best practices appropriate for municipal business use
- The Municipal GIS Capability Maturity Model assumes two broad areas of GIS operational development:
  - Enabling capability
  - Execution ability

A Proposed Municipal GIS Capability Maturity Model

- Enabling Capability:
  - Technology
  - Data
  - Resources
  - Infrastructure
  - GIS professional staff
- Execution Ability:
  - Ability of the staff to maximize use of available capability
  - Ability to execute relative to normative ideal

A Proposed Municipal GIS Capability Maturity Model

Enabling Capability Components:

1. Framework GIS Data
2. Framework GIS Data Maintenance
3. Business GIS Data
4. Business GIS Data Maintenance
5. Metadata
6. Spatial Data Warehouse
7. Architectural Design
8. Technical Infrastructure
9. Replacement Plan
10. GIS Software Maintenance
11. Data back-up and security
12. GIS Application Portfolio
13. GIS Application Portfolio Management
14. GIS Application Portfolio Operation and Maintenance
15. Professional GIS Management
16. Professional GIS Operations Staff
17. GIS Staff Training and Professional Development
18. GIS Governance Structure
19. GIS is Linked to Agency Strategic Goals
20. GIS Budget and Funding
21. GIS Financial Plan

A Proposed Municipal GIS Capability Maturity Model

Enabling Capability Assessment Scale:

16. Professional GIS Operations Staff

The agency GIS is operated and maintained by an adequate staff of GIS professionals. (For purposes of the GIS CMM, adequate operational staffing is defined as meeting the 'roles' defined by the Geospatial Technology Competency Model – see: http://www.aag.org/Roundtable/Resources/gaudet-et-al-2003.pdf - table 4).

[ ] 1.00 Fully implemented
[ ] 0.75 In progress with full resources available to achieve the capability
[ ] 0.50 In progress but with only partial resources available to achieve the capability
[ ] 0.25 Planned and with resources available to achieve the capability
[ ] 0.00 This is not planned or it is planned but no resources are available
Comments:

A Proposed Municipal GIS Capability Maturity Model

Execution Ability Components:

1. Client Services Evaluation and Development
2. Service Delivery Tracking and Oversight
3. Service Quality Assurance
4. Application Development Methodology
5. Project Management Methodology
6. Quality Assurance and Quality Control
7. GIS System Management
8. Process Event Management
9. User Support, Help Desk, and End-User Training
10. Contract and Supplier Management
11. Regional Collaboration
12. Staff Development
13. Performance Management
14. Client Satisfaction Monitoring and Assurance

A Proposed Municipal GIS Capability Maturity Model

Execution Ability Assessment Scale:

7. GIS System Management

How does the GIS unit manage the core GIS systems that it is responsible for? GIS system management includes system administration, database administration, network administration, system security, data backup, security, and restore processes, etc.

[ ] Level Five: Optimized processes
[ ] Level Four: Managed and measured processes
[ ] Level Three: Defined processes
[ ] Level Two: Repeatable processes
[ ] Level One: Ad-hoc processes
Comments:

2009 GIS CMM Survey

State of Washington – August 2009

- Based on draft Model
- 12 Page Survey (4 pages of explanation)
- Sent to 25 Counties – 12 responded (48%)
- Sent to 38 cities – 19 responded (50%)
- Solicited comments and suggestions

DRAFT MUNICIPAL GIS CAPABILITY MATURITY MODEL
QUESTIONNAIRE – PAGE 5

Name of Municipal GIS Organization: ______________________________

GIS Capability Maturity Model Score Card

Enabling Capability Components

For each question in the 'Enabling Capability' section, read the brief description. Check the implementation category that best describes your agency's current status. Feel free to include any clarifying comments or questions.

1. **Framework GIS Data**
   The agency has access to adequate framework GIS data to meet its business needs. For the GIS CMM, framework data is defined as NSDI framework layers (see: http://www.fgdc.gov/framework/).
   [ ] 1.00 Fully implemented
   [ ] 0.75 In progress with full resources available to achieve the capability
   [ ] 0.50 In progress but with only partial resources available to achieve the capability
   [ ] 0.25 Planned and with resources available to achieve the capability
   [ ] 0.00 This is not planned or it is planned but no resources are available
   Comments:

2. **Framework GIS Data Maintenance**
   One or more data stewards are defined for each framework GIS data layer and the data is maintained (kept up to date) to meet business needs.
   [ ] 1.00 Fully implemented
   [ ] 0.75 In progress with full resources available to achieve the capability
   [ ] 0.50 In progress but with only partial resources available to achieve the capability
   [ ] 0.25 Planned and with resources available to achieve the capability
   [ ] 0.00 This is not planned or it is planned but no resources are available
   Comments:

2009 GIS CMM Survey

Results:

Cites range from 0.43 to 0.89

Counties range from 0.27 to 1.00

Enabling Infrastructure	All City Averages	All County Averages
1. Framework GIS Data	0.86	0.71
2. Framework GIS Data Maintenance	0.75	0.67
3. Business GIS Data	0.65	0.67
4. Business GIS Data Maintenance	0.61	0.67
5. Metadata	0.51	0.58
6. Spatial Data Warehouse	0.88	0.79
7. Architectural Design	0.44	0.52
8. Technical Infrastructure	0.85	0.90
9. Replacement Plan	0.69	0.69
10. GIS Software Maintenance	0.97	0.94
11. Data back-up and security	0.96	0.77
12. GIS Application Portfolio	0.65	0.58
13. GIS Application Portfolio Management	0.58	0.56
14. GIS Application Portfolio Operation and Maintenance	0.72	0.65
15. Professional GIS Management	0.79	0.67
16. Professional GIS Operations Staff	0.61	0.63
17. GIS Staff Training and Professional Development	0.69	0.63
18. GIS Governance Structure	0.58	0.46
19. GIS is Linked to Agency Strategic Goals	0.57	0.58
20. GIS Budget and Funding	0.69	0.65
21. GIS Financial Plan	0.43	0.60
Total Rating:	14.51	13.90
Average Rating:	0.69	0.66

Municipal GIS Capability Maturity Model

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2009 GIS CMM Survey

Results:

Cites range from 0.43 to 0.89

Counties range from 0.27 to 1.00

Enabling Infrastructure	All City Averages	All County Averages
1. Framework GIS Data	0.86	0.71
2. Framework GIS Data Maintenance	0.75	0.67
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12. GIS Application Portfolio	0.65	0.58
13. GIS Application Portfolio Management	0.58	0.56
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15. Professional GIS Management	0.79	0.67
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Municipal GIS Capability Maturity Model

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2009 GIS CMM Survey

Results:

Cites range from 0.43 to 0.89

Counties range from 0.27 to 1.00

Enabling Infrastructure	Bothell	Seattle	All City Averages		King	Pierce	All County Averages
1. Framework GIS Data	0.75	1.00	0.86		1.00	1.00	0.71
2. Framework GIS Data Maintenance	0.50	0.75	0.75		1.00	1.00	0.67
3. Business GIS Data	0.00	0.50	0.65		0.50	1.00	0.67
4. Business GIS Data Maintenance	0.75	0.50	0.61		0.50	1.00	0.67
5. Metadata	0.75	0.50	0.51		0.75	1.00	0.58
6. Spatial Data Warehouse	0.75	1.00	0.88		1.00	1.00	0.79
7. Architectural Design	0.50	0.75	0.44		1.00	1.00	0.52
8. Technical Infrastructure	1.00	1.00	0.85		1.00	1.00	0.90
9. Replacement Plan	1.00	0.50	0.69		1.00	1.00	0.69
10. GIS Software Maintenance	1.00	1.00	0.97		1.00	1.00	0.94
11. Data back-up and security	1.00	0.50	0.96		0.75	1.00	0.77
12. GIS Application Portfolio	0.50	0.75	0.65		0.75	1.00	0.58
13. GIS Application Portfolio Management	0.50	1.00	0.58		0.75	1.00	0.56
14. GIS Application Portfolio Operation and Maintenance	0.75	1.00	0.72		0.75	1.00	0.65
15. Professional GIS Management	0.75	1.00	0.79		1.00	1.00	0.67
16. Professional GIS Operations Staff	0.50	1.00	0.61		1.00	1.00	0.63
17. GIS Staff Training and Professional Development	0.75	1.00	0.69		1.00	1.00	0.63
18. GIS Governance Structure	0.50	1.00	0.58		1.00	1.00	0.46
19. GIS is Linked to Agency Strategic Goals	0.75	1.00	0.57		1.00	1.00	0.58
20. GIS Budget and Funding	1.00	1.00	0.69		1.00	1.00	0.65
21. GIS Financial Plan	0.75	1.00	0.43		1.00	1.00	0.60
Total Rating:	14.75	17.75	14.51		18.75	21.00	13.90
Average Rating:	0.70	0.85	0.69		0.89	1.00	0.66

2009 GIS CMM Survey

Results:

Cites range from 1.00 to 3.93

Counties range from 1.00 to 4.57

Process Capability	All City Averages	All County Averages
1. Client Services Evaluation and Development	2.50	2.25
2. Service Delivery Tracking and Oversight	2.61	2.25
3. Service Quality Assurance	2.67	2.50
4. Application Development Methodology	2.17	2.17
5. Project Management Methodology	2.89	2.42
6. Quality Assurance and Quality Control	3.17	2.92
7. GIS System Management	3.22	2.58
8. Process Event Management	2.94	2.67
9. User Support, Help Desk, and End-User Training	2.89	2.50
10. Contract and Supplier Management	2.67	2.92
11. Regional Collaboration	2.28	2.33
12. Staff Development	2.33	2.33
13. Performance Management	2.72	2.50
14. Client Satisfaction Monitoring and Assurance	2.17	2.08
Total Rating:	37.22	34.42
Average Rating:	2.66	2.46

2009 GIS CMM Survey

Results:

Cites range from 1.00 to 3.93

Counties range from 1.00 to 4.57

Process Capability	All City Averages	All County Averages
1. Client Services Evaluation and Development	2.50	2.25
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6. Quality Assurance and Quality Control	3.17	2.92
7. GIS System Management	3.22	2.58
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10. Contract and Supplier Management	2.67	2.92
11. Regional Collaboration	2.28	2.33
12. Staff Development	2.33	2.33
13. Performance Management	2.72	2.50
14. Client Satisfaction Monitoring and Assurance	2.17	2.08
Total Rating:	37.22	34.42
Average Rating:	2.66	2.46

2009 GIS CMM Survey

Results:

Cites range from 1.00 to 3.93

Counties range from 1.00 to 4.57

Process Capability	Bothell	Seattle	All City Averages		King	Pierce	All County Averages
1. Client Services Evaluation and Development	3.00	3.00	2.50		3.00	4.00	2.25
2. Service Delivery Tracking and Oversight	2.00	2.00	2.61		3.00	4.00	2.25
3. Service Quality Assurance	3.00	2.00	2.67		4.00	4.00	2.50
4. Application Development Methodology	3.00	3.00	2.17		2.00	5.00	2.17
5. Project Management Methodology	3.00	2.00	2.89		2.00	5.00	2.42
6. Quality Assurance and Quality Control	4.00	2.00	3.17		3.00	5.00	2.92
7. GIS System Management	3.00	2.00	3.22		2.00	5.00	2.58
8. Process Event Management	4.00	2.00	2.94		2.00	5.00	2.67
9. User Support, Help Desk, and End-User Training	4.00	2.00	2.89		3.00	5.00	2.50
10. Contract and Supplier Management	3.00	2.00	2.67		4.00	5.00	2.92
11. Regional Collaboration	2.00	1.00	2.28		1.00	5.00	2.33
12. Staff Development	3.00	1.00	2.33		4.00	4.00	2.33
13. Performance Management	3.00	1.00	2.72		3.00	4.00	2.50
14. Client Satisfaction Monitoring and Assurance	1.00	2.00	2.17		4.00	4.00	2.08
Total Rating:	41.00	27.00	37.22		40.00	64.00	34.42
Average Rating:	2.93	1.93	2.66		2.86	4.57	2.46

2010 GIS CMM Update

Enabling Infrastructure	Bothell	Seattle	2009 All City Averages	2010 Very Large Canadian City	King	Pierce	All County Averages	Medium Sized Semi-Rural California County
1. Framework GIS Data	0.75	1.00	0.86	0.50	1.00	1.00	0.71	1.00
2. Framework GIS Data Maintenance	0.50	0.75	0.75	0.50	1.00	1.00	0.67	1.00
3. Business GIS Data	0.00	0.50	0.65	0.50	0.50	1.00	0.67	1.00
4. Business GIS Data Maintenance	0.75	0.50	0.61	0.50	0.50	1.00	0.67	0.50
5. Metadata	0.75	0.50	0.51	0.25	0.75	1.00	0.58	1.00
6. Spatial Data Warehouse	0.75	1.00	0.88	0.50	1.00	1.00	0.79	1.00
7. Architectural Design	0.50	0.75	0.44	0.50	1.00	1.00	0.52	1.00
8. Technical Infrastructure	1.00	1.00	0.85	0.75	1.00	1.00	0.90	1.00
9. Replacement Plan	1.00	0.50	0.69	0.50	1.00	1.00	0.69	1.00
10. GIS Software Maintenance	1.00	1.00	0.97	0.50	1.00	1.00	0.94	1.00
11. Data back-up and security	1.00	0.50	0.96	1.00	0.75	1.00	0.77	1.00
12. GIS Application Portfolio	0.50	0.75	0.65	0.50	0.75	1.00	0.58	0.75
13. GIS Application Portfolio Management	0.50	1.00	0.58	0.50	0.75	1.00	0.56	1.00
14. GIS Application Portfolio Operation and Maintenance	0.75	1.00	0.72	0.50	0.75	1.00	0.65	0.75
15. Professional GIS Management	0.75	1.00	0.79	0.00	1.00	1.00	0.67	1.00
16. Professional GIS Operations Staff	0.50	1.00	0.61	0.50	1.00	1.00	0.63	1.00
17. GIS Staff Training and Professional Development	0.75	1.00	0.69	0.50	1.00	1.00	0.63	1.00
18. GIS Governance Structure	0.50	1.00	0.58	0.50	1.00	1.00	0.46	0.00
19. GIS is Linked to Agency Strategic Goals	0.75	1.00	0.57	0.50	1.00	1.00	0.58	1.00
20. GIS Budget and Funding	1.00	1.00	0.69	0.25	1.00	1.00	0.65	1.00
21. GIS Financial Plan	0.75	1.00	0.43	0.25	1.00	1.00	0.60	1.00
Total Rating:	14.75	17.75	14.51	10.00	18.75	21.00	13.90	19.00
Average Rating:	0.70	0.85	0.69	0.48	0.89	1.00	0.66	0.90

Municipal GIS Capability Maturity Model

2010 GIS CMM Update

Process Capability	Bothell	Seattle	All City Averages		King	Pierce	All County Averages	
1. Client Services Evaluation and Development	3.00	3.00	2.50	1.00	3.00	4.00	2.25	3.00
2. Service Delivery Tracking and Oversight	2.00	2.00	2.61	1.00	3.00	4.00	2.25	4.00
3. Service Quality Assurance	3.00	2.00	2.67	1.00	4.00	4.00	2.50	3.00
4. Application Development Methodology	3.00	3.00	2.17	3.00	2.00	5.00	2.17	4.00
5. Project Management Methodology	3.00	2.00	2.89	2.00	2.00	5.00	2.42	4.00
6. Quality Assurance and Quality Control	4.00	2.00	3.17	2.00	3.00	5.00	2.92	3.00
7. GIS System Management	3.00	2.00	3.22	3.00	2.00	5.00	2.58	3.00
8. Process Event Management	4.00	2.00	2.94	1.00	2.00	5.00	2.67	3.00
9. User Support, Help Desk, and End-User Training	4.00	2.00	2.89	2.00	3.00	5.00	2.50	4.00
10. Contract and Supplier Management	3.00	2.00	2.67	2.00	4.00	5.00	2.92	2.00
11. Regional Collaboration	2.00	1.00	2.28	1.00	1.00	5.00	2.33	1.00
12. Staff Development	3.00	1.00	2.33	1.00	4.00	4.00	2.33	4.00
13. Performance Management	3.00	1.00	2.72	1.00	3.00	4.00	2.50	4.00
14. Client Satisfaction Monitoring and Assurance	1.00	2.00	2.17	1.00	4.00	4.00	2.08	1.00
Total Rating:	41.00	27.00	37.22	22.00	40.00	64.00	34.42	43.00
Average Rating:	2.93	1.93	2.66	1.57	2.86	4.57	2.46	3.07

Municipal GIS Capability Maturity Model

2009 GIS CMM Survey

Comments From Participants

In the past year our Board of Commissioners has embarked on a Performance Measurement program (ICMA) that is not very robust in terms of GIS performance measurement criteria, so the results of this exercise should provide an alternative viewpoint for internal evaluation of our program.

Benchmarks are often helpful to us all when trying to make the case for more funding for any technology program.

Some questions, hadn't really thought about much before and were pretty eye-opening.

These almost read like they should be reversed in order or are equal. I'd rather have a plan with resources than start progress only to find inadequate resources exist to support the capability:

- *[ ] 0.50 In progress but with only partial resources available to achieve the capability*
- *[ ] 0.25 Planned and with resources available to achieve the capability*

2009 GIS CMM Survey

Comments From Participants

In light of this maturity concept being a certification component, it seems to me some small cities should be able to achieve accreditation despite their overall funding.

I had a difficult time with the second part of the survey measuring execution ability components due to the answer choices. I discovered that our processes typically have characteristics of multiple answers (i.e. a process may not be written down, but it does serve as a guide to consistent performance within the organization, it is measured to some extent and adapted to certain conditions, and it is improved upon). I found myself answering the question based on how well we perform the particular task described in the question (i.e. Poor, Fair, Average, Above Average, and Excellent) rather than strictly following the defined responses.

Will we eventually be able to "self-assess" our capability? By that I mean after taking the survey to then add up our score and compare that to a scale such as: 0-5 points = "Are you sure you actually have a GIS program?", 5-10 points = "You are on your way, now!", etc.? I could see this as useful for internally gauging progress.

2009 GIS CMM Survey

Comments From Participants

Regarding certifying a program, I guess I could care less what others feel about our particular level of GIS maturity as long as we as a City are OK with where we are right now and how that relates to our goal of where we WANT to be. In many respects, moving up depends on funding, whether for staff, infrastructure, contract services, or whatever. If staff/Council/citizens are not happy with where the GIS program "sits" on the maturity scale, then funding needs to be approved to get the organization where they want to be.

I found it challenging to apply the definitions of Level 1 through Level 5 to some of the measures above. In some instances, I felt compelled to ignore the definitions and rate how well I thought the City was doing on a scale of 1 to 5.
It may have been better to conduct this survey when the economy was not in such bad shape. Current budget cuts and staff reductions influenced some of my answers on your questionnaire.

It seems this survey is very one-dimensional, and so doesn't' have much of a place for our GIS organization and productivity. We have a small county (75k population). We have many deficiencies, especially in metadata, and aging end-user software, but little of that would be fixed by becoming more "mature" without additional resources.

Future Development & Next Steps

- Feedback and comments on proposed approach
- Refine capability & ability components
- Refine assessment scales
- Further analyze data and apply model
- Assess normative maturity levels
- Invite feedback & additional survey results
- Is there value in the GIS CMM approach? If so, what is the value?
- Would there be value in 'accrediting' GIS programs?
- Half Day GIS CMM Workshop at GIS-Pro 2010 in Orlando

Acknowledgements

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Danielle Ayan, GISP, State of Georgia
Lisa Castle, King County GIS Center
Richard Gelb, King County DNRP
George Horning, King County GIS Center
Mike Leathers, King County GIS Center

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Questions, Follow-up Research, and Future Direction: Discussion

- Questions?
- Suggestions?
- Research Direction?
- What Next?

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