

Asset Management Data in a Knowledge Management World: Methods for Treating Data

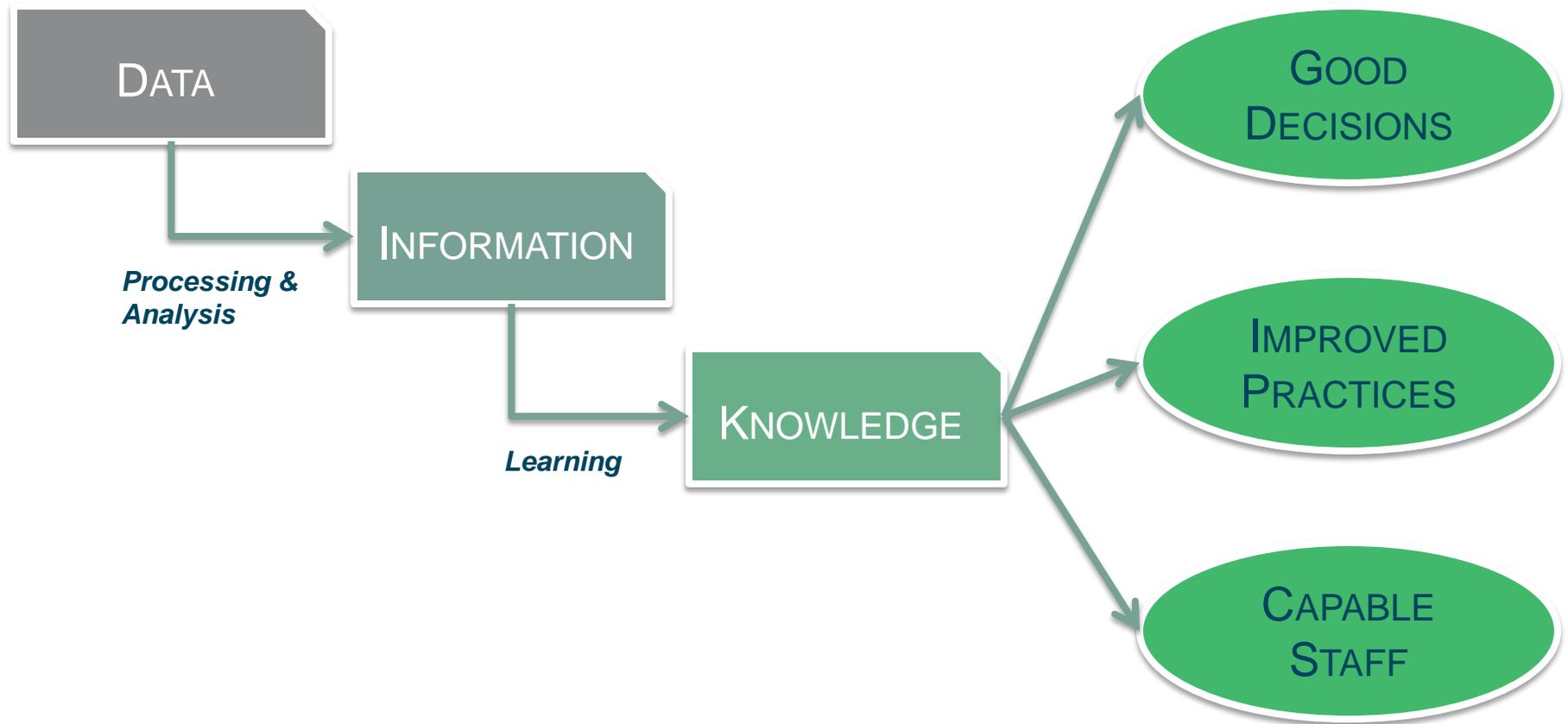
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TAM Data in a Knowledge Management World

- Data, Information and Knowledge Management Techniques can be implemented together to:
 - Ensure sound asset management decisions
 - Improve asset management practice over time
 - Build and sustain staff capabilities
- Keep in mind that:
 - Having the right data and the right tools to analyze it are important, but...
 - If you don't focus on the human side of the equation, you won't get very far and you won't be able to sustain progress

TAM Data in a Knowledge Management World



Types of Data, Information & Knowledge for TAM

Assets

- Inventory & condition
- Function, use, risk
- Life cycle
- Treatment effectiveness & cost
- Optimal strategies

Asset Management Processes

- Requirements and deadlines
- Approaches and activities
- Key players and roles
- History/evolution

Data/Information

- Sources
- Limitations
- Analysis methods, tools, expertise

DOT CEO Perspective on Data

“The idea here is that with real data, you can have a real conversation.... We had the confidence in our data that enabled us to squeeze money off higher-volume roads and put it into the lower-volume roads, which then made a very significant difference on those lower-volume roads... We make much better decisions when we have data that is consistent, repeatable, and available.”

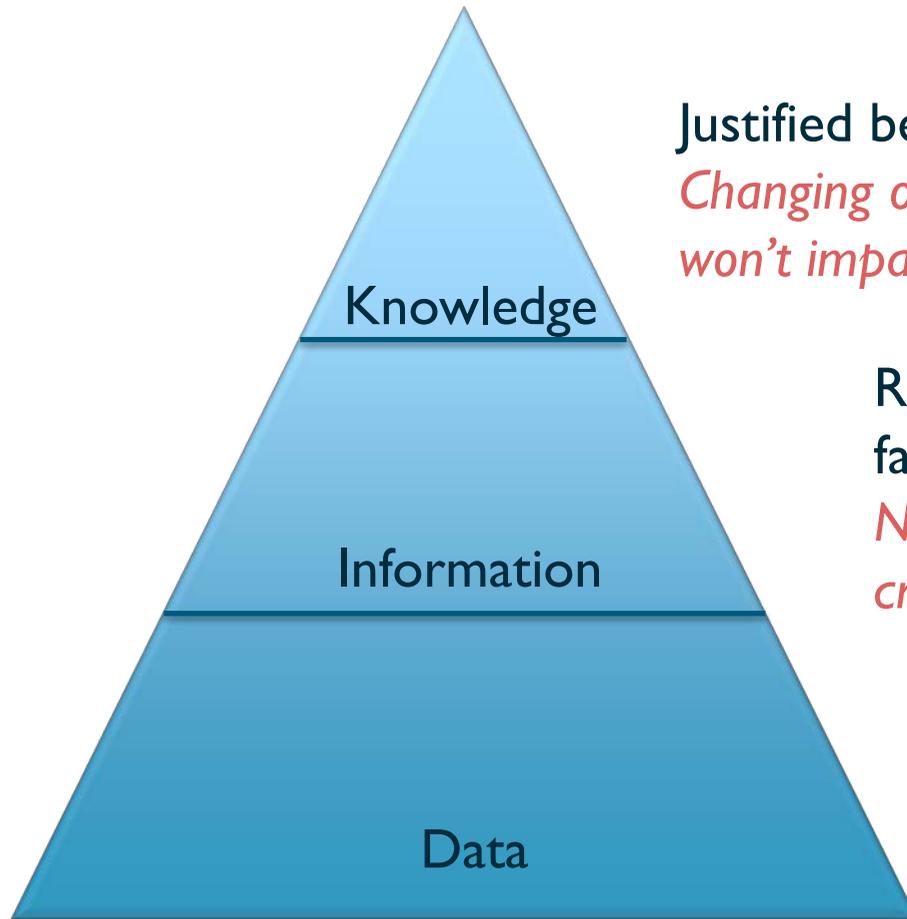
- Former Director, Utah DOT

DOT CEO Perspective on Knowledge

“As the CEO of a DOT you wake up one day and realize that every hand you shake is connected to a head full of knowledge. Knowledge management collects, shares and puts that knowledge to work over and over again across the entire agency—saving money, saving time, delivering quality projects, and reducing risk.”

- Former Director, Virginia DOT

Data, Information, Knowledge



Justified beliefs – basis for taking action
Changing our standard will save money and won't impact safety.

Relevant, processed, contextualized facts

No correlation between rut depth and crashes for less than 1" rut depth

Facts, observations
Rut depth, crashes

AASHTO's Data Principles

Data Principle

1. VALUABLE: Data is an asset
2. AVAILABLE: Data is open, accessible, transparent and shared
3. RELIABLE: Data quality and extent is fit for a variety of applications
4. AUTHORIZED: Data is secure and compliant with regulations
5. CLEAR: There is a common vocabulary and data definition
6. EFFICIENT: Data is not duplicated
7. ACCOUNTABLE: Decisions maximize the benefit of the data

Seven Laws of Information*

1. Information is infinitely sharable; duplication does not increase its value.
2. The value of information increases with use.
3. Information is perishable – its value decreases over time.
4. The value of information increases with accuracy, but there are diminishing returns.
5. The value of information increases when combined with other information.
6. More information is not necessarily better.
7. Information is not depletable. The more you use it, the more you have.

*“Measuring the Value of Information: An Asset Valuation Approach”, Moody and Walsh, European Conference on Information Systems (ECIS’99)

Data & Info Challenges

- Deciding what/how much data to collect
 - Weighing cost against value
 - Understanding and reconciling diverse needs for data
- Using available data
 - Findability
 - Quality
 - Skills and tools for translating to information
 - Understanding and integrating external data sources
- Efficiency
 - Avoiding duplication
 - Coordination and consistency

Data to Information: A Changing Landscape

Changing needs and expectations

Performance
Management/Accountability

Open Government/Open Data

Real Time Information available
anytime from anywhere

Context-Sensitive
Design/Practical Design

Workforce Dynamics -
Institutional Memory

Changing sources and analysis capabilities

Commercial Traveler Data

Sensor Data

Crowd Sourcing

Social Media

Text Mining

Big Data Analytics

Knowledge is Complicated

“...knowledge is not a result merely of filtering or algorithms...We get to knowledge — especially “actionable” knowledge — by having desires and curiosity, through plotting and play, by being wrong more often than right, by talking with others and forming social bonds, by applying methods and then backing away from them, by calculation and serendipity, by rationality and intuition, by institutional processes and social roles.”

- David Weinberger, “The Problem with the Data-Information-Knowledge Hierarchy, Harvard Business Review (2010)

Building Knowledge



Organizational
Culture



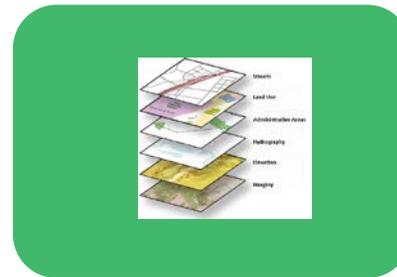
Expertise



Communities

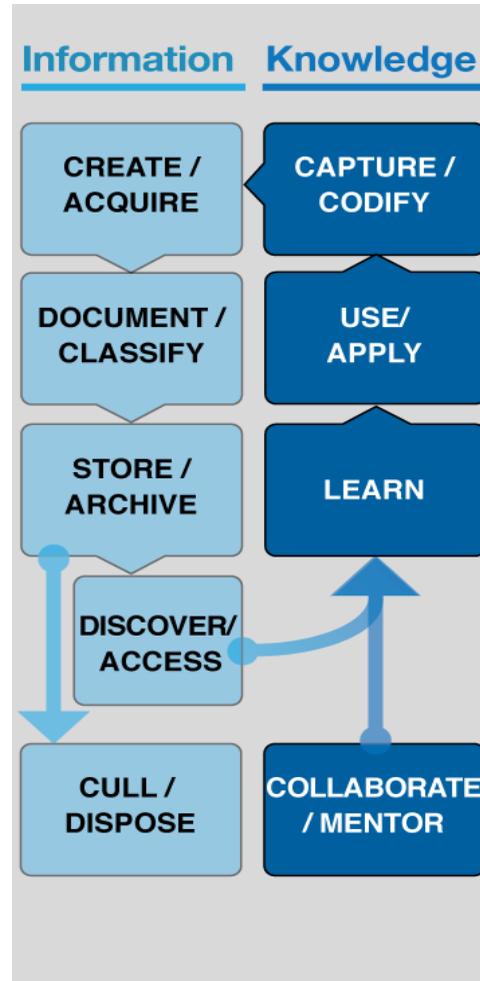


Data



Analysis Tools

The Knowledge & Information Cycle



Source; NCHRP Report 813, A Guide to Agency-Wide Knowledge Management for State Departments of Transportation

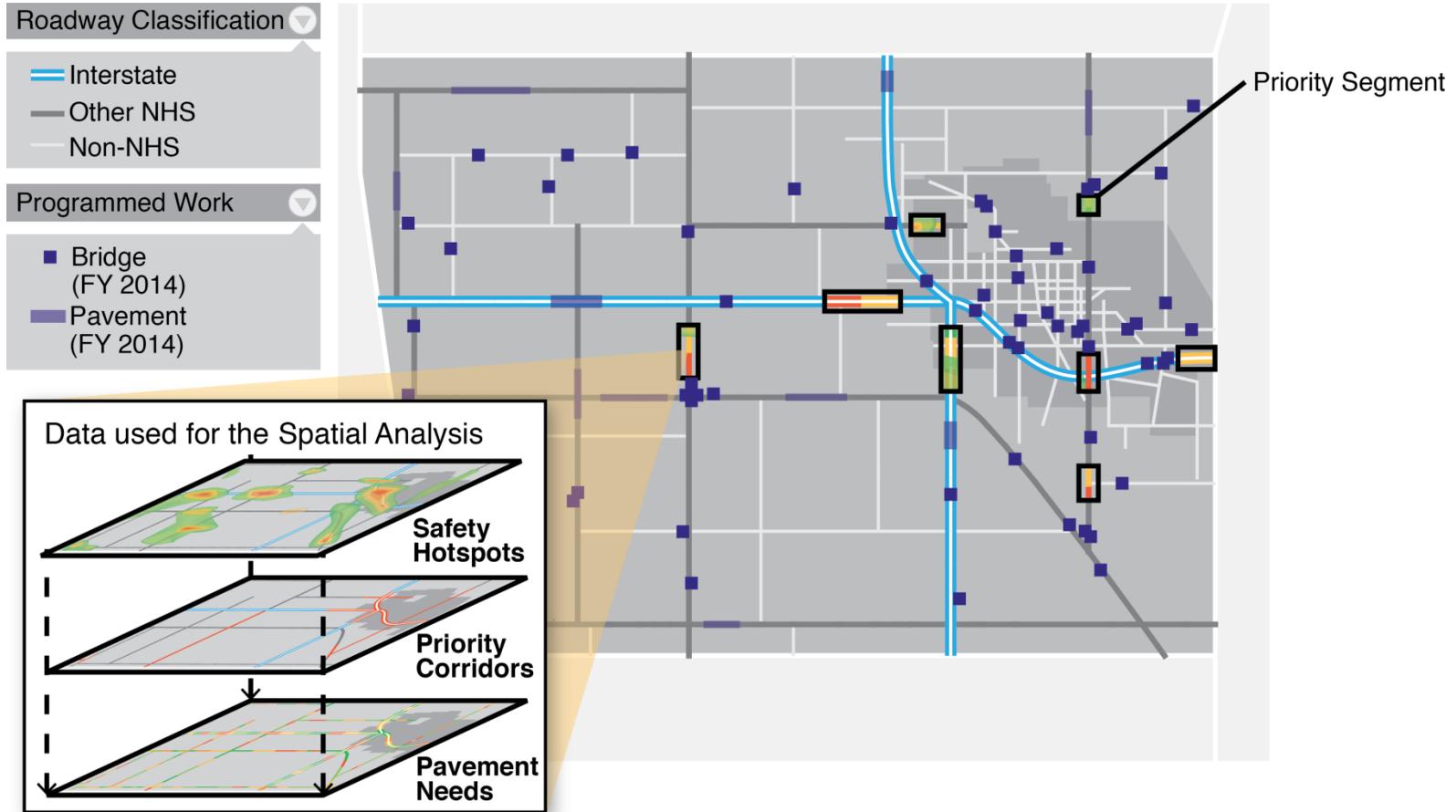
Knowledge Challenges

- Loss of institutional memory
- Shallow bench strength
- Lack of ability to adapt to new situations
- Disconnect between analysts and decision makers (leading to “analysis paralysis”)
- Lack of collaboration
- Lack of awareness of (or motivation to seek) documented information and available expertise
- Culture that values individual experts rather than people who share knowledge and coach others

Data, Information & Knowledge Management



Leveraging GIS for Turning Data into Information



Example: Highway Lighting

WSDOT

- Data: crash, roadway, traffic and illumination system inventory
- Analysis: Relationship between illumination and crashes
- Decisions:
 - LED conversion
 - lighting system removal
 - prioritization of pole replacement after being hit



Source: TRB Safety Data Governance Peer Exchange (2014)

Business Intelligence

“Technologies, applications, and processes for gathering, storing, accessing, and analyzing data to help users make better decisions.”

- Queries: predefined and ad-hoc (show current conditions)
- Descriptive analytics (produce performance report)
- Exploratory analytics (identify causal factors)
- Predictive analytics (analyze scenarios)
- Prescriptive analytics (recommend an action)

Example: Rail Maintenance UK Agencies

- Network Rail (UK)
 - Use imaging data from moving trains to identify maintenance issues such as loose bolts
- London Underground
 - Online dashboard monitoring equipment status, ability to deploy nearest maintenance staff and equipment
 - Predictive analytics to identify indicators of future equipment failure – let to replacement of escalator mechanical parts in pairs



Business Intelligence & Sense Making

Sensemaking:

- an organizational process of continuous insight generation

Namvar, Morteza; Cybulski, Jacob L.; and Perera, Luckmika (2016) "Using Business Intelligence to Support the Process of Organizational Sensemaking," Communications of the Association for Information Systems: Vol. 38, Article 20.
Available at: <http://aisel.aisnet.org/cais/vol38/iss1/20>

Business Intelligence & Sense Making

Ongoing Input

Access current, real time information; current info feeds trend info

Retrospection

Data Gathering & Preparation – to review historical events in relation to the current situation

Plausible Scenarios

Predictive Analytics – exploration of the range of possible outcomes

Communities

Collaborative BI – collective learning, interaction, information sharing in communities of experts

Defined Purpose

Clear alignment between information provision and business processes and concerns

Users

Individuals with skills, attitudes, motivations and time to do analysis

Implementation

Skillful implementation to ensure credibility, fit with need, personalize to uses, etc.

Adapted from: Namvar, Morteza; Cybulski, Jacob L.; and Perera, Luckmika (2016) "Using Business Intelligence to Support the Process of Organizational Sensemaking," Communications of the Association for Information Systems: Vol. 38, Article 20. Available at: <http://aisel.aisnet.org/cais/vol38/iss1/20>

Key Points

- Data, Information and Knowledge are integral to Asset Management – for decisions, processes and capabilities
- There are well established, separate but overlapping disciplines for information management (IM) and knowledge management (KM)
- These techniques involve managing data, information and knowledge as assets themselves
- KM in particular focuses on the human side of the equation – maximizing value of information and enabling renewal of knowledge assets as employees come and go
- BI/Analytics is a promising area for further application in asset management – skillful implementation supports transformation of data to information to build (and apply) knowledge

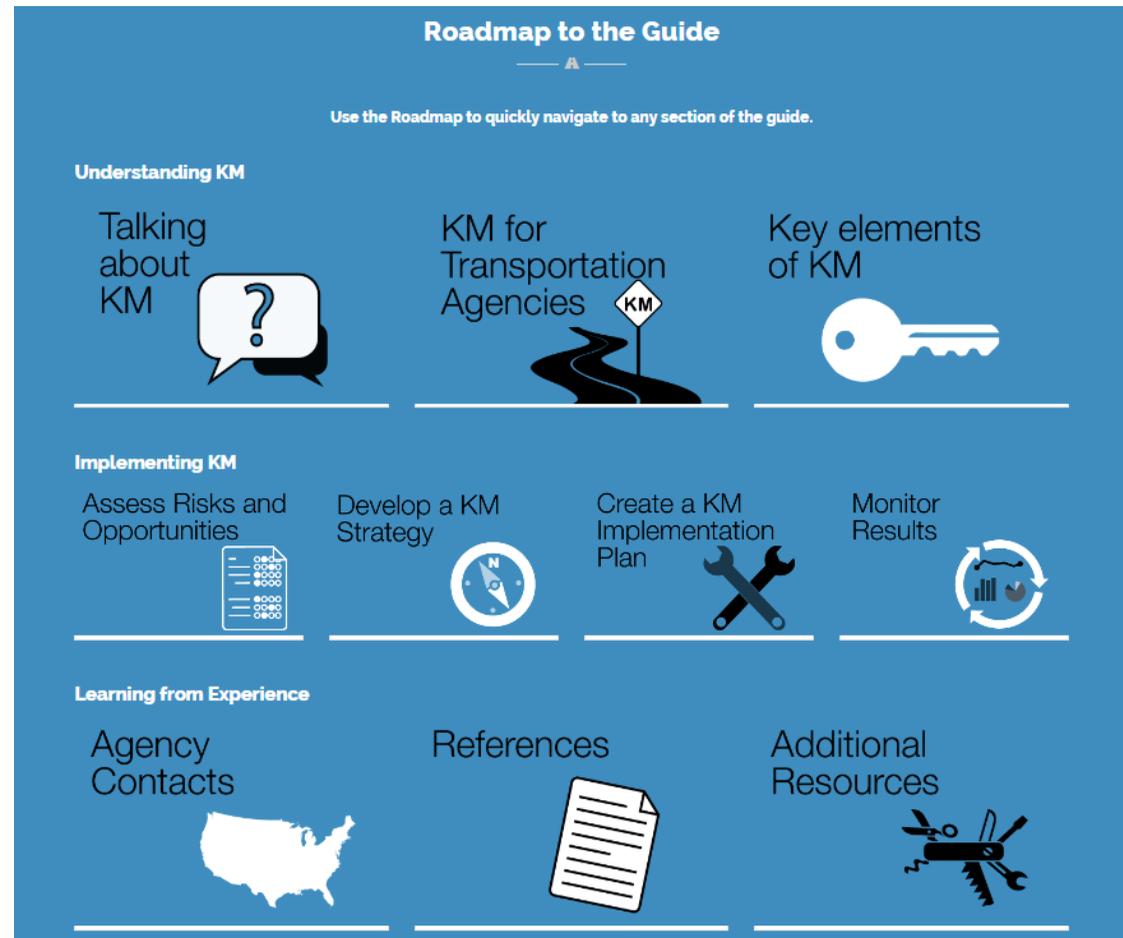
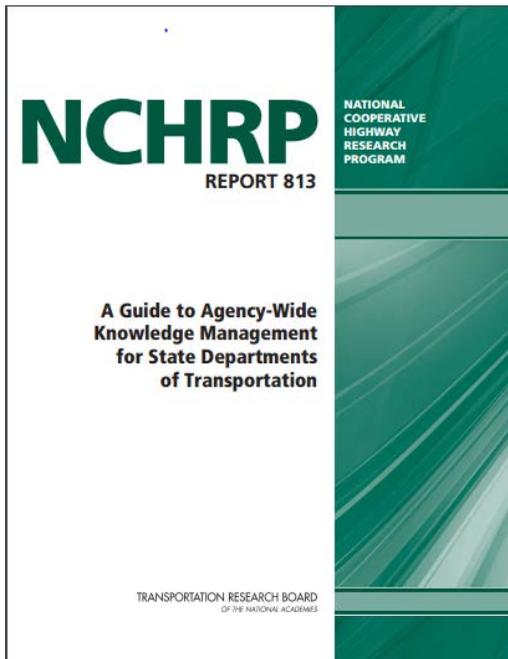
Selected Resources



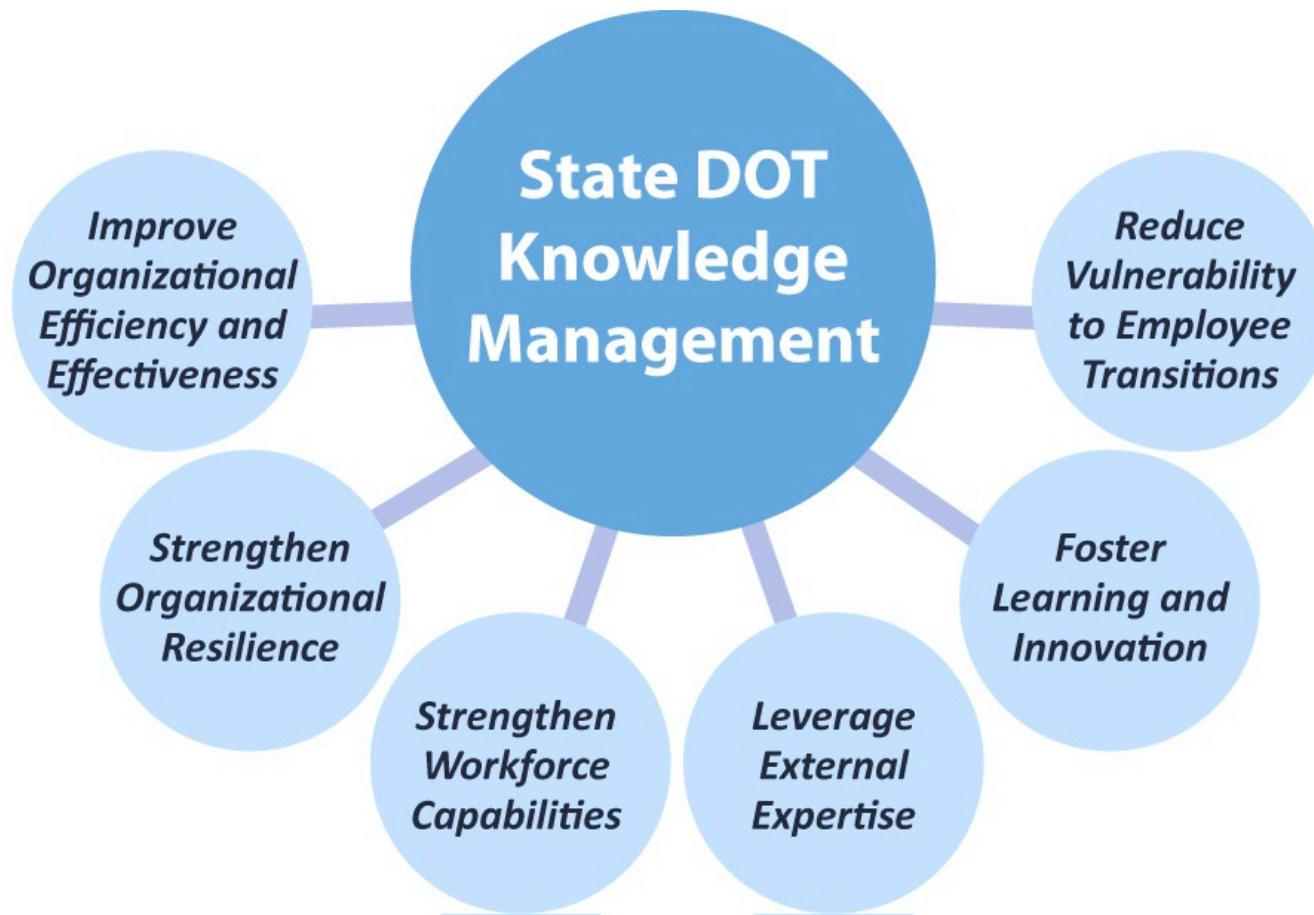
- [AASHTO TAM Portal](#) - Access to variety of resources
- [NCHRP Report 666](#) - Target Setting and Data Management
- [NCHRP Report 754](#) – Management of Transportation Information
- [NCHRP Report 813](#) – Guide to Agency-Wide KM
- [NCHRP Report 800](#) – Successful Practices for GIS and TAM
- [NCHRP Report 814](#) – Data Self-Assessment Guide
- [NCHRP Report 829](#) – Executive Guide to Strategic Information Management
- [NCHRP Project 08-90](#) Asset Management Gap Analysis Tool

NCHRP Report 813

A Guide to Agency-Wide Knowledge Management for State Departments of Transportation

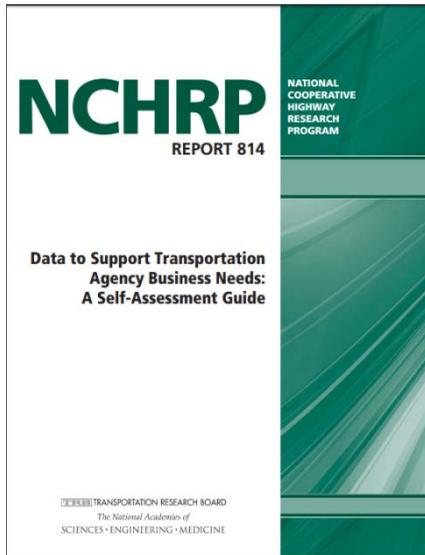


Knowledge Management Drivers



NCHRP Report 814

Data to Support Transportation Agency Business Needs: A Self Assessment Guide



- Do we have the right data to make good decisions and meet reporting requirements?
 - What data do we need and why?
- Is our current data good enough?
 - What level of accuracy, timeliness, completeness, etc. is needed?
- Are we making best use of our data collection and management resources?
 - Are we being efficient about how we collect and manage the data?
- Are we getting full value from the data that we have?
 - Are users able to access, integrate and analyze it?

Implementing a Transportation Agency Data Self-Assessment

NCHRP 08-92

Prepare > Assess > Improve

QUESTIONS

Do we have the right data to make good decisions and meet reporting requirements?



Agency Leaders

How can our agency make it quicker and easier to access and analyze data so that we can do our jobs more efficiently and effectively?



Data Users

Is our data good enough? Do we need to improve its level of accuracy, precision or timeliness?



Data Stewards

Are we managing our data to maximize its value and ensure its integrity?



Data Managers

Prepare

- ASSEMBLE TEAM**
Assemble a broad-based team to guide the effort.
- ESTABLISH ASSESSMENT GOALS**
Set a clear direction for what is to be accomplished.
- SET SCOPE AND TIMELINE**
Select data programs and assessment elements to include and establish a scope and schedule for the effort.

Assess

- ASSESS DATA VALUE**
Assess current data availability, quality, and usability.
- ASSESS DATA MANAGEMENT**
Assess maturity level for current data management processes.
- DETERMINE GAPS**
Identify gaps between current state and desired state and identify candidate actions to close gaps.

Improve

- PRIORITIZE IMPROVEMENTS**
Analyze the results and prioritize actions for improvement.
- DEVELOP ACTION PLAN**
Develop a plan of specific actions to address the priority gaps.
- IMPLEMENT PLAN**
Assign responsibilities, allocate resources and track implementation.

ASSESSMENT

DATA VALUE

Availability
Quality
Usability

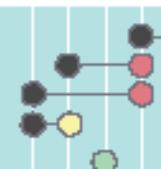
Rating
Poor Fair Good Excellent



DATA MANAGEMENT

Data Strategy and Governance
Data Architecture and Integration
Life Cycle Data Management
Data Collaboration
Data Quality Management

Maturity Level
1 2 3 4 5



KEY

Current

Target



No Gap

Small Gap

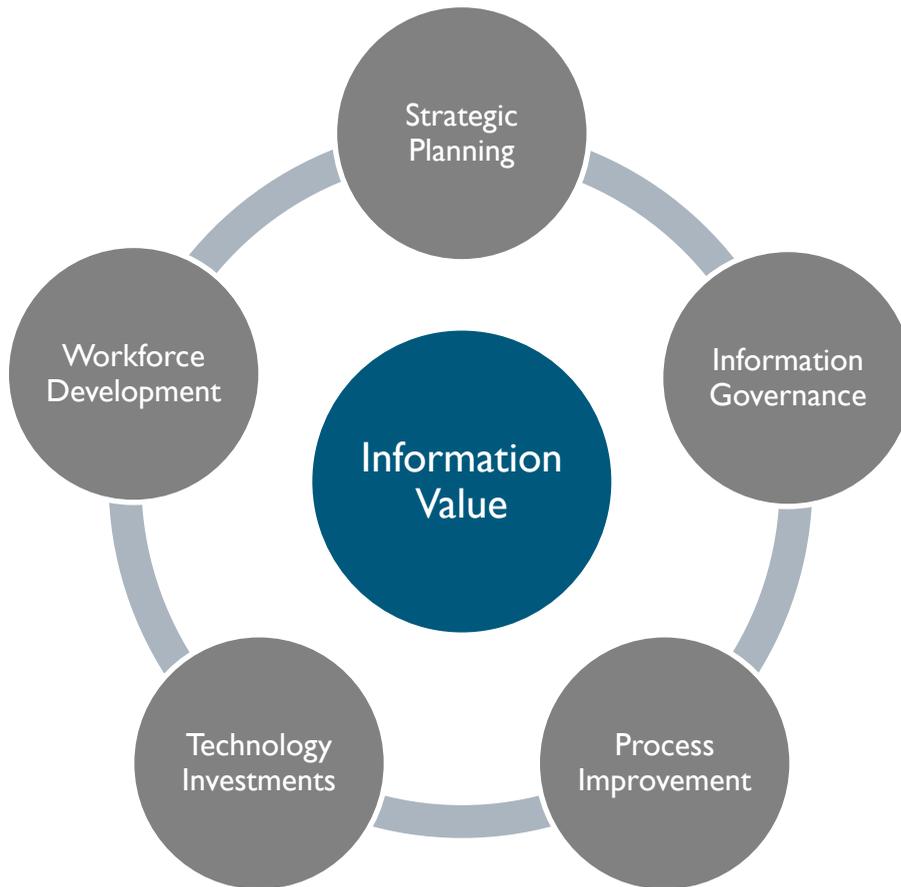
Large Gap

ACTIONS

Data Consolidation and Standardization
Data Collection, Processing, and Quality Improvements
Data Management Staffing and Responsibilities
Data Policies, Procedures, and Standards
Data Mapping and Documentation
Data Presentation and Analysis Improvements
Information System Improvements

NCHRP Report 829

Leadership Guide to Strategic Information Management for State Departments of Transportation



Guidebook for state DOT executives and managers on how to **effectively allocate resources** to develop and maintain the agency's capability to **provide mission-critical information when and where it is needed.**