Assessing and Reporting on Traffic Management System (TMS) Capabilities and Performance

Transportation Management Center (TMC) Pooled-Fund Study[(1)]

Federal Highway Administration (FHWA)

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Presentation Outline

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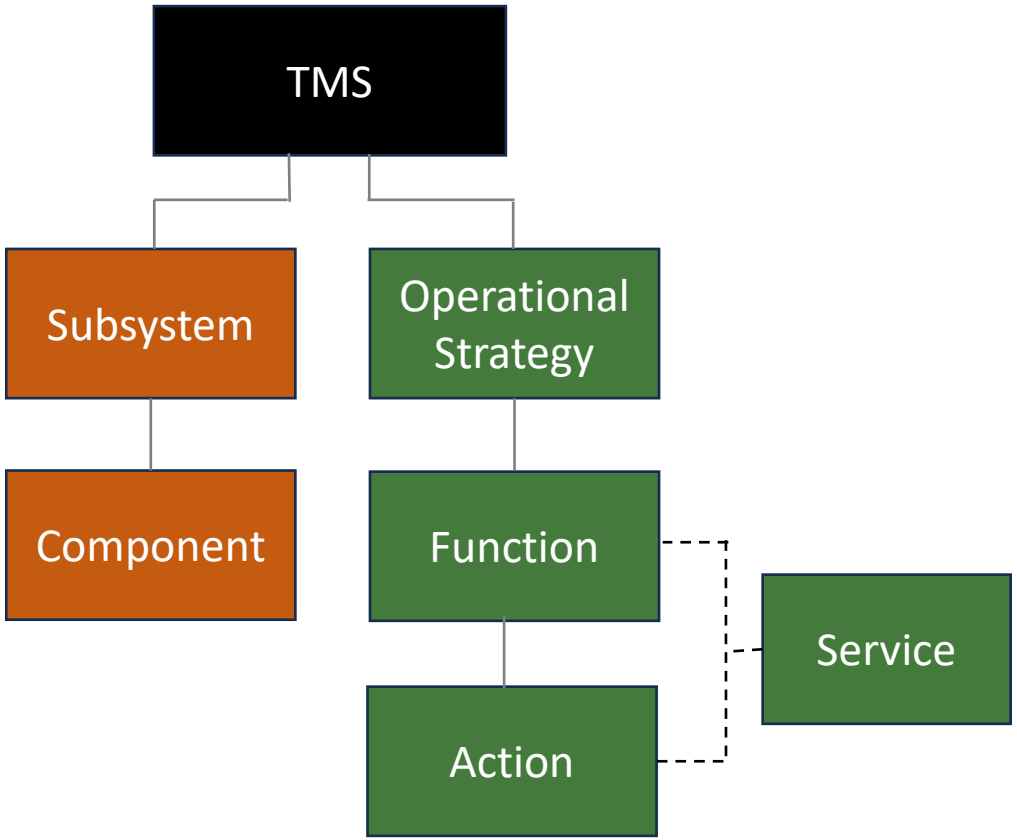
Framing the Discussion: TMSs

- Resources typically do not exist to support assessing and benchmarking TMS institutional performance.
- The following assessment considerations are unique:
  - Day-to-day management and operations.
  - Operations staff, policies, and procedures.
  - TMS planning, design, and implementation.
  - TMS data sharing and external stakeholders.
  - Maintenance and repair of TMS assets.



Source: FHWA.

Note: A solid line indicates composition and a dashed line indicates realization.

Framing the Discussion: Assessments

An assessment is a formal, structured process for identifying current levels of capabilities and performance.

Use an established process or framework for conducting assessments.

Involve key stakeholders in the process.

Outputs of assessments can be used to:

- Identify enhancements to improve performance.
- Identify opportunities and develop consensus around needed improvements.
- Identify immediate priorities for action or changes.

The Relationship of TMS and Transportation Systems Management and Operations (TSMO) Assessments

Agencies may consider conducting a TMS-specific assessment, in addition to other assessments conducted in support of their TSMO program, such as the following assessments:

- Active traffic management.
- Traffic management.
- Active demand management.
- Traffic incident management.
- Planned special events.
- Traffic signal management.
- Work zone traffic management.
- Road weather management.

Dimensions or Process Improvement Areas[2]	What Is It?
1. Business process.	Plans, programs, and budget.
2. Systems and tech.	Approach to building systems.
3. Performance measurement.	Use of performance measures.
4. Workforce.	Improving the capability of the workforce.
5. Culture.	Changing culture and building champions.
6. Collaboration.	Improving working relationships.

Motivation for Assessing TMSs

Provides a means for assessing:

- System effectiveness and reliability.
- TMS management and operation.
- Operational decisionmaking implications.
- TMS assets' condition.
- Actions for continuously improving capabilities.

Provides a basis for:

- Improving TMSs management and operation, considering implications.
- Identifying opportunities to improve TMS capabilities and performance.
- Creating a baseline to compare future capabilities and performance.
- Engaging key stakeholders to build and maintain support for improvements or allocation of resources.
- Enhancing assets management.
- Identifying and prioritizing needed improvements.

Assessing TMS Considerations

- Managing and operating TMS day-to-day:
  - Maintenance and repair of the system and assets.
  - Operations of the system and response to changing conditions and events.
  - Management of operational strategies.
- Staffing to support TMSs.
- Creating policies, procedures, and tools to support managing and operating TMSs.
- Including TMS plans, requirements, and resources in other programs, plans, initiatives, services, or efforts (e.g., TSMO).
- Planning, design, development, and implementation of TMSs.
- Planning for the agency's next-generation TMS.

A Framework to Assess TMSs

What other dimensions might agencies consider when assessing TMSs?

Existing Dimensions[2]

Dimensions	Description
Business processes.	Plans, programs, and budget.
Systems and technologies.	Approach to building systems.
Performance measurement.	Use of performance measures.
Workforce.	Improving the capability of the workforce.
Culture.	Changing the culture and building champions.
Collaboration.	Improving working relationships.

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Missing Improvement Areas

Dimensions	Description
Management and operations.	Managing and operating daily.
Maintenance and repairs.	Conducting daily maintenance and repairs.
Sharing data.	Policies, procedures, agreements, and activities to enable sharing and using data with sources external to TMS.

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TMS Dimensions

Dimensions	Description
1. Business processes.	Plans, programs, and budget.
2. Systems and technologies.	Approach to building systems.
3. Performance measurement.	Use of performance measures.
4. Workforce.	Improving the capability of the workforce.
5. Culture.	Changing the culture and building champions.
6. Collaboration.	Improving working relationships.
7. Management and operations.	***Managing and operating daily.***
8. Maintenance and repairs.	***Conducting daily maintenance and repairs.***
9. Sharing data.	***Activities to enable sharing and using data with sources external to TMS.***

Note: Bold-italic text signifies new dimensions specific for TMSs.

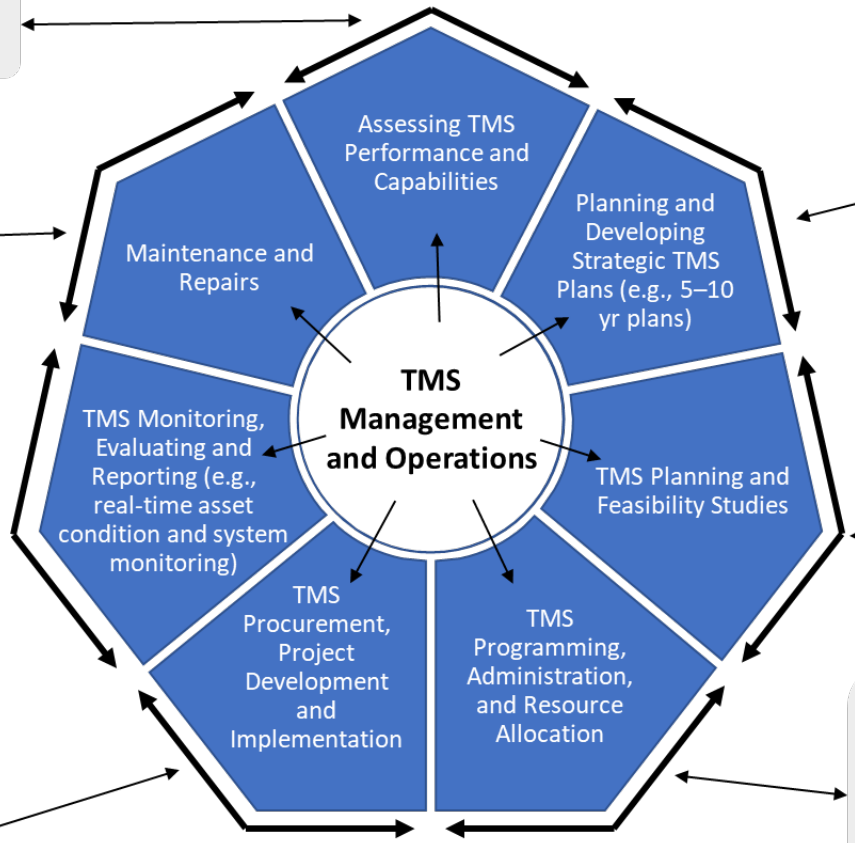
Activities Supporting the Active Management and Evolution of a TMS[3]

Capability Maturity Framework for TSMO (Traffic Management)

Conducting daily maintenance and repairs

Facilities performance monitoring and reporting,
TMS asset monitoring and reporting,
TMS asset performance evaluation,
TMS program and plan

Design, development, and procurement of projects (e.g., systems engineering), TMS program and plan, agency or regional ITS architecture



Agency strategic plan, TSMO program and plan, TMS program and plan, MPO TSMO or ITS plan, agency or regional ITS architecture

Planning and design of TSMO initiatives, operational strategies, or ITS projects (feasibility study, planning study), agency or regional ITS architecture

TSMO project selection and prioritization, TMS improvement projects, allocation of resources for maintenance and operations, TMS program and plan, agency or regional ITS architecture

MPO = metropolitan planning organization; ITS = intelligent transportation systems.

Source: FHWA.[3]

Assessing TMSs: Dimensions and Subdimensions(2)

Planning and Operational Focused Dimensions

Business Processes	*Culture*	*Collaboration*	*Workforce*	*Systems and Technology*
•TMS program and plan. •TMS and plan integrated into agency plans and programs. •Programming and budget. •Operating policies and procedures.	•Visibility of the TMS program within agency strategic plans. •TMS program integrated into TSMO and agency program plans and funding.	•Agency Collaboration. •Third-party relationships.	•Organizational structure and governance. •Staff development. •Staff recruitment. •Staff development and retention plans.	•Subsystem, components, and devices. •System multiyear plan. •System design. •Inventory assets and resources.

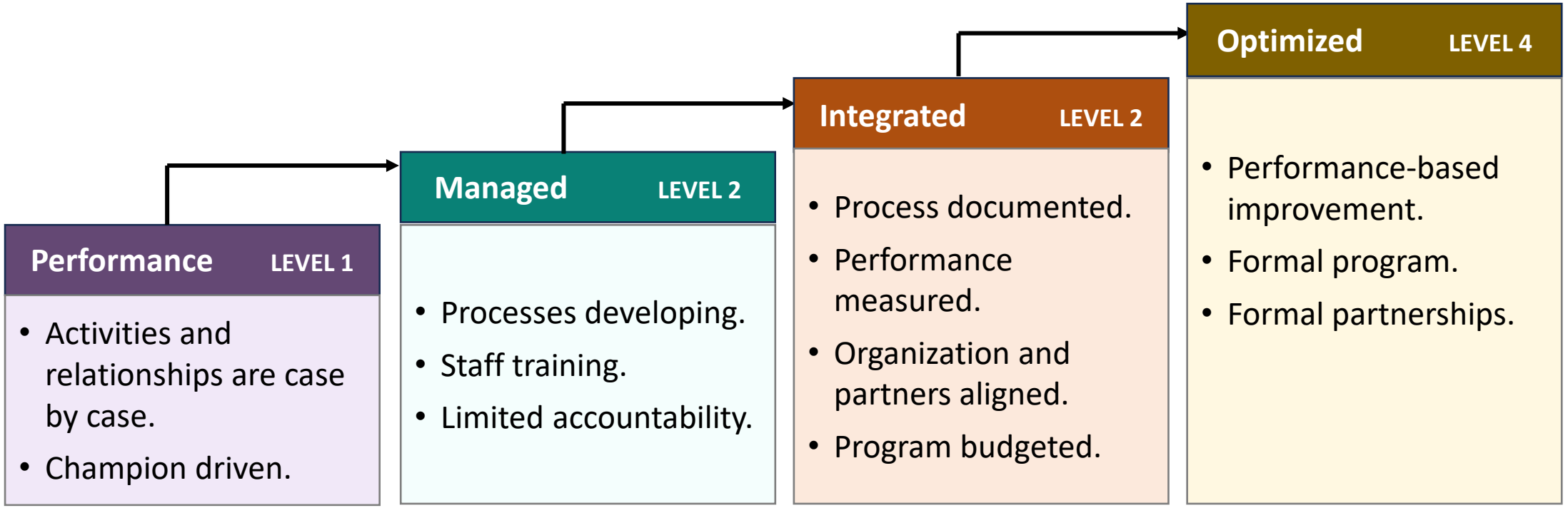
Technical Focused Dimensions

Sharing Data	*Performance*	*Management and Operations*	*Maintenance and Repairs*
•Data sharing. •Data-exchange procedures, agreements, APIs, and data formats. • Data use from other sources. •Interoperability.	•Data collection. •Performance measures. •TMS monitoring. •TMS asset monitoring.	•Service level and resiliency. •TMS operational capabilities. •TMS asset impact. •High availability and remote operations.	•Asset documentation. •Configuration management. •Maintenance request management. •TMS feature roadmap.

API = application programming interface.

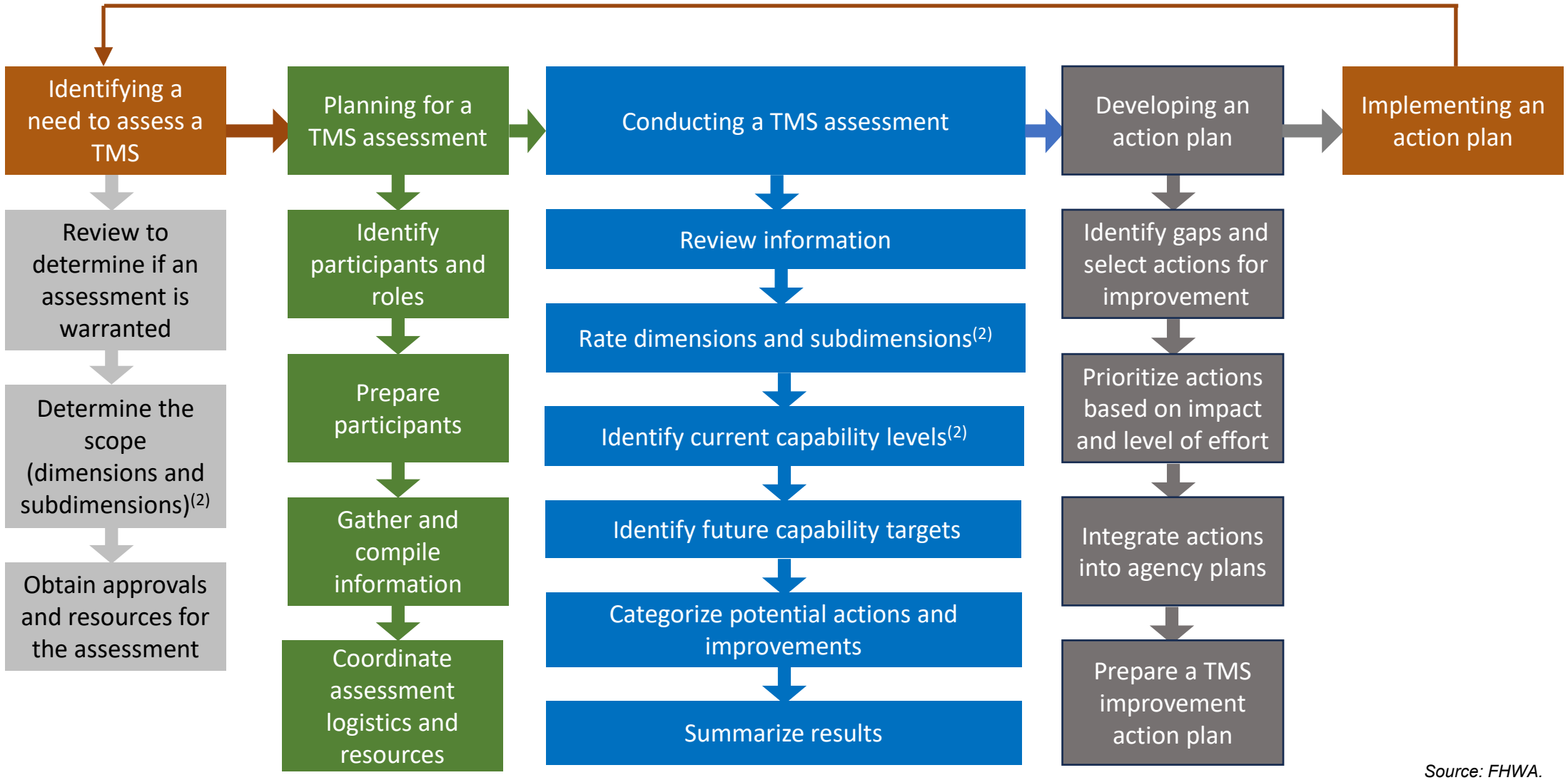
TMS Capability Levels(2)

- Capability levels help define current TMS capabilities and identify improvement opportunities.
- Each dimension is evaluated across four levels of capability maturity levels.



Source: FHWA.

The TMS Assessment Process



Source: FHWA.

Assessing Dimensions: Systems and Technologies Example(2)

An example of assessing one dimension: systems and technologies.

Today's TMSs

Focused on improving travel safety, efficiency, and predictability on the surface transportation system using:

- Field devices.
- ITS infrastructure.
- Communications media.
- Information technology.
- Operations personnel.
- Operational strategies and control plans.
- Active management and control of traffic.
- Operations centers.

Technology Challenges Facing Today's TMSs

- A limited ability to share information internally within the agency, with other systems, or with the public.
- A limited ability to capture or use data from emerging sources or third parties.
- A lack of capabilities or resources to automate system functions or use operational strategies.
- An operating environment, software, or components that are difficult to modify, replace, or integrate with new or emerging technologies or devices.
- A system replacement or upgrade may require adding functions, services, or technologies due to limitations in the system design.

Assessing Capability Levels: Systems and Technologies Example(2)

The following table contains examples of descriptions for all four levels of the systems and technologies dimension. Descriptions generally follow the four capability level descriptions. Agencies may choose to emphasize specific aspects of systems and technologies in their individual assessment.

Dimension Description	Level 1	Level 2	Level 3	Level 4
Systems engineering requirements for operating and maintaining the TMS, including systems architecture, concepts of operation, standardization, and documentation processes. Focuses on key processes and aspects of technology procurement, operations, and planning.	Case-by-case approaches to TMS implementation are used without consideration of systems engineering and appropriate procurement processes. TMS architecture is not intentional.	The TMS is incorporated into the ITS architecture; TMS changes include ConOps and architectures. An appropriate procurement process is employed. The TMS uses proven technology. Staff is trained on system engineering principles. TMS staff, IT staff, and third-party providers are not fully working together well.	The TMS is reviewed on a case-by-case basis and emerging technologies are recognized. The TMS group works with the IT group and third-party vendors to establish technical standards, procure equipment, and increase capabilities.	The TMS program keeps pace with emerging technology and minimizes the use of outdated equipment. The systems engineering process is fully implemented at all stages of the TMS lifecycle. Strong synergy exists between the TMS and IT groups.

ConOps = Concept of Operations; IT = information technology.

Example Assessment: Systems and Technologies (1/2)

The following are examples of issues to consider when assessing the current capability level (analysis):[2]

- Focus on approaches to planning and building systems:
  - Ensure agency and stakeholder needs are addressed.
  - Follow systems engineering principles to develop and trace requirements, establish concept of operations, etc.
- Other issues to consider:
  - Technical feasibility.
  - The TMS concept of operations.
  - The condition of assets.
  - Economic feasibility.
  - The TMS structure and design.
  - Current and anticipated staff and contract support.
  - Planning, plans, and planned improvement projects.

Dimensions or Process Areas[2]	*What Is It?*
Business process.	*Plans, programs, and budget.*
Systems and technologies.	*Approach to building systems.*
Performance measurement.	*Use of performance measures.*
Workforce.	*Improving the capability of the workforce.*
Culture.	*Changing the culture and building champions.*
Collaboration.	*Improving working relationships.*
Day-to-day management and operations.	*Managing and operating daily.*
Day-to-day maintenance and repair.	*Conducting daily maintenance and repairs.*

Example Assessment: Systems and Technologies (2/2)

This chart contains examples of improvement opportunities to select for action plans when assessing the systems and technologies dimension.(2)

Technology Advances

- Emerging data sources.
- Travelers using mobile devices to share and use data.
- Innovative technologies and tools to analyze data.
- Advanced computing capabilities
- Open-source, agency-owned, off-the-shelf software.
- Enhanced ITS and traffic control device capabilities.
- Ability to share information with other systems and the public.

The Next Generation of an Agency's TMS

- Improvements to capabilities and entirely new functions or services.
- Real-time decisionmaking with highly automated operation to proactively manage traffic.
- Information sharing with other systems and service providers to improve safety and mobility.
- Modular components and expandable platforms that are easier for agencies to manage, operate, maintain, and modify to meet evolving future needs.

Key Functions of an Agency's Next-Generation TMS

- Monitor, calculate, and predict.
- Propose, select, and implement.
- Automate management and operation.

Example Improvement Actions for Systems and Technologies

This table provides examples of improvement actions for one subdimension of the systems and technologies dimension.(2)

Systems and Technologies: TMS ConOps Subdimension		
Achieving Level 2	**Achieving Level 3**	**Achieving Level 4**
Identify key processes needed to support the TMS ConOps development.	Develop the TMS ConOps and align with agency priorities.	Establish a formal, continuous improvement process for the TMS ConOps, integrated with overall agency processes.
Create basic documentation to explain the components and interfaces required for the TMS ConOps to use and administer the TMS.	Document and integrate interface specifications into the ConOps.	Align the TMS ConOps system architecture with formal internal and external partner specifications.
Develop interoperability and data for the TMS ConOps.	Manage and measure the adherence of the TMS ConOps to interoperability and data standards.	Agencywide adoption of and accountability to common interoperability and data standards in all system ConOps.

TMS Assessments: Example Subdimensions (1/3)

This table contains potential subdimensions for TMS assessment dimensions.(2) Agencies may decide to focus on a subset of these dimensions or adjust the subdimensions based on the agencies' specific needs.

Business Processes	Systems and Technologies	TMS Performance
• Setting TMS strategic direction and plans. • Planning for TMS improvements. • TMS program and plan. • Regional TSMO planning and plans TMS integration. • Managing TMS resources. • Managing TMS assets. • Pursuing TMS improvement projects.	• TMS feasibility and planning studies. • TMS concept of operations. • TMS structure and design. • TMS architecture. • TMS improvements and enhancements. • Inventory, document, and configure TMS assets. • Managing changes to TMSs.	• Data collection. • Performance measures. • TMS monitoring. • TMS asset monitoring. • Data management plan and services. • Reporting on TMS performance. • Incorporating TMS performance into agency and regional programs and plans.

TMS Assessments: Example Subdimensions (2/3)

This table contains potential subdimensions for TMS assessment dimensions.(2) Agencies may decide to focus on a subset of these dimensions or adjust the subdimensions based on the agencies' specific needs.

Workforce	Culture	Collaboration
• TMS staffing plan. • Monitoring, evaluating, and reporting on staff performance. • Position descriptions, requirements and performance expectations. • Procuring and managing staff resources needed to support TMSs. • Staff development. • Staff recruitment and retention. • Succession planning.	• Awareness of TMS program within the agency. • TMS incorporated into the agency strategic planning and plan. • TMS incorporated into TSMO program and plan. • Workplace desirability.	• Operational agency collaboration. • Third-party provider collaboration.

TMS Assessments: Example Subdimensions (3/3)

This table contains potential subdimensions for TMS assessment dimensions.[2] Agencies may decide to focus on a subset of these dimensions or adjust the subdimensions based on the agencies' specific needs.

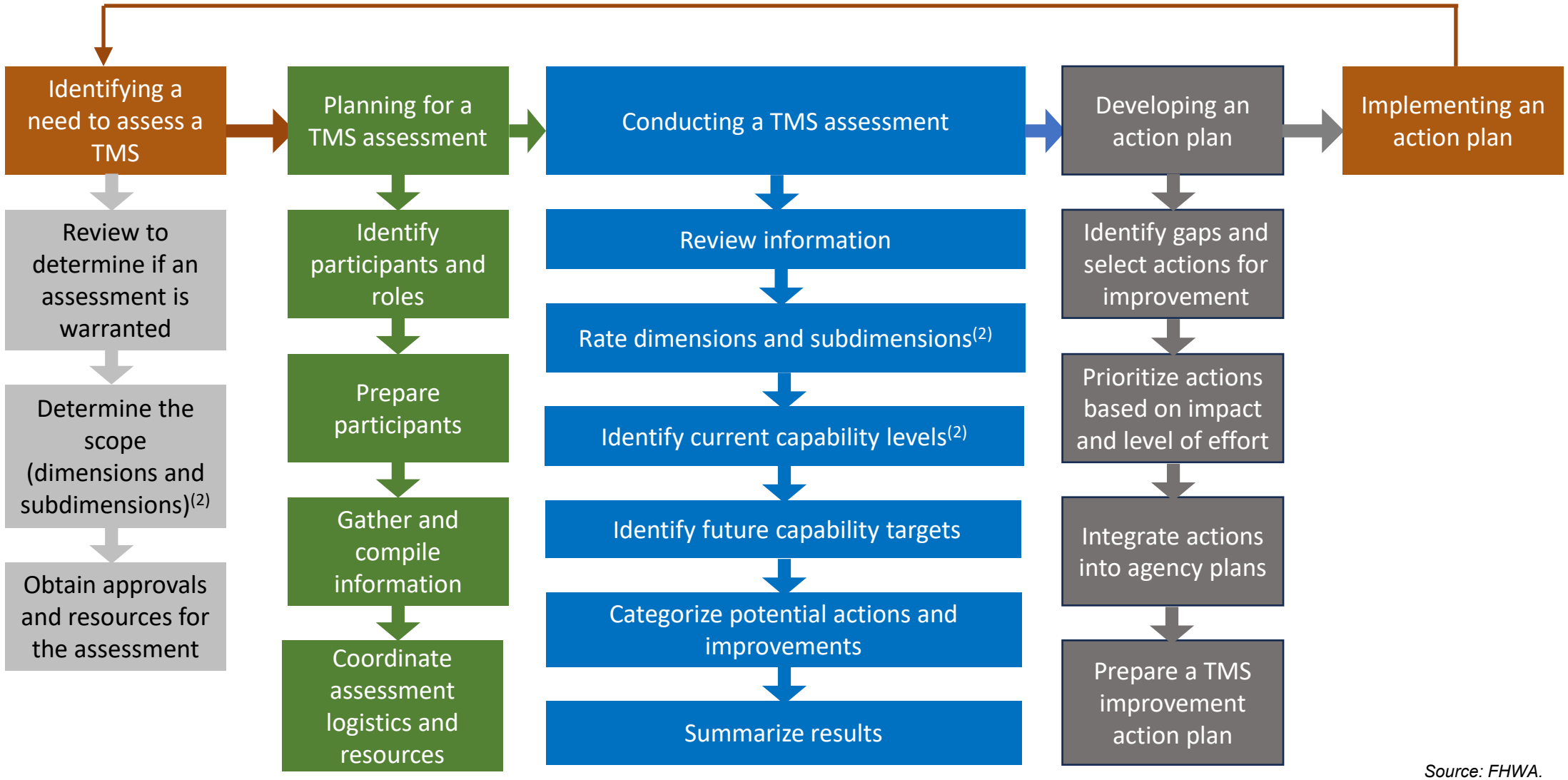
Sharing Data	Management and Operations	Maintenance and Repairs
• Internal agency data sharing. • External partner data sharing. • Third-party data integration. • Data management plan. • Managing APIs. • TMS subsystems, components, and device data sharing. • Testing, acceptance, and monitoring information sharing.	• Operational policies and procedures. • Managing and operating TMS. • Managing TMS support resources. • Monitoring travel conditions, asset conditions and TMS operations. • Remote and virtual operations. • Managing TMS for special events. • TMS security.	• Inventory, documentation and configuration of TMS assets and resources. • Maintenance management system. • Managing changes to TMS system. • TMS maintenance and repair plan and resources. • Managing repair and maintenance of TMS assets and resources.

Preparing for a TMS Assessment

Questions to consider when preparing for a TMS assessment:

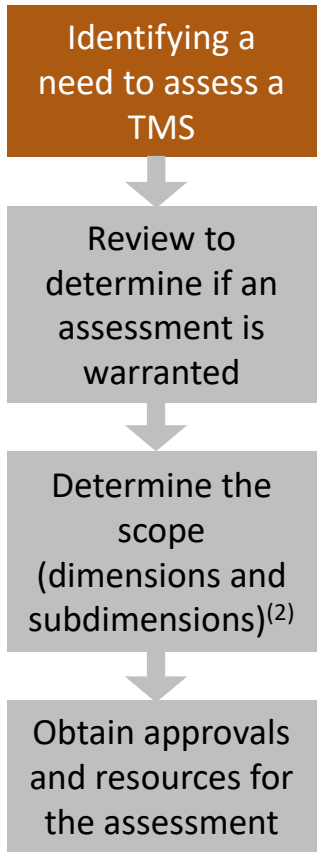
- Who will be involved in the assessment? What are their roles?
- What other resources are needed to support the assessment?
- How will stakeholders be engaged to support the assessment?
- Which topics (dimensions and subdimensions) are being included?(2)
- What information may need to be complied to support the assessment?
- How will results be documented?
- What process will be followed?

Preparing, Conducting, and Summarizing a TMS Assessment



Source: FHWA.

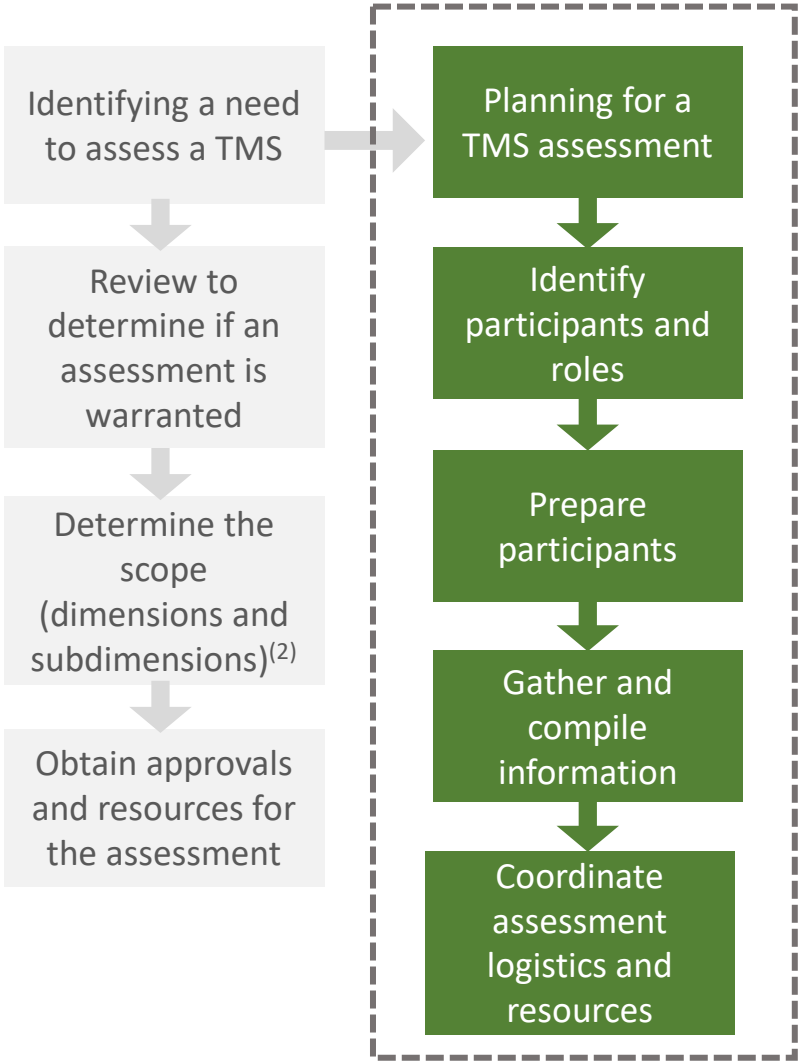
Reviewing and Identifying the Need to Assess a TMS



Source: FHWA.

- Check for any recently completed assessments.
- Determine if an assessment is needed.
- Decide the exact scope of the assessment:
  - Dimensions.(2)
  - Priorities.
  - Topics.
- Align with other projects or priorities.
- Obtain approval for assessment.

1. Planning for a TMS Assessment (1/2)



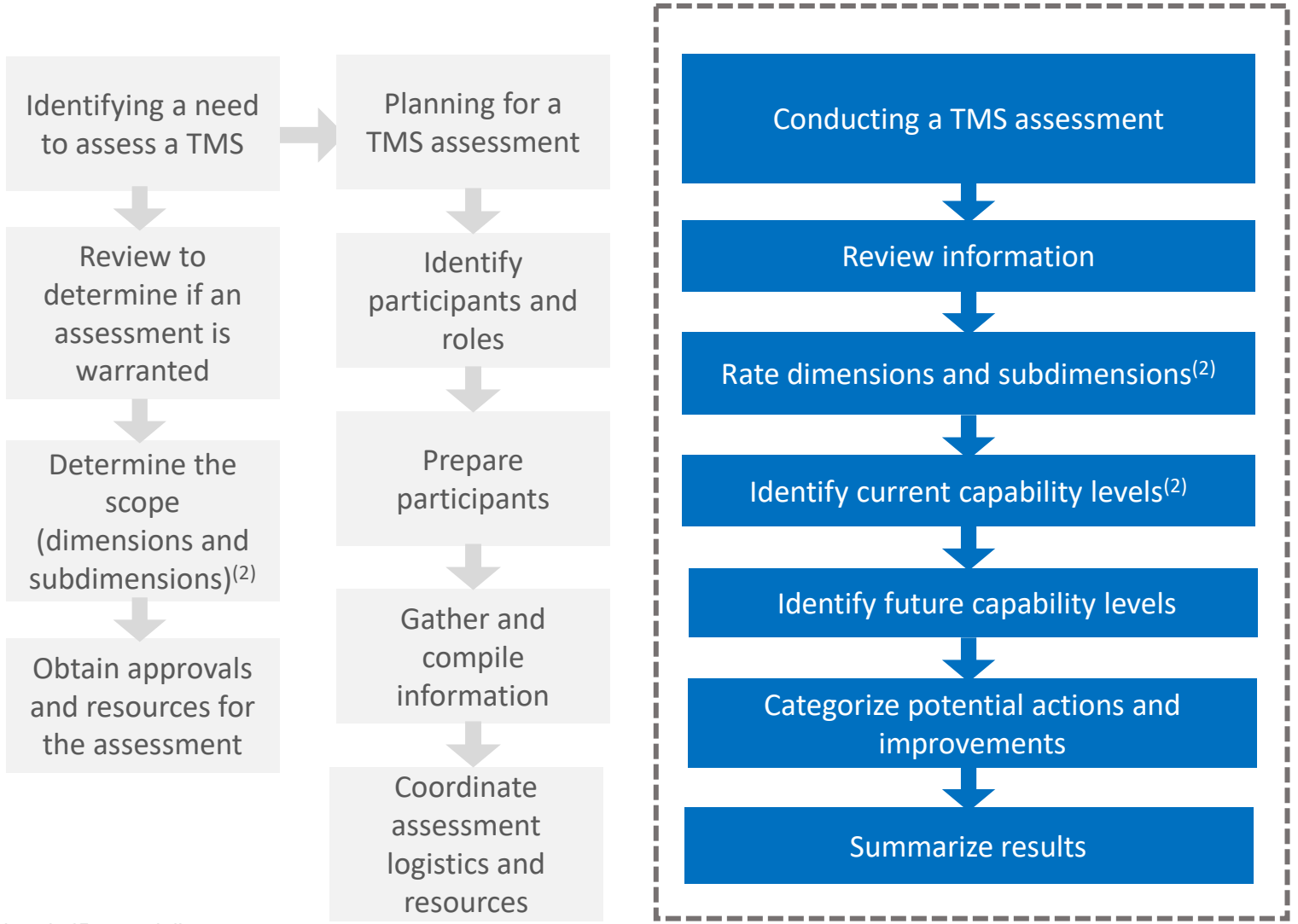
Source: FHWA.

- Identify participants and roles:
  - Champion.
  - Agency leadership.
  - Stakeholders.
- Prepare participants; ensure that participants understand the assessment process and dimensions.(2)
- Gather information to support the assessment.
- Coordinate assessment logistics:
  - Room and meeting location.
  - Schedule, dates, and invitations.

1. Planning for a TMS Assessment (2/2)

- Gather information:
  - Strategic goals and plans.
  - Agency and regional TSMO plans.
  - ITS strategic plans.
  - TMS asset condition, performance measures, and dashboards.
  - Traffic signal system and signal timing programs.
  - Agency staffing or training plans.
  - TMS program and plan.
  - Policies and operating procedures.
- Include participants:
  - TMS and TSMO staff.
  - Planning staff.
  - Capital program managers.
  - ITS maintenance staff.
  - IT staff.
  - Traffic operations center operators.
  - Public relations staff.
  - Partner agency stakeholders.

2. Conducting a TMS Assessment (1/2)



Source: FHWA.

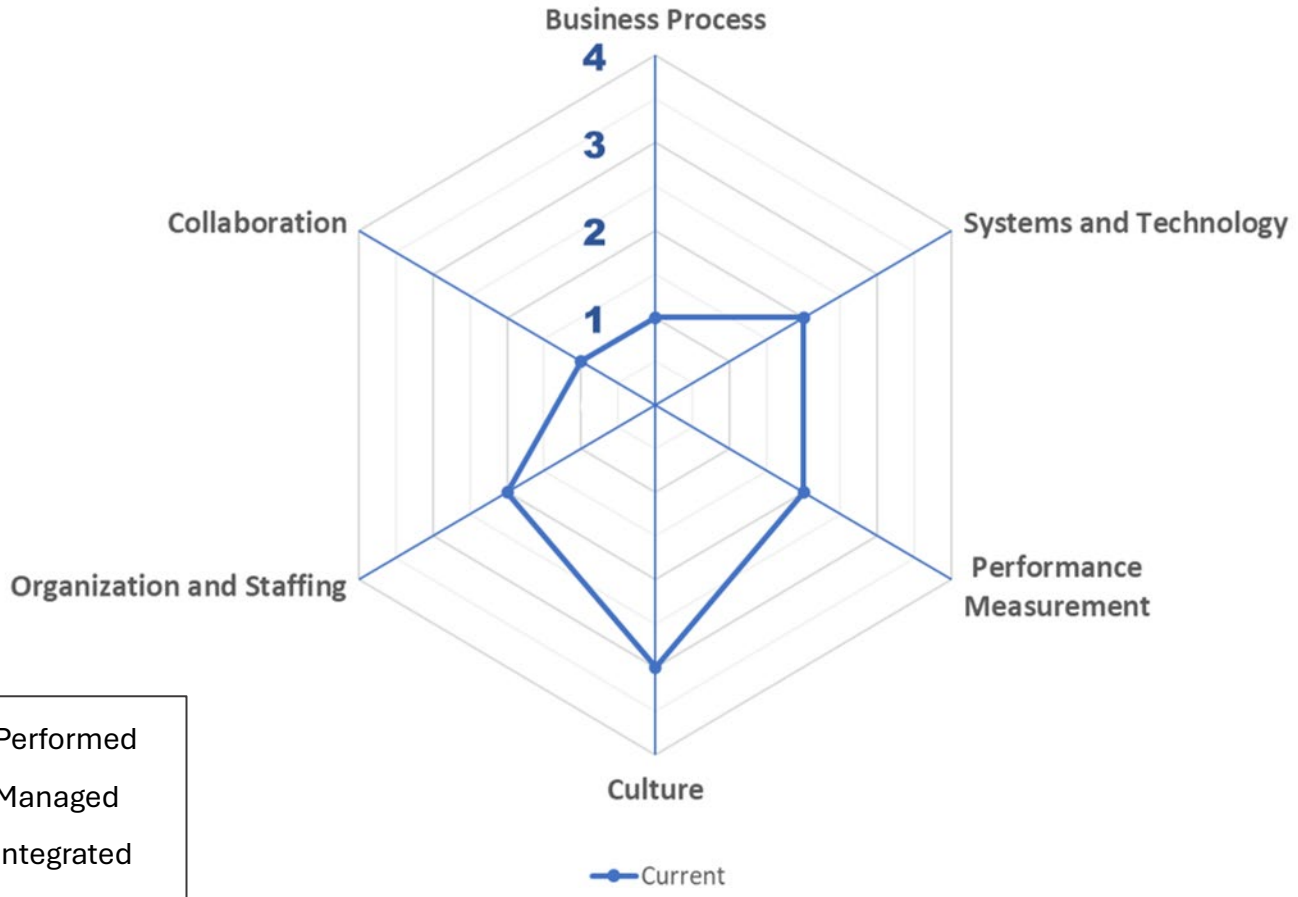
- Review information and engage stakeholders to rate selected dimensions and subdimensions.(2)
- Identify and assign current and target capability levels.(2)
- Identify and prioritize improvements.
- Categorize and prioritize actions for improving capabilities.
- Document selected target capability levels across each dimension.(2)

2. Conducting a TMS Assessment (2/2)

- Assign current levels of capability:[2]
  - Consider broad stakeholder feedback.
  - Rank prioritized subdimensions or priority topics.
  - Use CMF tables of descriptions across four levels of capability.
- Consider questions—Business process, for example:
  - Is there a formal planning process for the TMS?
  - Is TMS planning aligned with broader TSMO planning?
  - How are TMS projects funded?
  - Does the TMS have sufficient documentation that is routinely updated?

Visualizing Current Capability Levels(2)

After current capability levels are assigned for all selected dimensions, use a spider diagram to visualize the results of current capability levels. This information may be used in the following steps to help identify potential improvements.

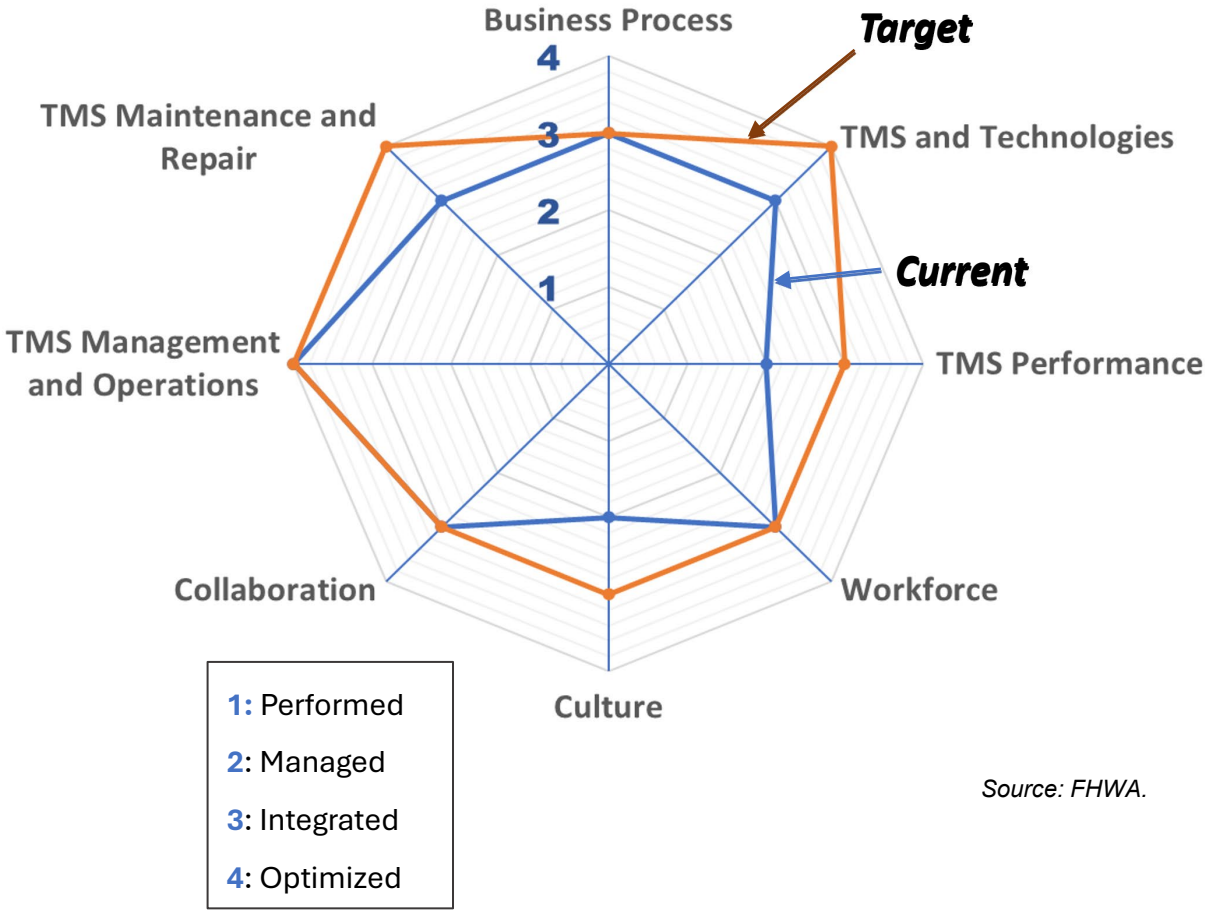


1: Performed
2: Managed
3: Integrated
4: Optimized

Source: FHWA.

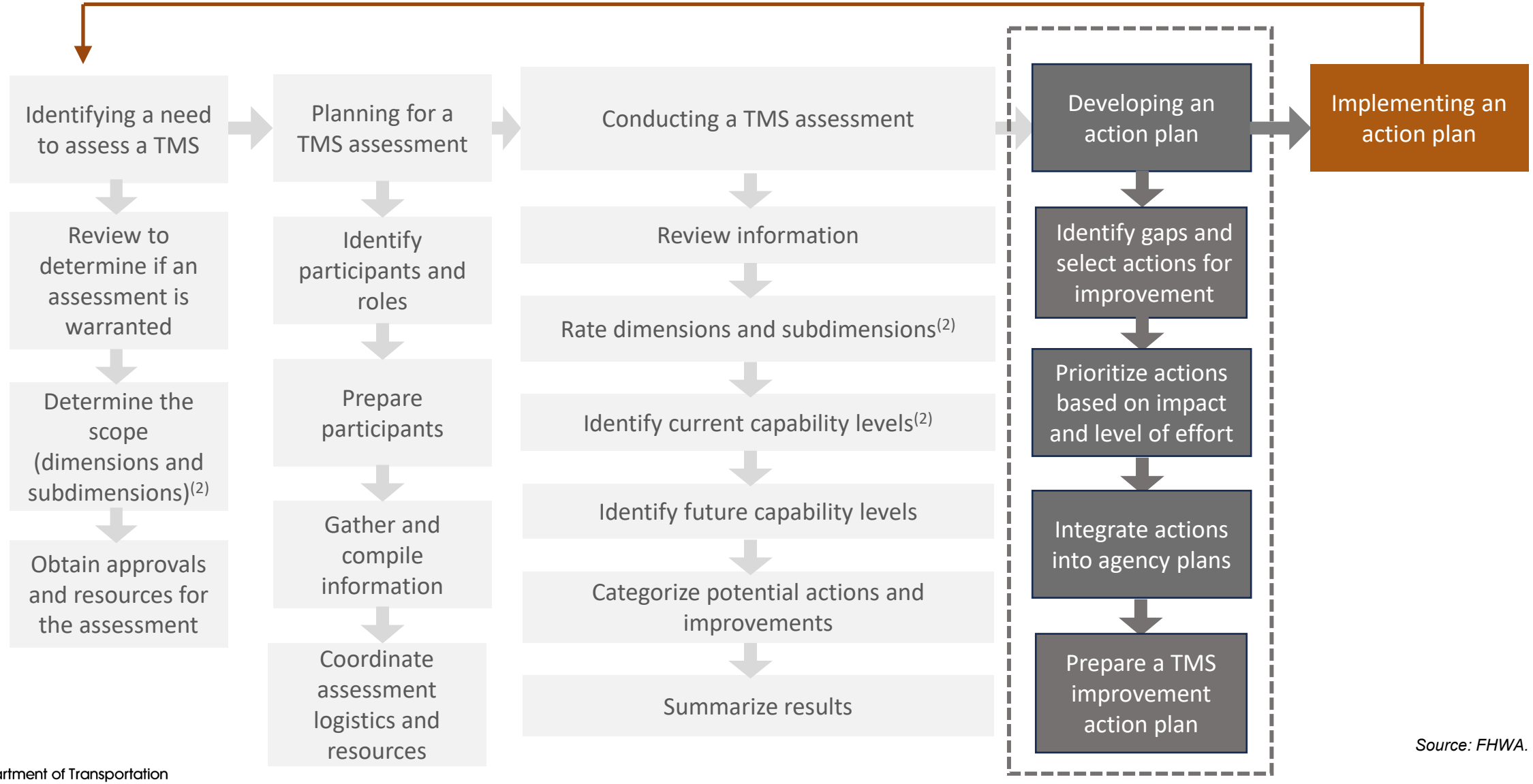
Visualizing Future Target Capability Levels(2)

After current capability levels are assigned for all selected dimensions, use a spider diagram to visualize the results of current capability levels. Add a new line to the same chart with current capability levels. Gaps between the lines represent improvement opportunities.



Source: FHWA.

4. Developing an Action Plan (1/4)



Source: FHWA.

4. Developing an Action Plan (2/4)

- Identify gaps, improvement opportunities, and identified actions.
- Prioritize actions for dimensions and subdimensions:[2]
  - Identify immediately actionable actions or changes.
  - Prioritize improvements that need resources to pursue.
  - Align proposed improvements with agency or regional priorities.
- Integrate actions into other agency plans.
- Combine selected actions into an action plan.

4. Developing an Action Plan (3/4)

The following table is an example of evaluating and prioritizing actions.

Dimension[2]	Action	Value	Risk	Effort	Cost
Workforce	Develop detailed job descriptions for TMS staff	1	7	2	4
Systems and Technologies	Create a joint task force to align technology decisions	2	8	4	8
Culture	Establish agency peer-to-peer exchanges to discuss TMS operations and maintenance	1	5	5	6

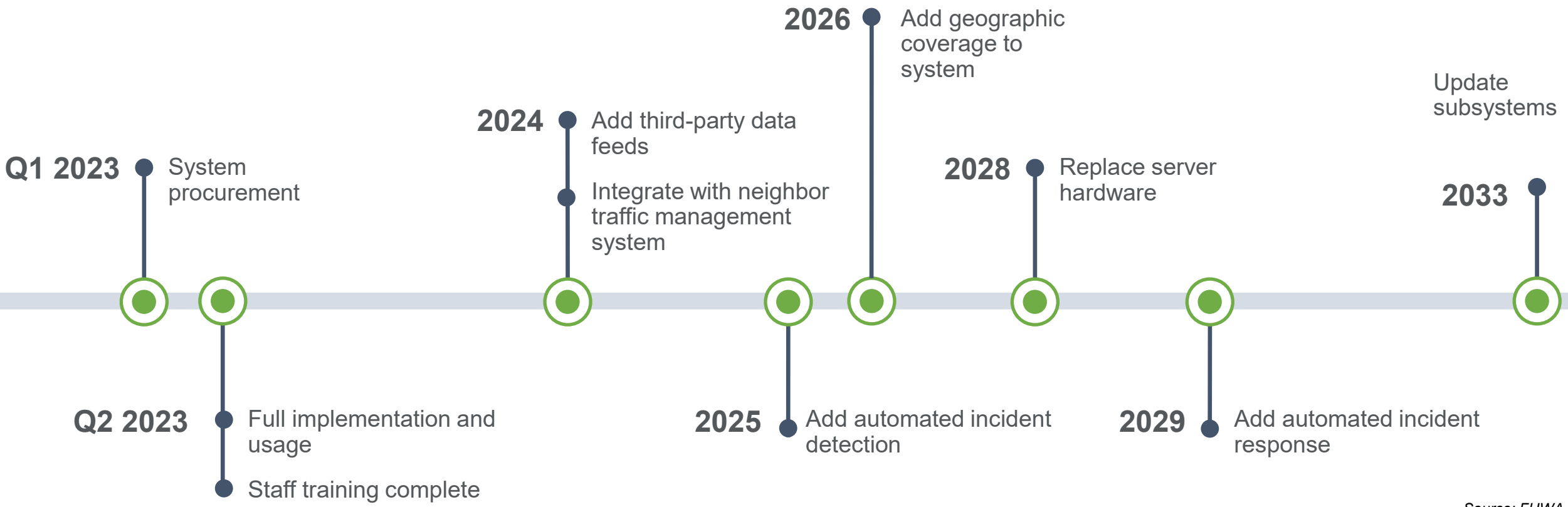
4. Developing an Action Plan (4/4)

Not all target capability levels are immediately prioritized in the action plan.(2) Add a third line to the spider diagram to visualize selected actions for implementation. The new action plan line represents selected actions to implement now, based on available resources and priority.

Source: FHWA.

4. Creating an Action Plan: Feature Roadmap

A TMS feature roadmap contains selected improvements scheduled.



Source: FHWA.

4. Creating an Action Plan: Example Improvements (1/2)

This list contains example improvement opportunities identified in TMS assessments.

- Prepare procedures, control plans, and actions for specific events or scenarios.
- Identify and obtain staff or contract support with the knowledge, ability, and resources to support TMSs.
- Plan for and obtain the resources needed for improvements.
- Develop plans for the next generation of the agency's TMS.
- Develop a staffing plan and obtain resources to improve scheduling staff and support resources to meet the TMS's operational needs.

TMS Resources

- National Operations Center of Excellence (NOCoE) TMS portal.(4)
- TMC Pooled-Fund Study website.(1)
- Next Generation of TMSs resources.(5)

References

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Questions?

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