Esri Departments of Transportation Webinar Series

Best Management Practices in Transportation GIS

Best Management Practices in GIS

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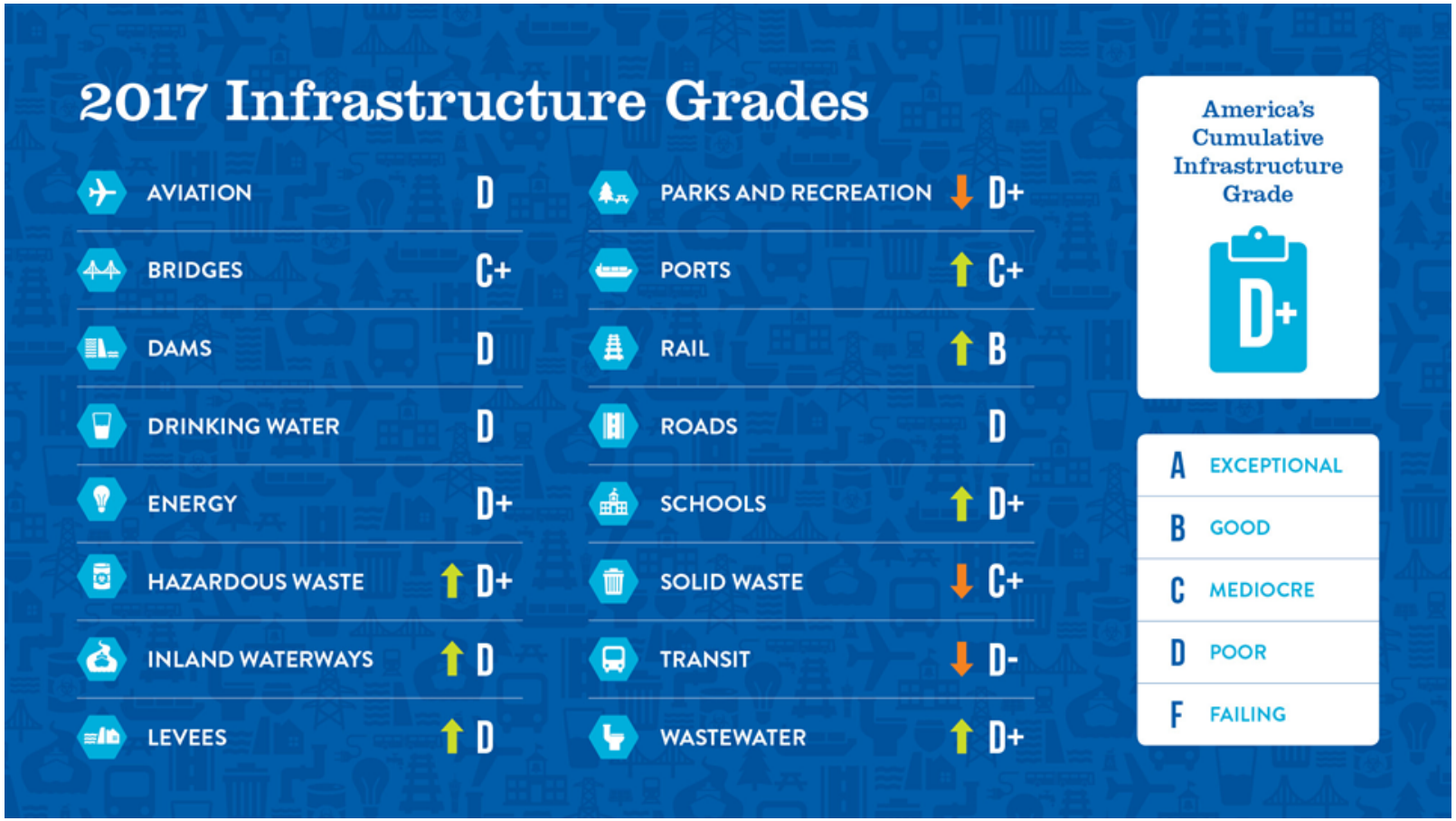
Best Management Practices in GIS



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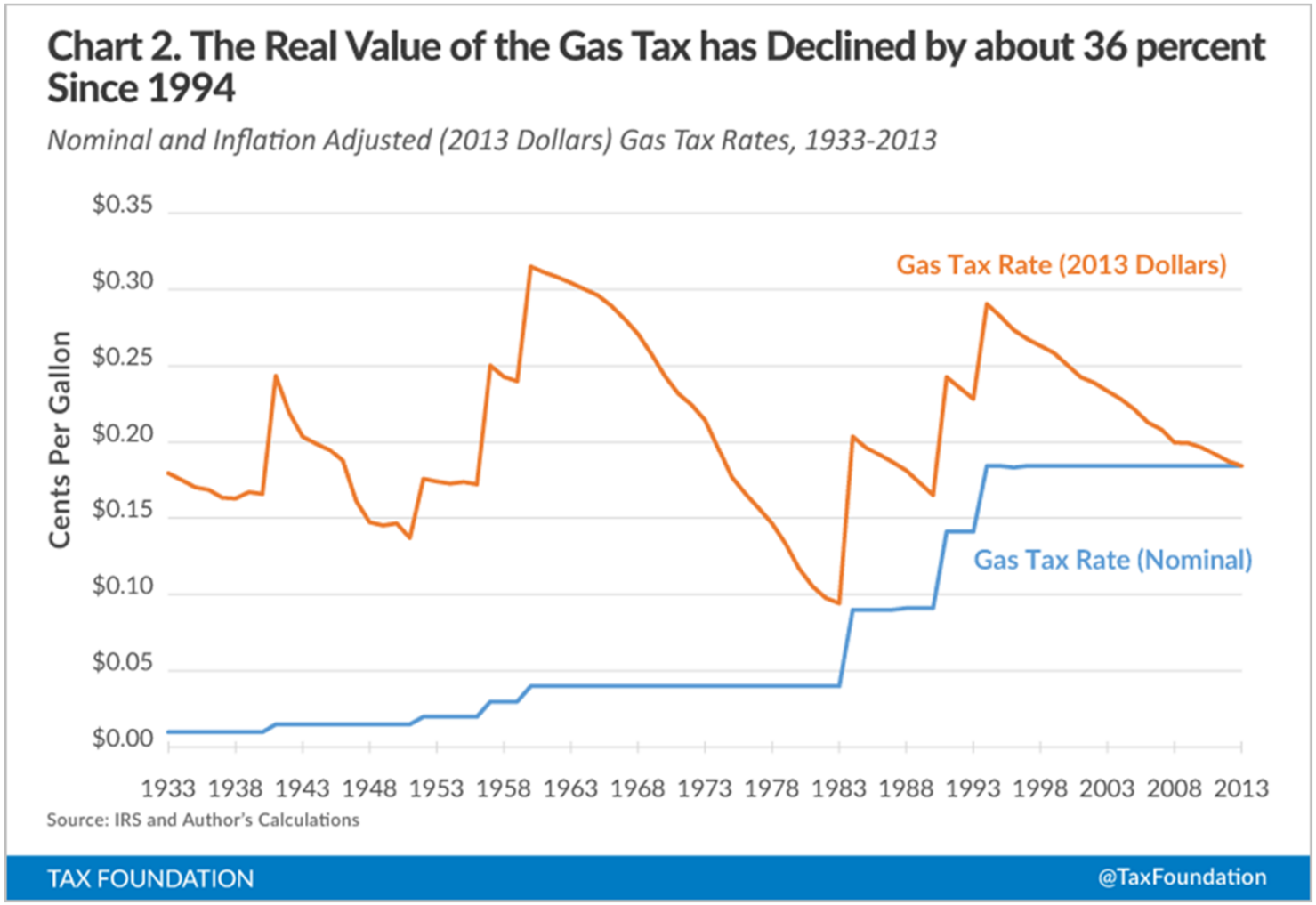

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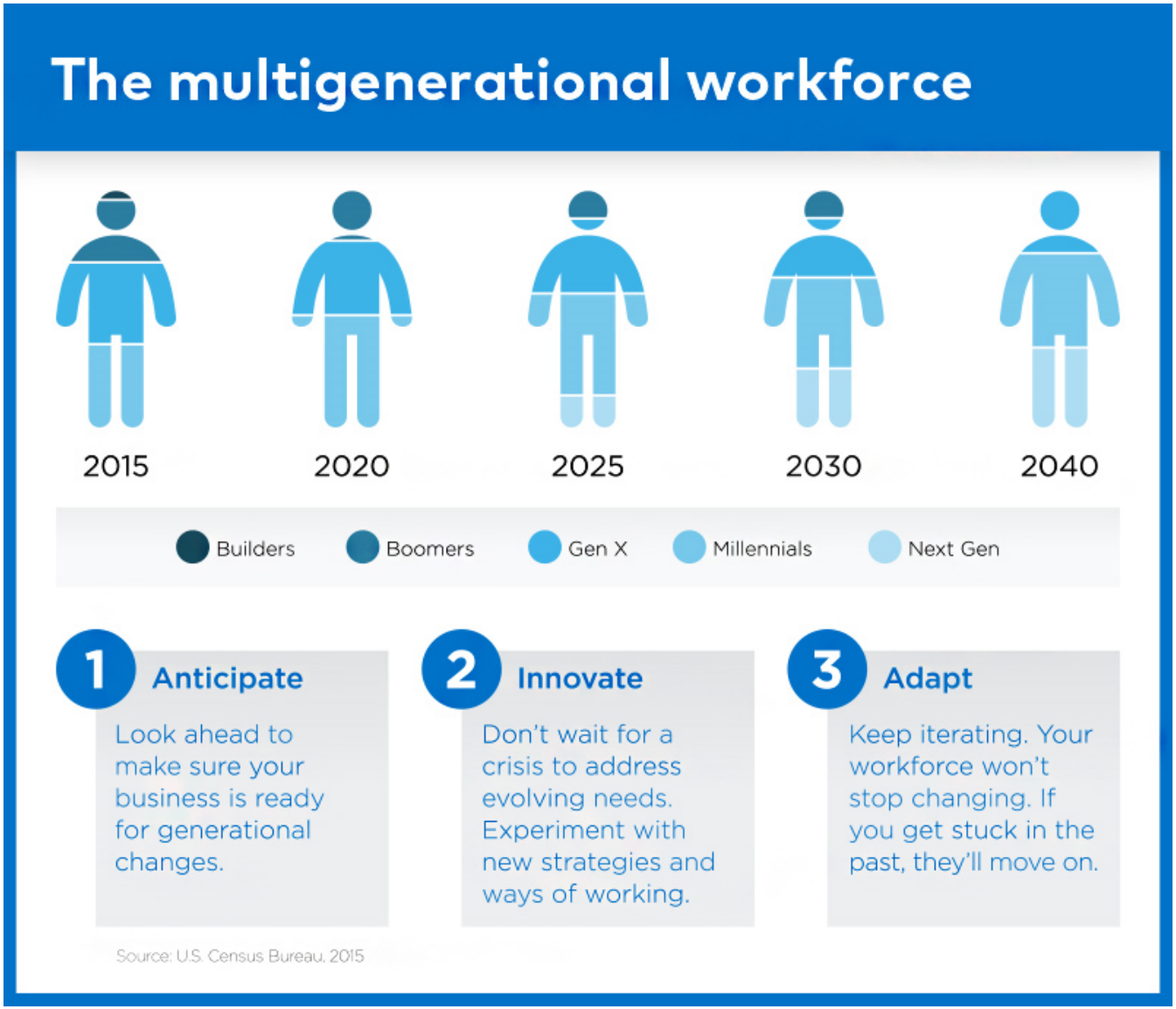


Best Management Practices in GIS

TAM Principles

1. Policy Driven
2. Performance-Based
3. Evaluates Options
4. Data Driven
5. Transparent

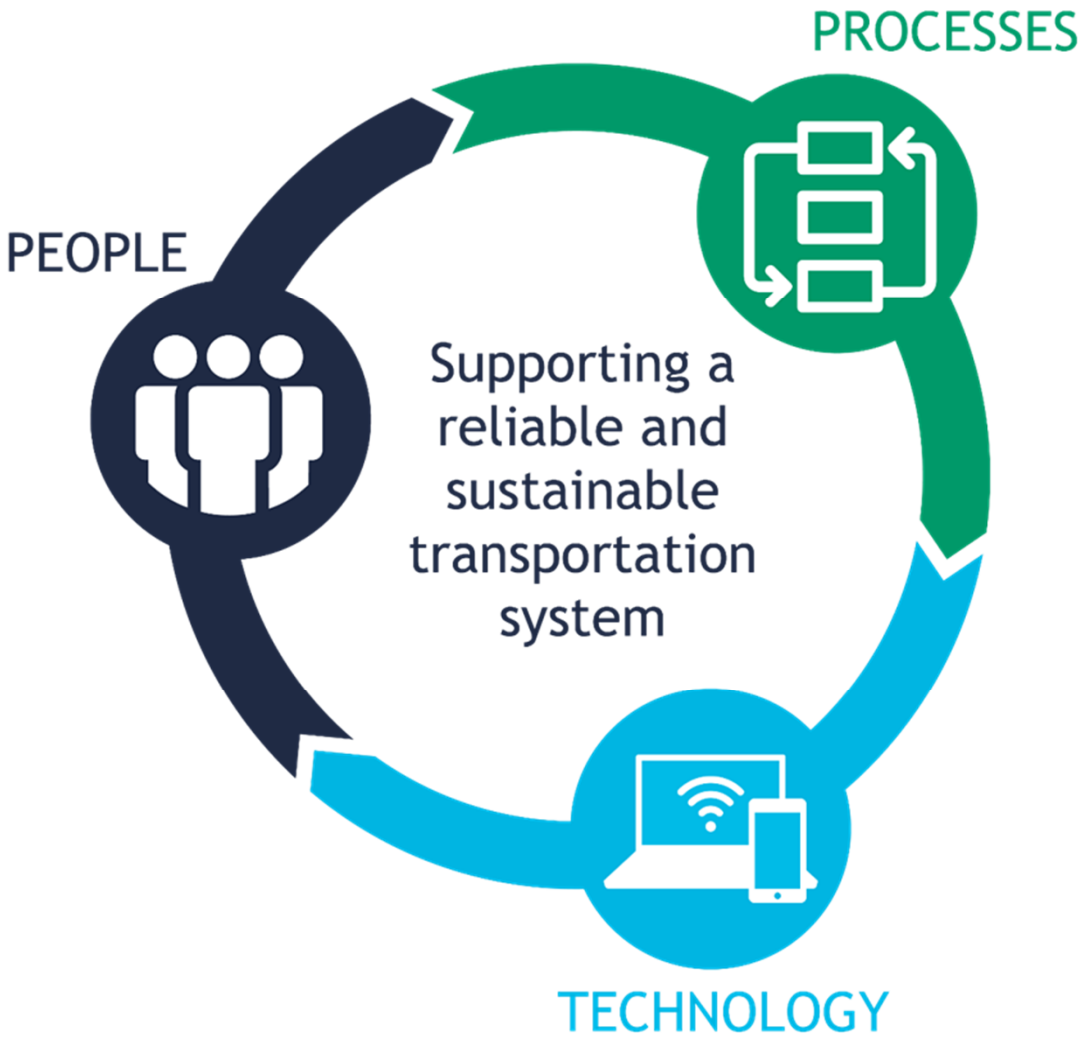
Best Management Practices in GIS

Transportation Asset Management

https://www.youtube.com/watch?time_continue=145&v=A73b4dtE1Bk

Best Management Practices in GIS

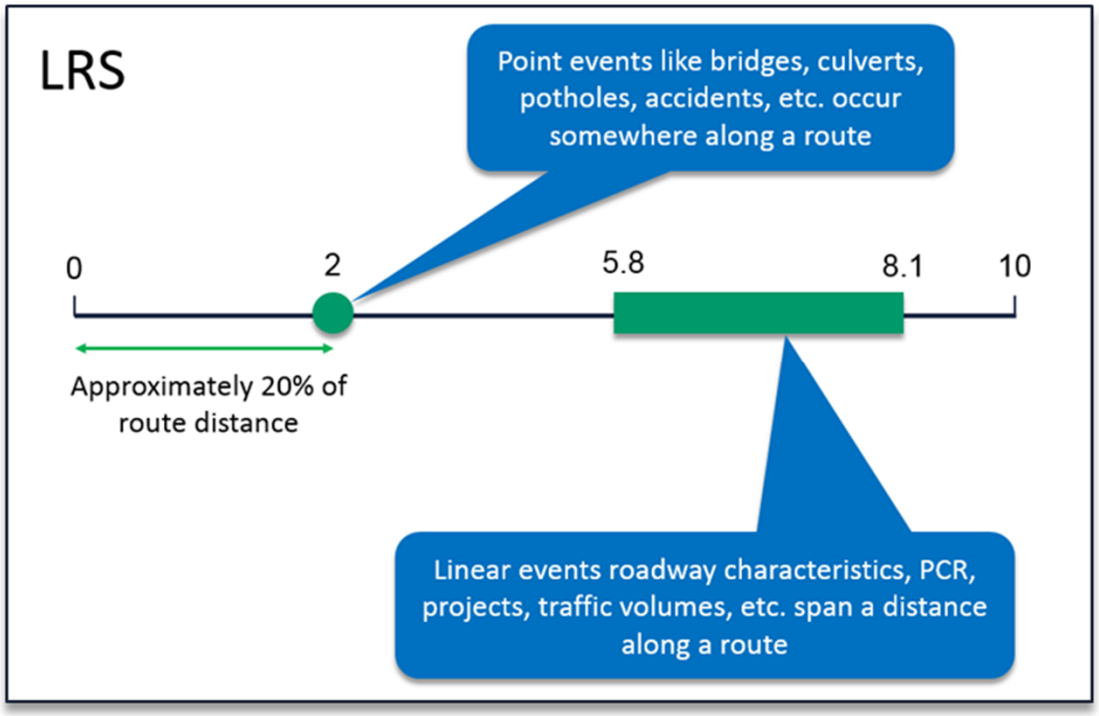
Critical TAM Elements



Best Management Practices in GIS

Why GIS matters for TAM?

- Location Matters
- Linear Referencing enables IT system isolation & integration simultaneously



Maintain complex data in separate systems, and is connected via the LRS

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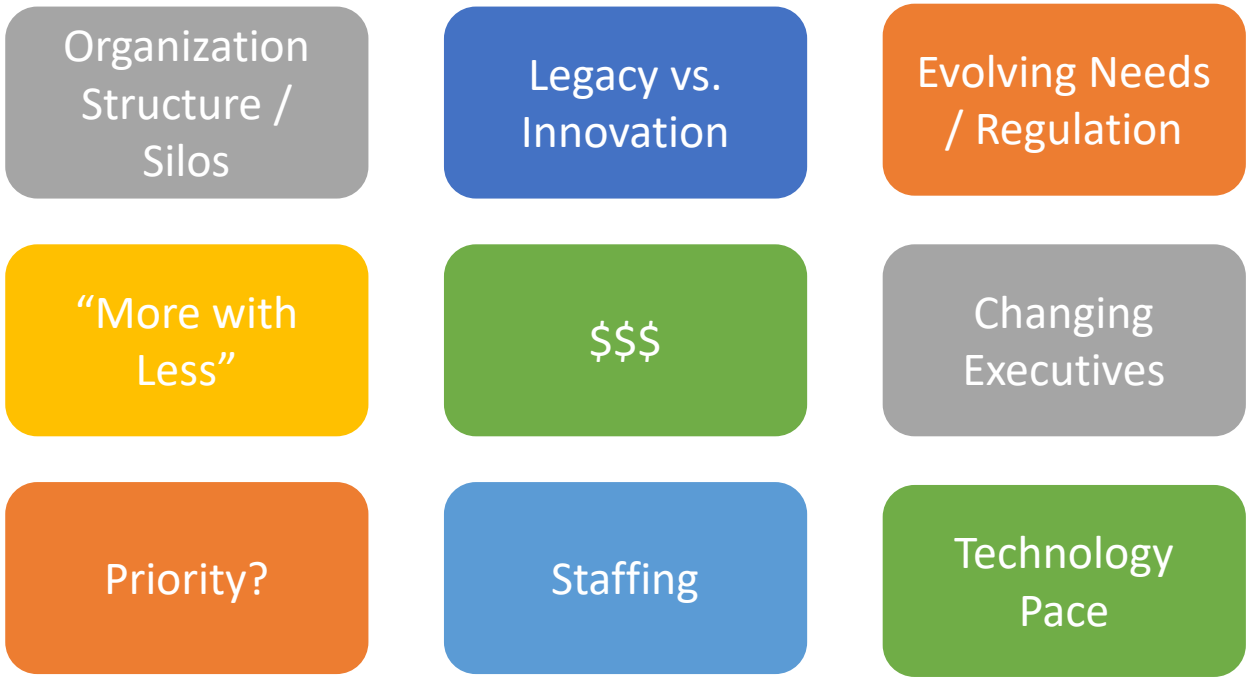
DOT GIS Staff Challenges



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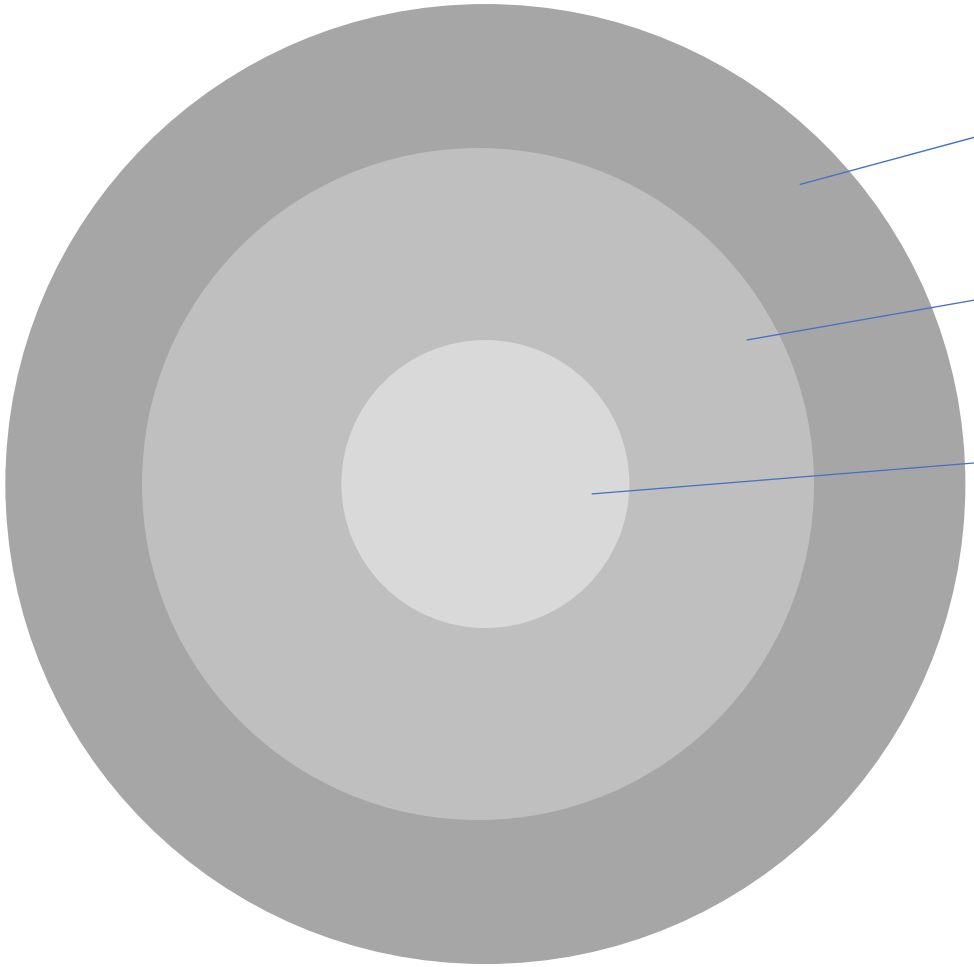

How to structure a GIS program while balancing these varying levels of interest / influence?

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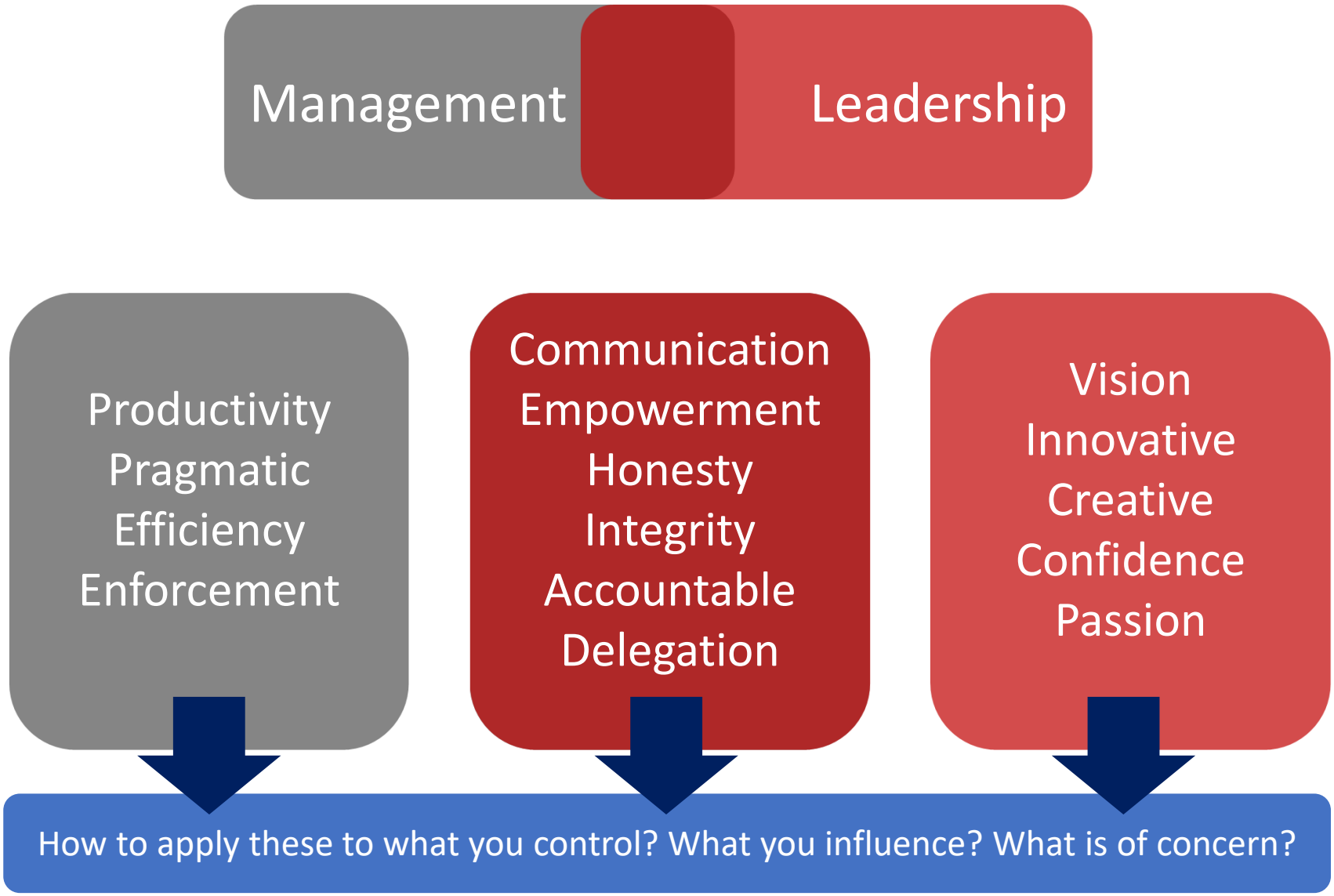


Best Management Practices in GIS

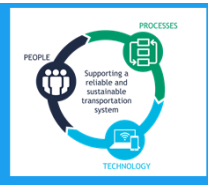
ITIL Concept

Program

A group of related activities whose outcomes achieve a Vision, Mission or Goal Programs are often continual, and change over time

Project

A specific set of activities, with a defined begin and end, whose outcomes contribute to the Objectives, CSF, KPI Metrics or Measures needed by a Program to be successful

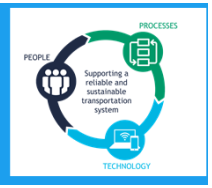


Capability Maturity Models

What is maturity?

Organizational maturity is a measure of an organization's readiness and capability expressed through its people, processes, data and technologies and the consistent measurement practices that are in place

Best Management Practices in GIS: **Process**



Capability Maturity Models

How do we determine maturity?

A **maturity model** is a framework that is used as a benchmark for comparison when looking at an organization's processes. It is specifically used when evaluating the capability to implement data management strategies and the level at which that organization could be at risk from said strategies.

Best Management Practices in GIS: **Process**

Capability Maturity Models

How do we determine maturity?

A **Capability Maturity Model** (CMM) is a methodology used to develop and refine an organization's process. The **model** describes a five-level evolutionary path of increasingly organized and systematically more mature processes.

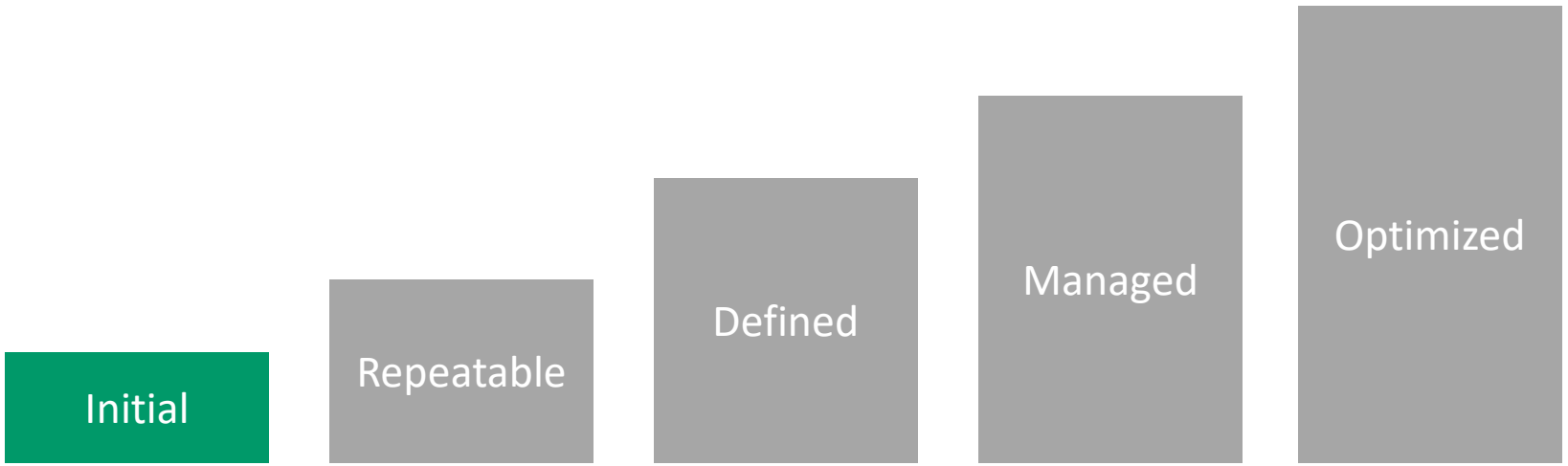
Best Management Practices in GIS: **Process**

Capability Maturity Models

Maturity Levels

Initial

- Processes are disorganized
- Individual efforts
- Not repeatable
- Not defined and documented
- Reactive



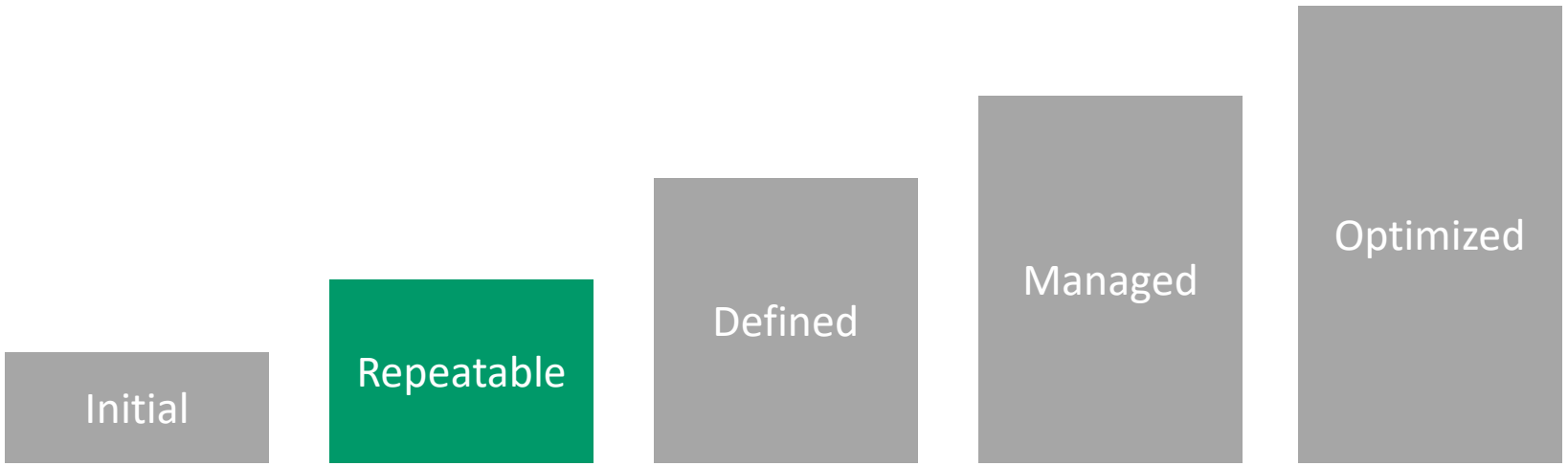
Best Management Practices in GIS: **Process**

Capability Maturity Models

Maturity Levels

Repeatable

- Basic management techniques
- Successes can be replicated
- Established process



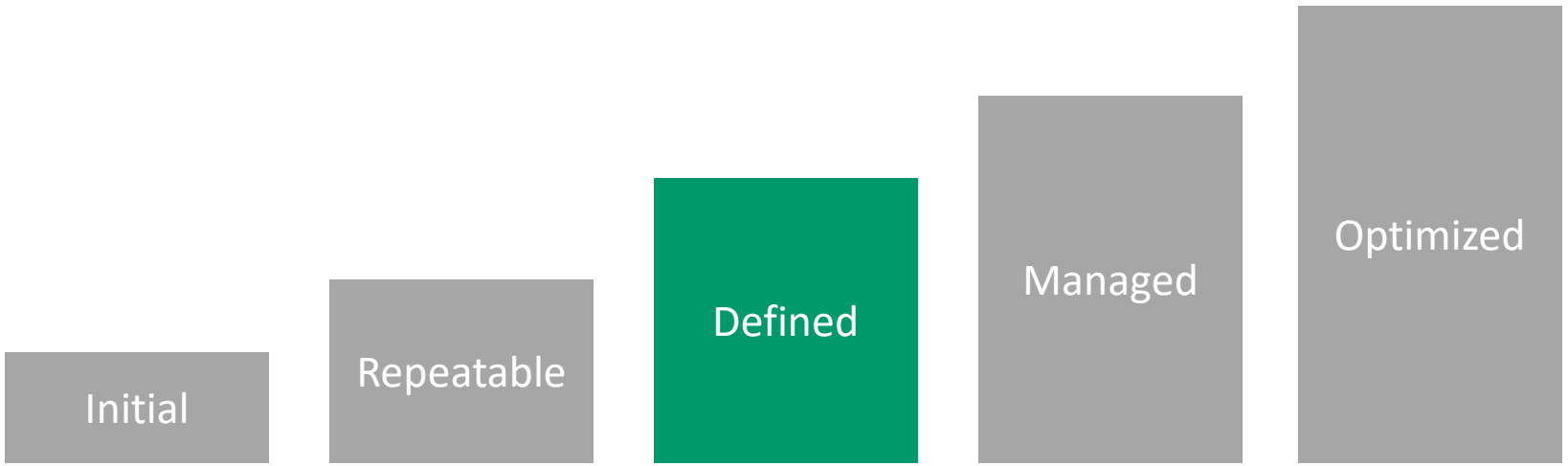
Best Management Practices in GIS: **Process**

Capability Maturity Models

Maturity Levels

Defined

- Documented processes
- Generally consistent application



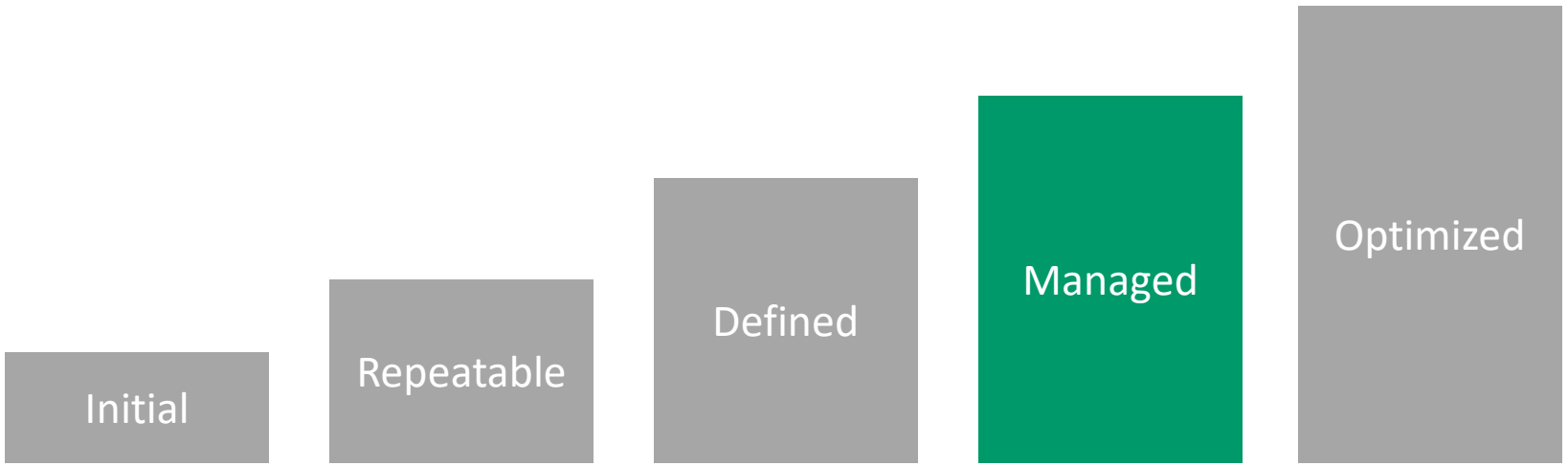
Best Management Practices in GIS: **Process**

Capability Maturity Models

Maturity Levels

Managed

- Documented processes
- Performance measured



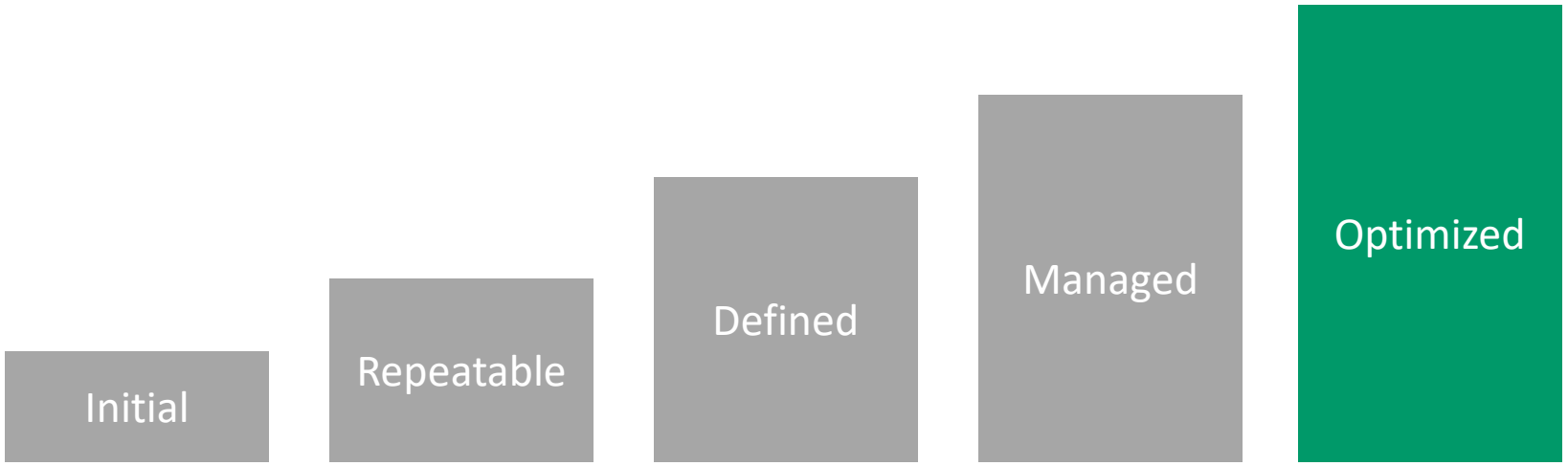
Best Management Practices in GIS: **Process**

Capability Maturity Models

Maturity Levels

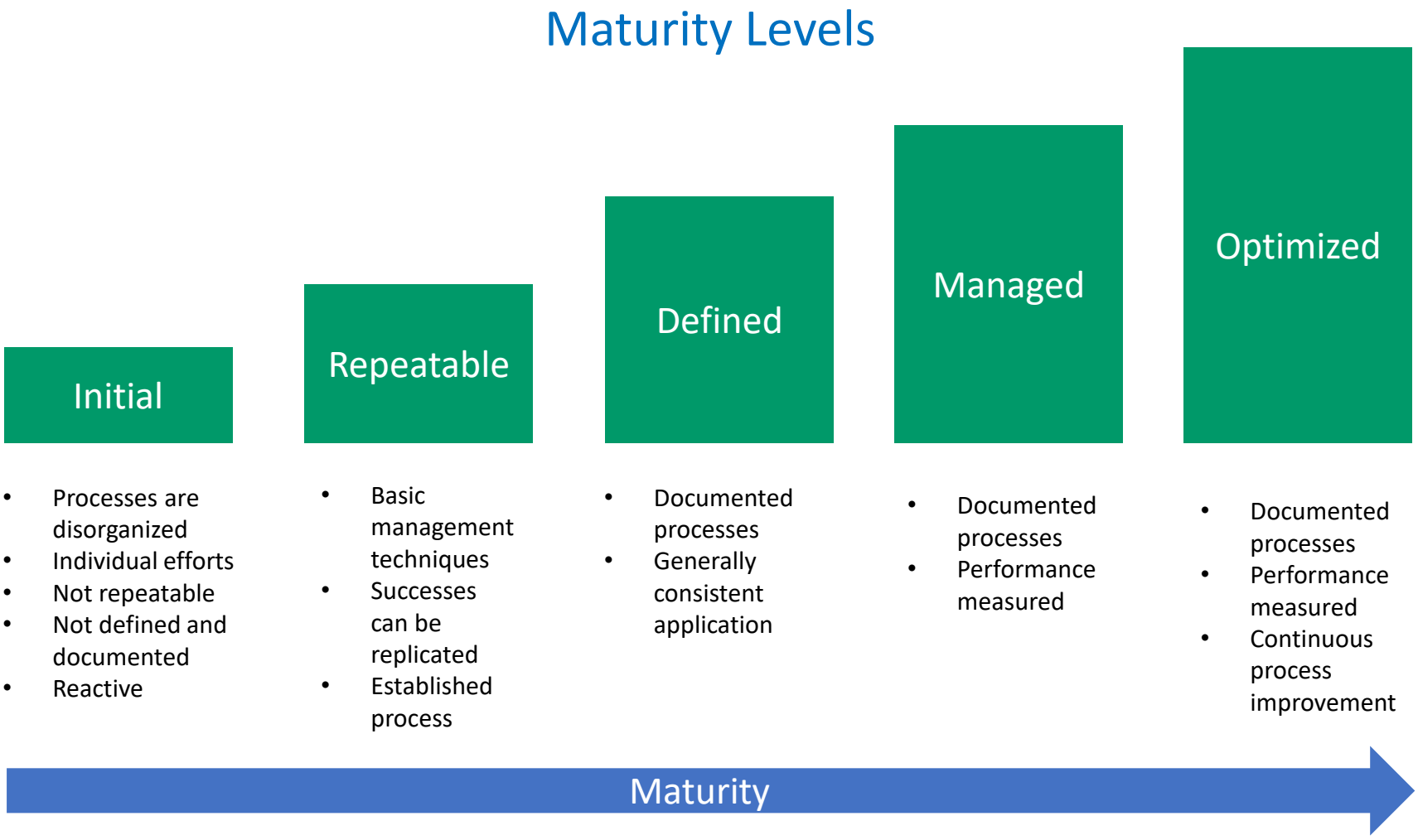
Optimized

- Documented processes
- Performance measured
- Continuous process improvement



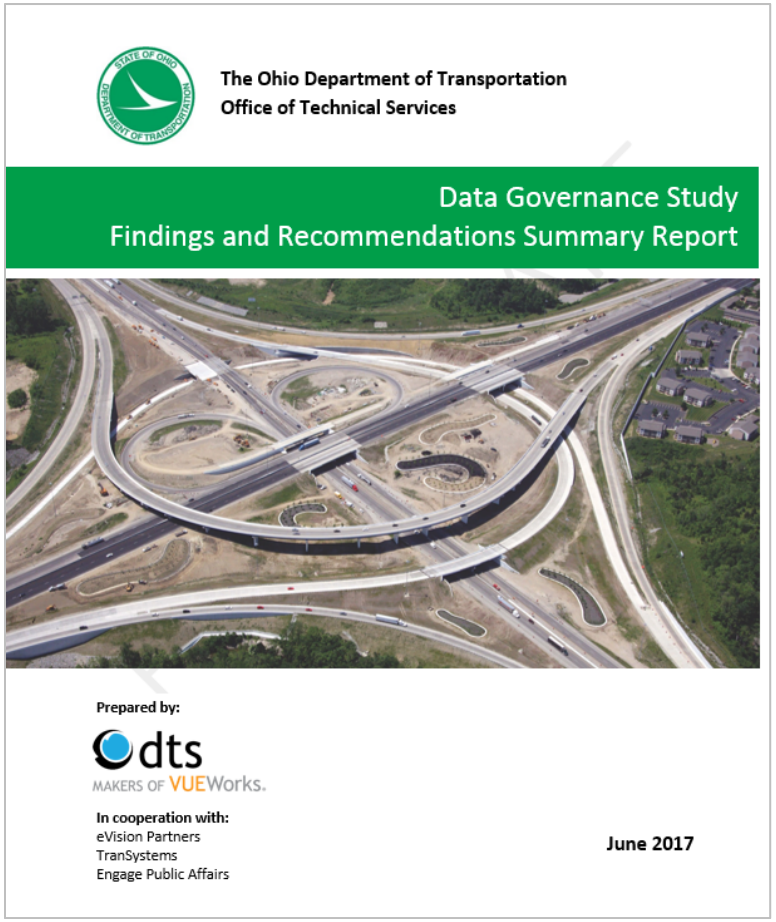
Best Management Practices in GIS: **Process**

Capability Maturity Models



Best Management Practices in GIS: **Process**

Capability Maturity Models: Example – ODOT Data Governance



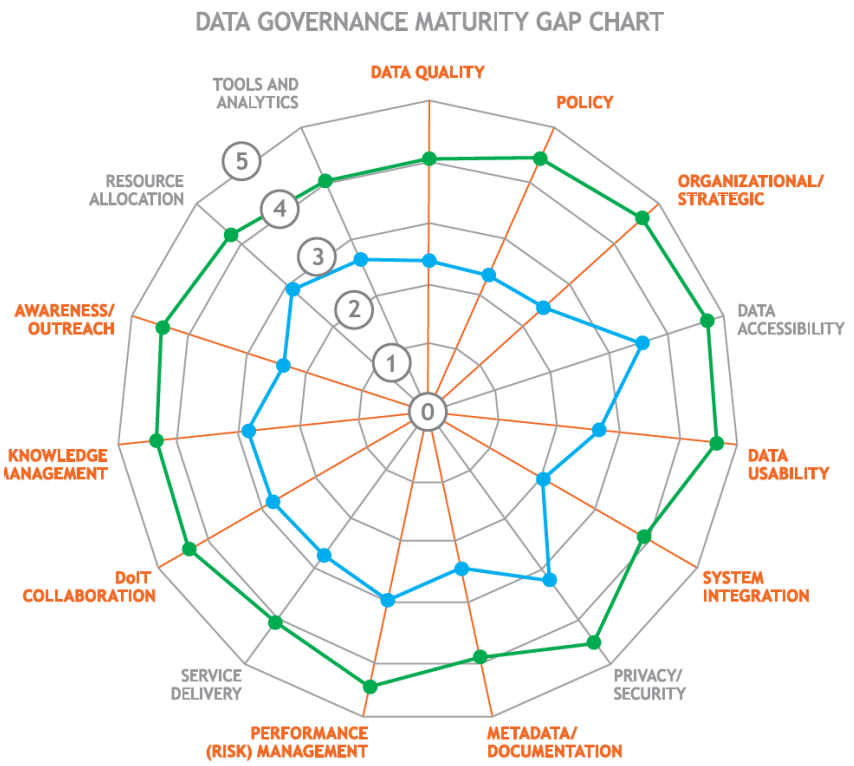
- Tailored Maturity Model
- Online Survey
- 2 rounds SME interviews
- DG Committee Results Review
- Recommendations

Best Management Practices in GIS: **Process**

Capability Maturity Models: Example – ODOT Data Governance

Maturity Summary

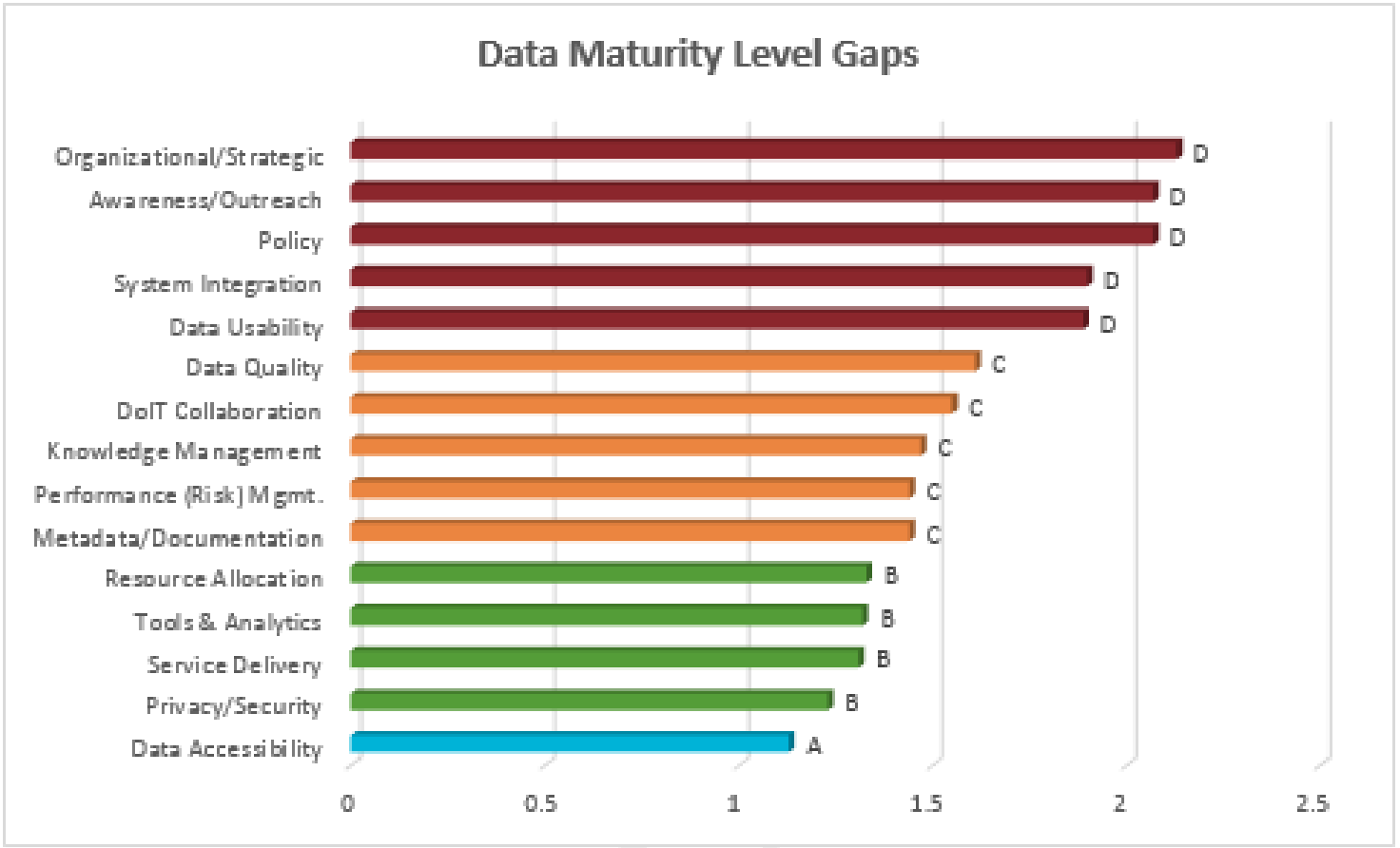
Table 2 – Data Governance Area Summary Assessment for All Assets				
Data Governance Areas	**Current Maturity Level**	**Target Maturity Level**	**Gap**	**Grade**
Data Quality	2.43	4.04	1.61	C
Policy	2.40	4.47	2.07	D
Organizational/Strategic	2.51	4.64	2.13	D
Data Accessibility	3.60	4.73	1.13	A
Data Usability	2.78	4.67	1.89	D
System Integration	2.13	4.03	1.90	D
Privacy/Security	3.33	4.57	1.23	B
Metadata/Documentation	2.56	4.00	1.44	C
Performance (Risk) Mgmt.	3.07	4.51	1.44	C
Service Delivery	2.84	4.16	1.31	B
DoIT Collaboration	2.88	4.43	1.55	C
Knowledge Management	2.89	4.36	1.47	C
Awareness/Outreach	2.43	4.50	2.07	D
Resource Allocation	2.93	4.27	1.33	B
Tools and Analytics	2.68	4.00	1.32	B



Best Management Practices in GIS: **Process**

Capability Maturity Models: Example – ODOT Data Governance

Maturity Summary



Best Management Practices in GIS: **Process**

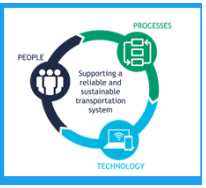
Capability Maturity Models: Example – ODOT Data Governance

Recommendations

ODOT Data Governance Proposed 5-Year Timeline

PHASE 1	PHASE 2	PHASE 3
PLAN AND DESIGN	**BUILD**	**IMPLEMENT**
New Agency-Wide Approach to Data Governance	New Data Governance Framework	New Data Governance Plan
▸ Hire Chief Data Officer ▸ Establish data governance framework ▸ Create data governance oversight committee ▸ Develop executive level-approved data governance policy	▸ Review DoIT's current organizational structure ▸ Review skillsets needed to support the data governance framework ▸ Ensure IT strategic plan supports business needs ▸ Explore business intelligence capabilities	▸ Develop and integrate data warehouse/data lake ▸ Standardize data and migrate to new system ▸ Incorporate locational component in enterprise data

Best Management Practices in GIS: **Process**



Capability Maturity Models: Example – SLIMGIM-T

Tailored DOT GIS CMM

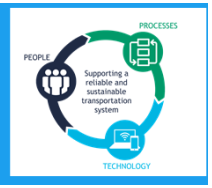
- Developed through FHWA Peer Exchange collaboration
- Goal to enable organizational maturity comparison

Maturity Areas

- Organizational Structure & Leadership
- Corporate Culture
- Organizational Capability
- Enterprise GIS Sustainability
- Foundational Data Technologies

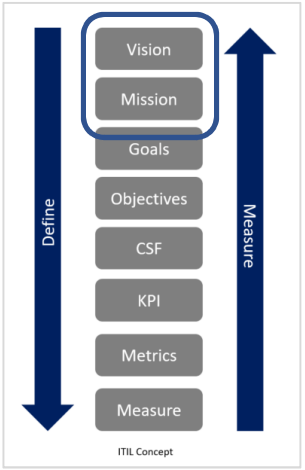
Free via Creative Commons public use license
Hosted online by Paul Giroux at:
https://www.slimgim.info/the-models.html

Best Management Practices in GIS: **Process**



Strategic Planning: Business Plan Importance

- Strategic planning determines **where** the GIS program is going, **how** you are going to get there, and **how you will know** if you got there.



Disciplines

- Strategic planning
- Organizational change
- Program Management
- Public management
- GIS—management & technical

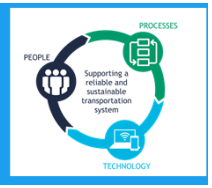
GIS Strategic Planning

- Methods
- Leadership
- Management
- Resources
- Timing
- Understanding & Commitment

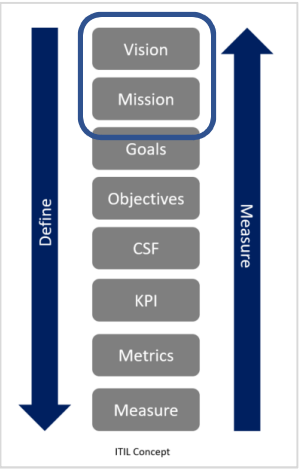
Techniques & Tools

- Communication
- Group processes
- Consensus building
- Conflict resolution
- Analysis

Best Management Practices in GIS: **Process**



Strategic Planning: Business Plan



Office of Technical Services

Transporta
Informatio
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Business Plan 2019

OHIO DE
TRANSP

Office of Technical Services • Transportation Information Management Section
Business Plan 2019

Executive Summary

PRIMARY OBJECTIVES	**Roadway Informatio** We are responsible f roadway information distribute tax revenu analysis across ODOT As technology and t Vehicles, Intelligent roadway information **Geographic Informat** We are responsible accessing information deploy business intel applications) and fiel iPad applications for We ensure this techn upgrade to keep ODO
VISION	Information and Serv
MISSION	Fulfill assigned regula Support Ohio's Strate Implement Transport
CORE VALUES	Integrity, Transparen

OBSTACLES	Competing priorities,
SHORT-TERM	Enable cross-project
LONG-TERM	Implement continuou
SUCCESS	Adopt process-orient

PEOPLE	Empower, enable & c
PROCESSES	ITIL; CMM; Agile
TECHNOLOGY	Simplify, Integrate, C

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Business Plan 2019

Guiding Principles

ITIL + Capability Maturity

Information Technology Service Management (IT

ITIL is a framework that enables strategic alignmer
services with customer needs, focusing on delive
value while creating efficiency. This is achieve
defining processes to enable consistency, leadin
the ability to measure their performance.

The TIM Section leads several ODOT mission cri
systems and processes, and ITIL provides a framev
for organizing these activities to ensure our teams
adapt to changing needs.

While we have unknowingly implemented ITIL
practices over the last several years, our Sec
formally embraced the methodology in 2018.
members are now ITIL Foundations Certified and
striving to integrate these concepts into our every
workflows.

DoIT also utilizes the ITIL framework, which ena
strong collaboration opportunities across our are

Capability Maturity

Capability Maturity is a simple method of assessin
based on common criteria. Assessing the matur
opportunities exist.

It also helps manage scope of our work; often our team members want to jump to the Optimized phase due to their desire to be the best, but often this is not feasible until other factors have matured as well.

These concepts help make our progress manageable and realistic.

Initial

- Processes are disorganized
- Individual efforts
- Not repeatable
- Not defined and documented
- Reactive

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Strategic Trends

Item	Status	Trend
People	Individuals & teams continue to grow in aptitude, skill and collaboration. This growth enables the TIM Section more productivity & ownership of solutions	↑
Processes	Workflows & architectures are being documented and integrated to daily operations. This enables better understanding of value and performance	↑
Technology Platform	Two of four ESRI based systems (RIMS & Collector) are experiencing performance issues. ESRI is also seeking to increase our licensing costs. Secured agreement to maintain current licensing in 2019 & revisit once issues are resolved.	↔

Enterprise Program Support

In addition to the core work plan items specified in this business plan, the TIM leadership for the following initiatives:

2019 Work Plan	
Program	**Goal**
Transportation Asset Management	Provide oversight & guidance for District Transportati Coordinators (DTAMC)
	Create & implement DTAMC annual action plan
	Develop process for monitoring and reporting TAM pr
Data Governance	Project Kick-Off for Data Governance Phase 1
	Begin Data Governance Policy & Framework developr

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Roadway Information Program Descriptions

The Roadway Information is the official record keeping of the road network information for the State of Ohio. This portfolio includes several programs, each driven by specific State/Federal regulatory statute, or to meet a business purpose related to ODOT's overall maintenance of Ohio's transportation system. Several projects are underway to advance some component of the business processes or systems related to ODOT's Roadway Information.

Program: Highway Performance Monitoring System (HPMS)

HPMS is a mandated by Congress (**23 U.S.C. 502(h)**) for the purposes of reporting the conditions and performance of the nation's transportation system. State DOTs are required to complete an annual submission related to public roads eligible for Federal-aid funding. The annual submission is utilized to apportion these funds. HPMS submissions are due by April 15th and June 15th annually, and reflect the road network conditions as of December 31st of the previous year.

Federal Highway Administration

Program: Annual Local Road Mileage Certification

The annual local road mileage certification program is mandated by **Ohio Revised Code 4501.04**, requiring County and Township agencies to certify public road mileage with the state annually. Certification requires signature from all three County Commissioners and the County Engineer, or the three township trustees. The certified mileage is used to distribute County and Township Road funds. Local certification forms are due to ODOT by April 1st and reflect the road network conditions as of December 31 of the previous year.

Program: Certified Road Mileage, All Roads Network of Linear Referenced Data

The Certified Public Road Mileage is an FHWA requirement (**23 CFR 460**) which required state DOTs to annually submit public road mileage certification to FHWA by June 1st. This information is utilized for the apportionment of Highway Safety Funds. The All Roads Network of Linear Referenced Data (ARNOLD) program is implemented through MAP-21, requiring a geospatial digitized linear referencing network of all roads. This submission can be facilitated to FHWA as part of the HPMS submittal or separately with the certified public mileage submission.

Federal Highway Administration

Program: Functional Classification

Functional Classification is a designation system prescribed by FHWA which assigns roadways a category that identifies the primary purpose of a given route. This designation includes implications for design and operational standards, safety standards, Federal-Aid funding, and other factors. Functional Class is updated in conjunction with the decennial census. Functional classification is a significant designation utilized by transportation planners during project planning processes.

Federal Highway Administration

Program: Location Based Response System (LBRS)

The Location Based Response System (LBRS) is an Ohio based initiative, which establishes a partnership between ODOT, the Ohio Geographically Referenced Information Program (OGRIP), and local government agencies to create and maintain a statewide street centerline and address file. This program enables communication across jurisdictions for NexGen911 purposes and helps ODOT meet ARNOLD requirements to FHWA.

OGRIP

Best Management Practices in GIS: **Process**

Strategic Planning: Business Plan

Federal Highway Administration

HPMS

Ohio Certified Mileage

Federal Highway Administration

ARNOLD

Federal Highway Administration

Functional Class

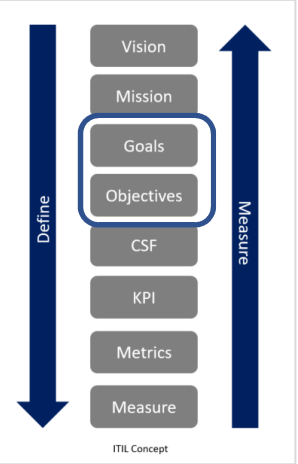
LBRS

ODOT Roadway Information Program

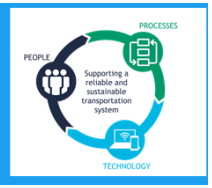
Best Management Practices in GIS: **Process**

Strategic Planning: Business Plan

2019 Work Plan	
Project/Activity	**Goal**
RIMS	Complete RIMS 2018 Season by 2/15/19 (edits, certified mileage, etc.)
	RIMS Maintenance
	Begin RIMS 2019 Season by (open system by May)
	BTRS 2018 Implementation
	BTRS Replacement
	Complete Validation Processes (shifting validations from BTRS to front end) – Priority 3
	Develop & Implement Publication / Reports – Priority 3
	RIMS Stability Issues – Priority 1
	Intersection Preserve Identifiers – Priority 3
	Intersection Phase II
	RIMS Process Improvement (implementing ITIL, updating RI Manual, establishing CSF/KPI for RIMS, Incident Management implementation)
HPMS	April Submission
	June Submission
	NBI-HPMS Data Sync
Falcon	Implement document imaging software & processes
LBRS Priority 2	Complete Preble, Medina, Auglaize, Geauga, Cuyahoga, Belmont, Delaware, Harrison, Union, Logan, Henry, Ashtabula, Athens, Stark, Carroll (15 counties)
PWEB	Implement Phase 1
	Implement Phase 2
Administration	Section Oversight
	Software Licensing (ESRI ELA, other software)
	OSIP Imagery MOU Funds
	ITIL Process Implementation

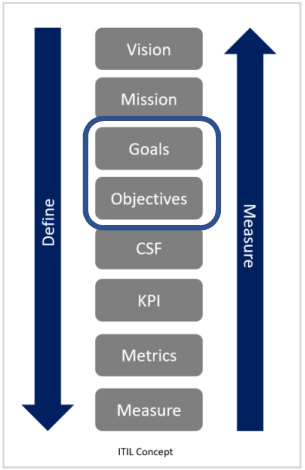


Best Management Practices in GIS: **Process**



Strategic Planning: Business Plan: Strategic Analysis

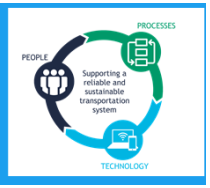
- Review the program and the environment
- SWOT analysis
  - Strengths & weaknesses (internal)
  - Opportunities & threats (external)



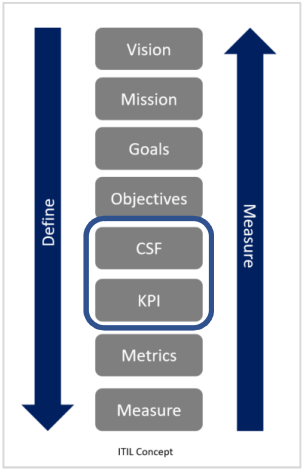
2018 SWOT

SWOT ANALYSIS	
INTERNAL FACTORS	
STRENGTHS	WEAKNESSES
• Exceptional staff • Ample funding • Advanced information systems • Enterprise support	• Strategic project/program activity alignment • Ownership/integration of core technology for core business processes
EXTERNAL FACTORS	
OPPORTUNITIES	THREATS
• Influence vendor technology dev • Provide leadership for national/ state / local programs	• Unknown regulatory implementation timelines from FHWA • Changing DAS / IT / Procurement rules
SWOT ANALYSIS	
The TIMS area is successful in meeting current needs, and in a strong position to adapt to changing needs due to the high quality staff, funds and systems currently in place. These factors enable ODOT to guide industry solution development to benefit ODOT's objectives. Inconsistent or unknown timelines/rules create planning challenges, combined with existing internal coordination deficiencies result in disruptive reactionary response to issues as they arise.	

Best Management Practices in GIS: **Process**

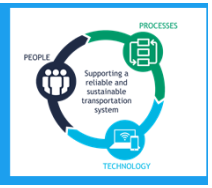


Strategic Planning: Business Plan

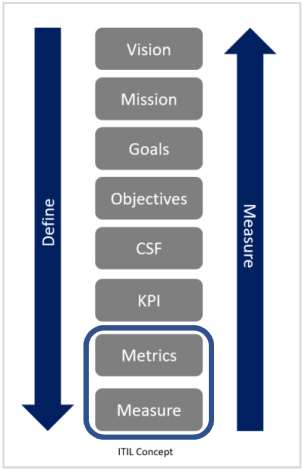


	ID	TAMP CSF / KPI		Measure (0 - 100%)	Maturity (0 - 5)	Last Period	Trend
CSF	1	Asset Information Ability to Make Informed Decisions		26%	0.9		
	1.1	Asset Inventories Enable Informed Decisions	KPI	44%	1.1		
	1.2	Asset Inspections Enable Informed Decisions		8%	0.7		
CSF	2	Performance Monitor Assets to Enable Improvement		0%	0		
	2.1	Monitor Operational Maintenance Activities	KPI	0%	0		
	2.2	Annual Asset Performance		0%	0		
CSF	3	Personnel Enable Employees for TAM Success		13%	0.4		
	3.1	TAM Training Suffiently Supports Program Activities		40%	1.3		
	3.2	Sufficient Personnel Resources Are Available	KPI	0%	0		
	3.3	District Workplans Have Access to Needed Information		0%	0		
CSF	4	Communication Enable Dialogue Across Division-Districts-Counties		35%	1.1		
	4.1	Opportunities Enabling TAM Communication		56%	2.3		
	4.2	TAM Program Feedback Opportunities	KPI	50%	1.0		
	4.3	Local Collaboration Exists to Support TAM in Other Agencies		0%	0.0		
CSF	5	Technology Enables TAM Process Success		15%	0.8		
	5.1	Technology Software & Hardware Sufficiently Supports TAM	KPI	15%	0.8		

Best Management Practices in GIS: **Process**



Strategic Planning: Business Plan



1	Asset Information - Ability to Make Informed Decisions		26%	0.9	KPI Balance			
1.1	**Asset Inventories Enable Informed Decisions**	**Measurement Method**	**Completeness (0 - 100%)** 44%	**Maturity (0 - 5)** 1.1	**Technology / Process / Service**	**Progress / Compliance / Effectiveness /**	**Leading / Trailing**	**Inside / Outside**
1.1.1	Assets Are Assigned a Prioirty Tier	AMLT Pri… Tier Worksheet	100%	3	Process	Compliance	Trailing	Outside
1.1.2	Ability to Monitor Inv…tory Progress	Report: New Assets A… (by asset, county); Annua…	…%	0	Technology	Progress	Trailing	Inside
1.1.3	Ability to Monitor Inventory Dat…lity / Completeness	Report: List of Assets requ… QA (by Asset, District, County; percent …te/remaining; annual & …y progress)	0%	0	Technology	Compliance	Tr…g	Inside
1.1.3.1	Complete Annual PWEB QAQC	…Completion of Annual PWEB …AQC	0%	0	Process	Compliance	Trailing	…ide
1.1.4	Inventory Systems Receive Ti…y Enhancements	Report: TAMAG Development Status	100%	2	Process	Effectiveness / Efficiency	Traili…	
1.1.5	Assets Have Identi…d DBO / SME	Report: DBO / SME List Available on TAM Extranet	100%	2	Service	Compliance	Trailing	Inside
1.1.6	New Construc…on Assets Are Captured in Asset Inven…tory Systems	Process: Create DGN to GIS converstion process	10%	1	Technology	Efficiency	Leading	Inside
1.2	**Asset Inspections Enable Informed Decisions**	**Measurement Method**	**Completeness (0 - 100%)** 8%	**Maturity (0 - 5)** 0.7	**Technology / Process / Service**	**Progress / Compliance / Effectiveness /**	**Leading / Trailing**	**Inside / Outside**
1.2.1	Asset Inspections Are Completed Per Requirements	Report: Inspections Completed by asset, county, month, annual vs. expected	0%	0	Technology	Compliance	Trailing	Inside
1.2.2	Number of Upcoming Asset Inspection Required	Report: Numbe… of Inspections Anticipated in X timef…e	0%	0	Technology	Compliance	Leading	Outside
1.2.3	Asset C…les / Handoffs Are Defined	Asset Lifecycle Diagrames a…sted on TAM Extranet	25%	2	Process	Efficiency	Leading	Outside

CSF

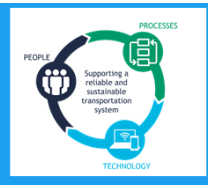
KPI

KPI Balance

Metrics

Measure (SMART)

Best Management Practices in GIS: **Process**



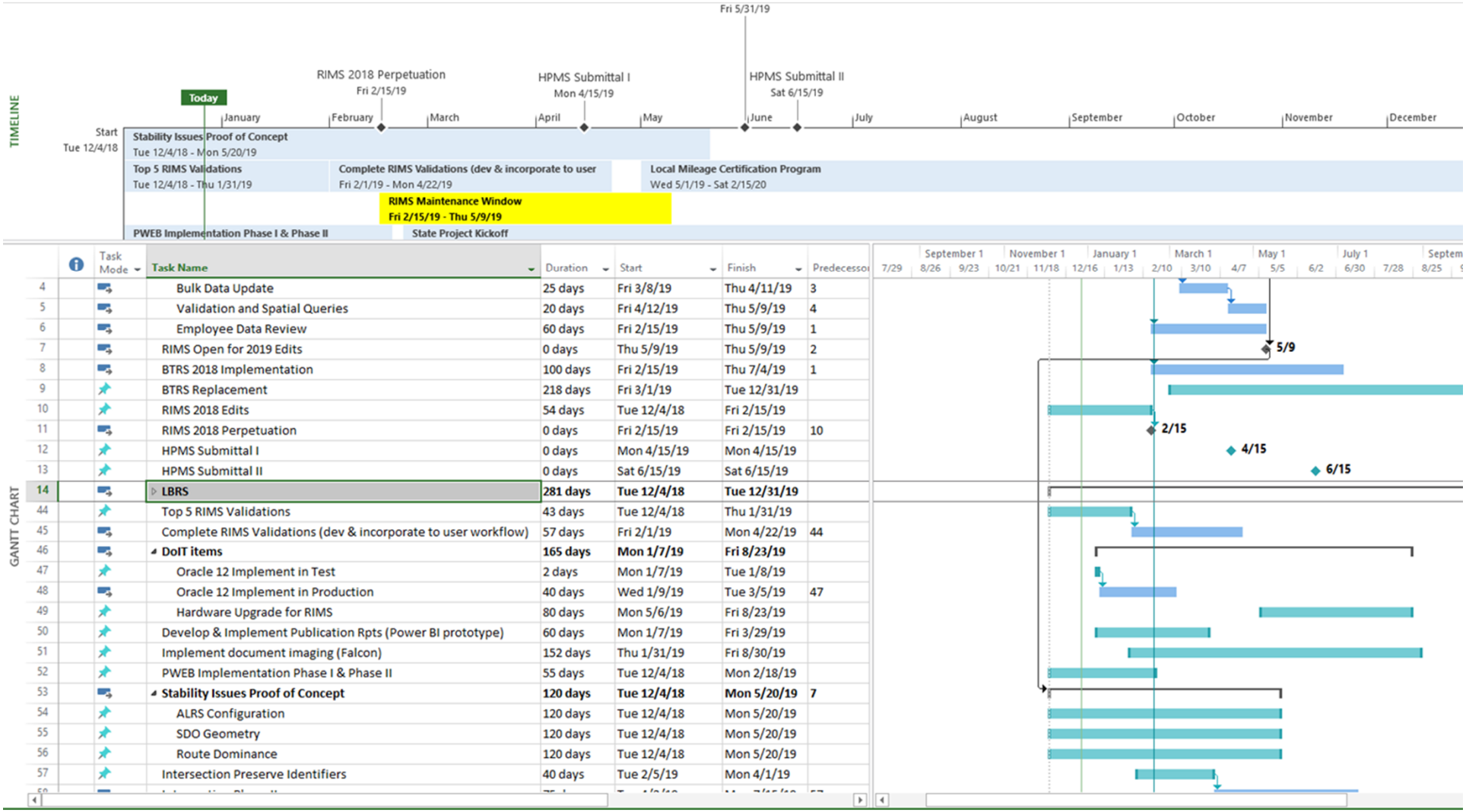
Project Management

Best Practices in Project Management (PM) solutions helps organizations answer questions in five critical areas:

- Risk Control and Mitigation
- Resource Planning
- Financial Management
- Operational Improvement
- Compliance and Control

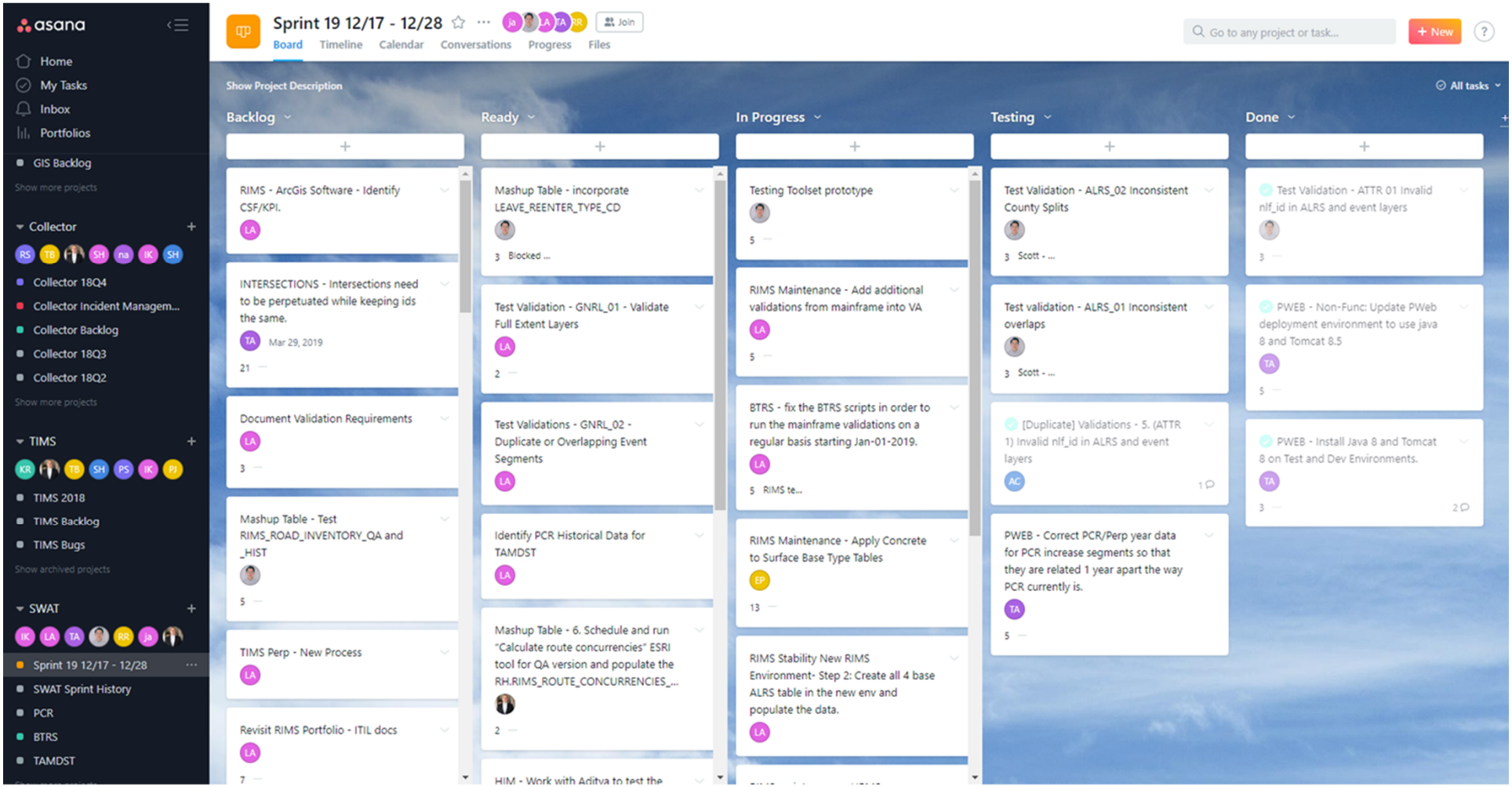
Best Management Practices in GIS: **Process**

Project Management



Best Management Practices in GIS: **Process**

Project Management

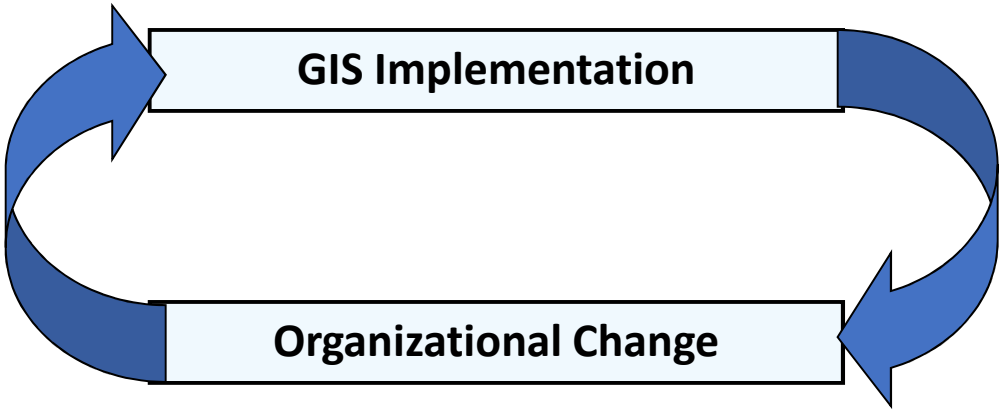


Best Management Practices in GIS: **Process**

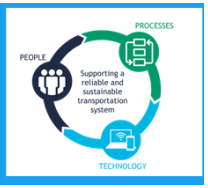
Organizational Change Management

Critical to GIS Success

- Achieve vision and plan
- Achieve benefits
- Improve the organization's operation
- Benefit employees



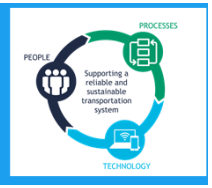
Best Management Practices in GIS: **Process**



Organizational Change Management

- Common Terms
  - Organizational change
  - Planned change
  - Change management
- Organizational Development
  - "A system-wide application of behavioral science knowledge to the planned development and reinforcement of organizational strategies, structures, and processes for improving an organization's effectiveness." – Cummings and Worley, 1997

Best Management Practices in GIS: **Process**



Organizational Change Management

Components

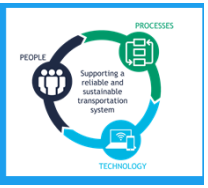
Elements:

- Management support
- Understanding and willingness
- Change agent
- A plan and method
- Participation
- Team
- Communication
- Education
- Closure

Changes Must Occur in…

- Structure
- Roles
- Strategic planning
- Policies and procedures

Best Management Practices in GIS: **Process**



Organizational Change Management

Change Sources

Source of Change

- Internal
  (inside organization or project structure)
- External

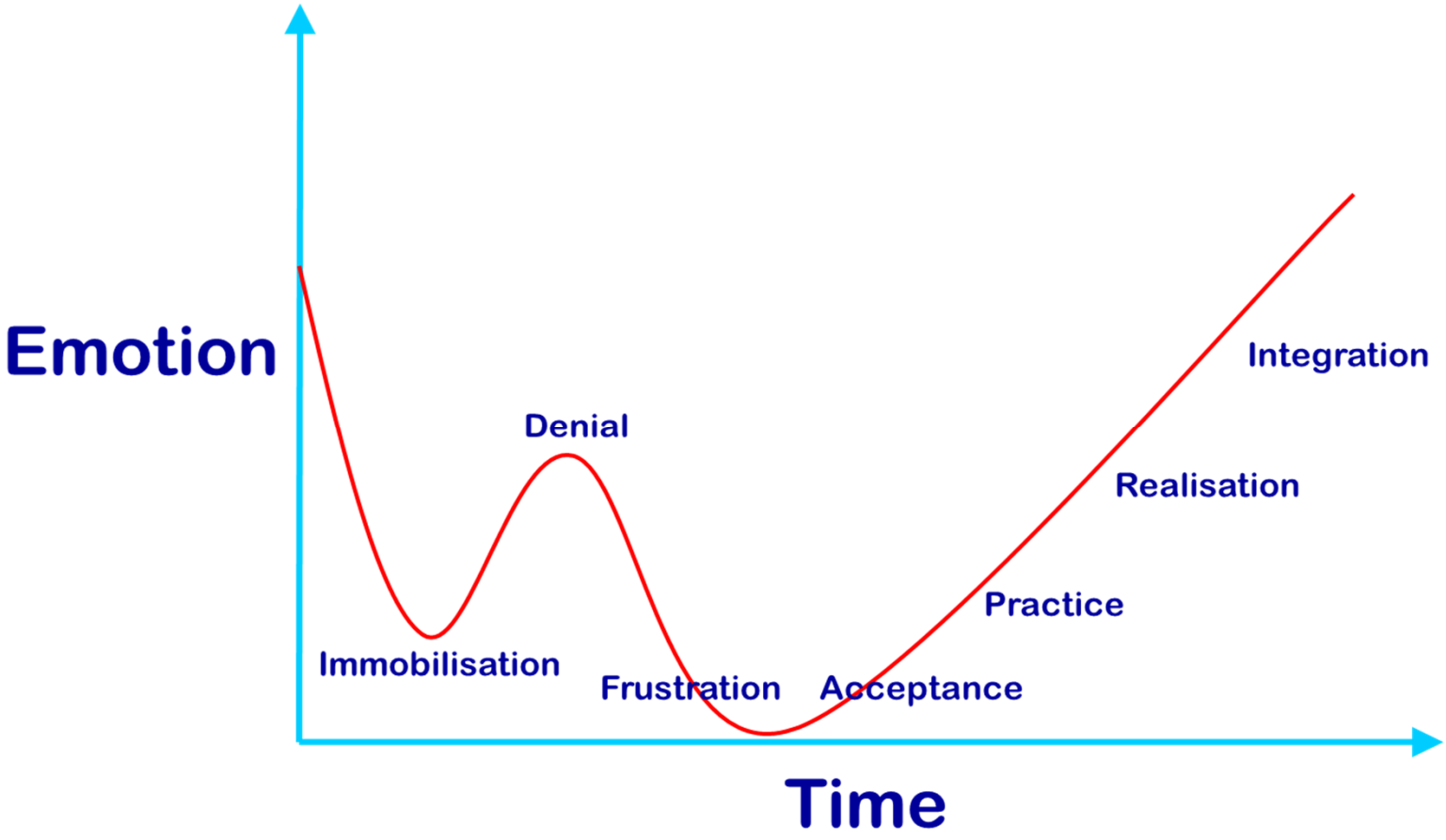
Nature/Triggers of Change

- Cyclical/Predictable
- Self-induced or planned
- Unpredictable
- Forced/Mandated

Best Management Practices in GIS: **Process**

Organizational Change Management

Phases of Change



Organizational Change Management

Managing Change

- Clarify expectations and roles for the change process
- Identify priorities for change
- Plan organizational development activities to address priorities

Best Management Practices in GIS

Industry Hot Topic: Data Governance: Data is THE Asset

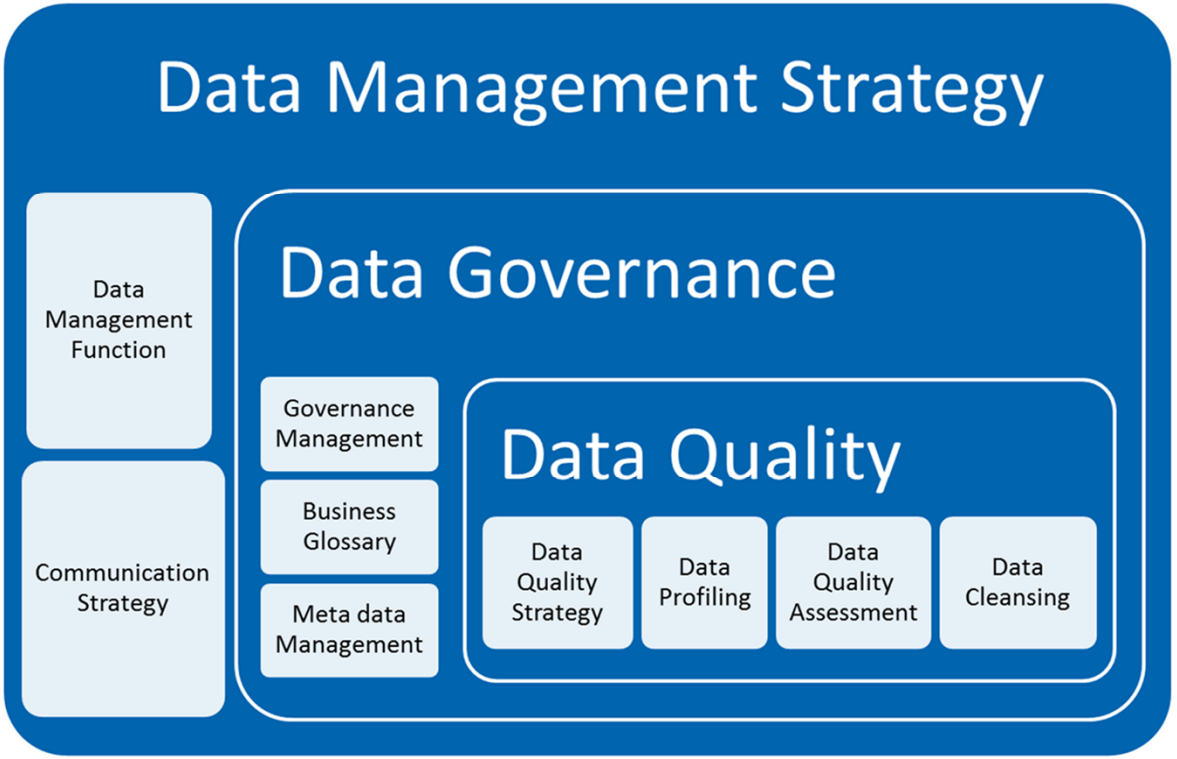
Typical Data Management Challenges

- Defining and distinguishing critical data assets from all other data
- Big data architecture decisions
- Data capture
- Data storage
- Analysis capabilities
- Robust search capabilities
- Maintaining data currency
- Data visualization
- Data privacy
- Data protection

Best Management Practices in GIS

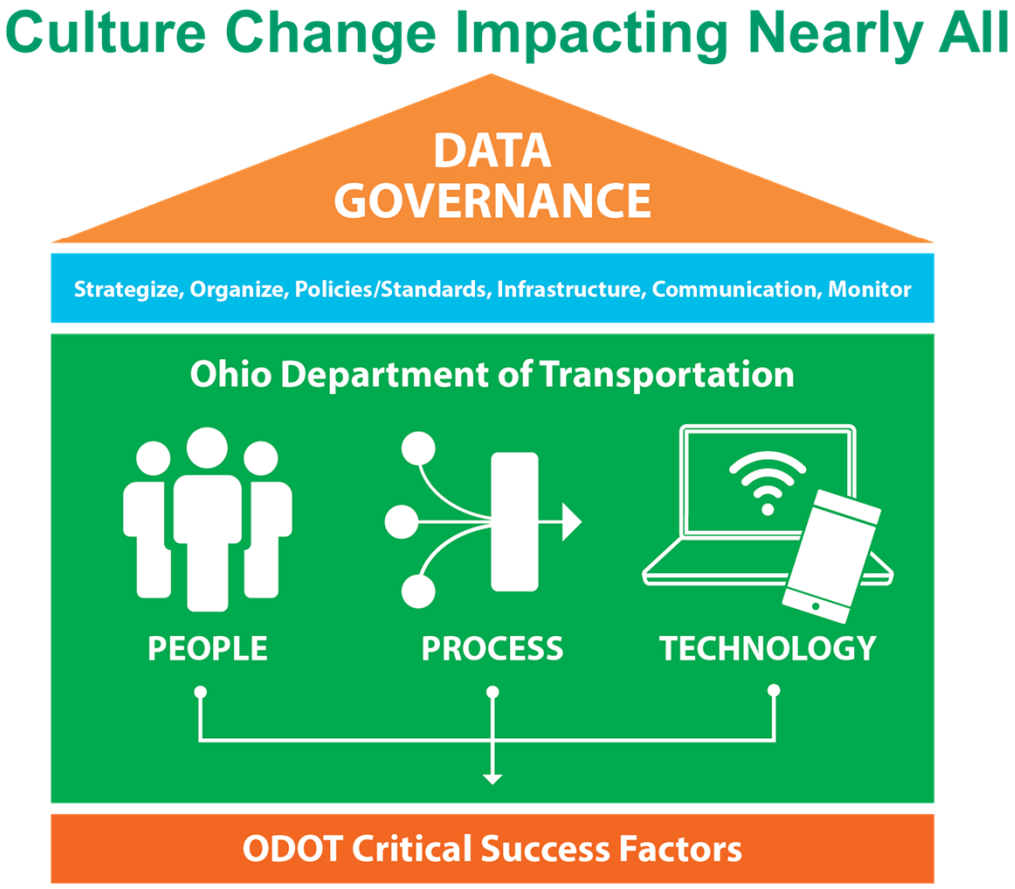
Industry Hot Topic: Data Governance

Managing Relationship between Data Management, Governance and Quality



Best Management Practices in GIS

Industry Hot Topic: Data Governance: ODOT Strategy



Best Management Practices in GIS

Industry Hot Topic: Data Governance: ODOT Definition

What is it?

- Governance of data within ODOT
- Core foundation for how ODOT implements data management policy, standards, and procedures
- Continuous collaborative process requiring participation throughout agency

Why?

- ODOT's planning and decisions impact Ohio's economy (multi-billion dollars)
- Citizen safety
- Data is highly valuable enterprise asset needing oversight

Best Management Practices in GIS

Industry Hot Topic: Data Governance: Mission and Vision

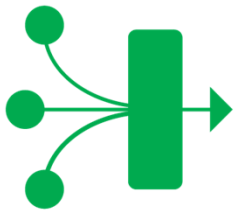
Mission

- Ensure ODOT creates and maintains reliable transportation data that is accurate, available, timely and usable for *People, Processes and Technology.*

Vision

- Data Governance (DG) will steward the standardization, coordination, and integration of existing and future applications, data sources, and reporting at ODOT.

PEOPLE



PROCESS

TECHNOLOGY

Best Management Practices in GIS

Industry Hot Topic: Data Governance: State of the Practice: Future

No DG process leading to:

- Inaccurate data
- Untimely data
- Data redundancy
- Absence of data standards
- Unavailable data
- Data integration difficulties

Some aspects of DG are in place

- TAM Audit Group, GIS (TIMS) Standards, STP (Enterprise Architecture), DoIT Technical Requirements and BTRS

ODOT needs coordinated, agency-wide DG process to improve effectiveness

Best Management Practices in GIS: References

AASHTO Core Data Principles (https://data.transportation.org/aashto-core-data-principles/)

Researchers should be familiar with at least the following data-related publications and research projects:

•NCHRP 08-36, Task 100: Transportation Data Self Assessment Guide (2011)
http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-36(100)_FR.pdf

•NCHRP Report 814: Data to Support Transportation Agency Business Needs: A Self-Assessment Guide (2015)
http://www.trb.org/Main/Blurbs/173470.aspx

•NCHRP Synthesis 508: Data Management and Governance Practices (2017)
http://www.trb.org/NCHRP/Blurbs/176005.aspx

- Standards and Governance for Enterprise Geopatial Systems in Transportation (FHWA TOPR HPP180003)
  - Scope of Work (https://www.dropbox.com/s/u8ffb5i1a0wh8nn/TOPR%20HPPI180003%20Statement%20of%20Work.pdf?dl=0)

Best Management Practices in GIS: References

- IAM Asset Management Maturity Scale and Guidance (http://theiam.org/knowledge/Knowledge-Base/asset-management-maturity-scale-and-guidance/)
- IAM Self Assessment Methodology+ (http://theiam.org/knowledge/Knowledge-Base/sam/)
- US DOT GIS Strategic Plan 2016-2019 https://www.transportation.gov/sites/dot.gov/files/docs/GISStrategicPlan_0831_final.pdf
- Slimgim (GIS maturity model) https://www.slimgim.info/dot-downloads.html
- Best Practices in GIS-Based Transportation Asset Management (2012) https://www.gis.fhwa.dot.gov/documents/GIS_AssetMgmt.pdf
- NCHRP Project 08-115, "Guidebook for Data and Information Systems for Transportation Asset Management" (ongoing project)
  - Project description (http://apps.trb.org/cmsfeed/trbnetprojectdisplay.asp?projectid=4362)

Best Management Practices in GIS

Questions?

Best Management Practices in GIS

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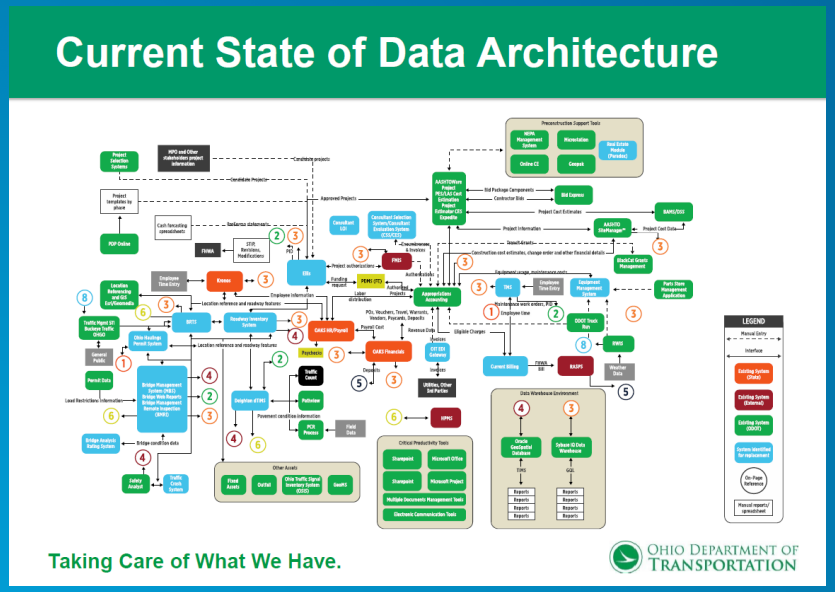

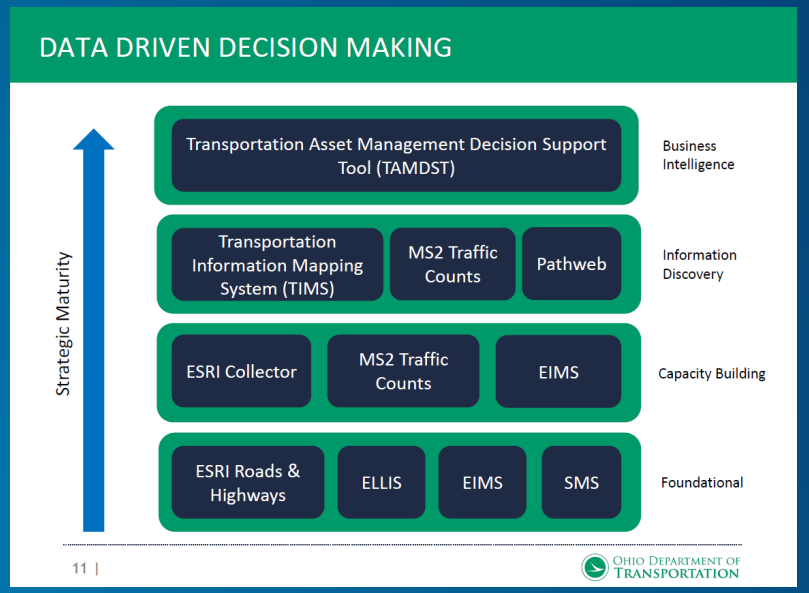

Terry Bills, Esri

Allen Ibaugh, DTS

Ian Kidner, Ohio DOT

Further Resources

- **Successful Practices in GIS Based Asset Management (NCHRP 08-87):** http://www.trb.org/Main/Blurbs/172204.aspx
-
- https://solutions.arcgis.com/state-government/transportation/
- http://www.vueworks.com/creating-a-solid-foundation-for-successful-asset-management/

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