Rethinking Risk Management

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Mission Success in Complex Environments (MSCE) Project

Part of the SEI Acquisition Support Program (ASP), the MSCE Project develops methods, tools, and techniques for assuring success in complex, uncertain environments.

The project builds on more than 17 years of SEI research and development in managing uncertainty.

- Continuous Risk Management for software-development projects
- Operationally Critical Threat, Asset, and Vulnerability Evaluation (OCTAVE®) for organizational security and information assurance

Current work is *Mosaic*, a structured approach for assessing and managing for success in distributed environments.

This tutorial is derived from the Mosaic work.

Topic Areas

Risk Management: *Key Concepts*

A Different Perspective

The Mission Diagnostic

The Risk Diagnostic

Implementation Options

Summary

Learning Objectives

Understand the limitations of traditional risk management approaches for today's complex, multi-organizational, system-of-system programs

Understand how current program conditions can be used to estimate the program's current momentum towards success

Learn how to use the Mission Diagnostic to evaluate a program's key drivers of success and failure and determine its current potential for success

Understand how to use the Risk Diagnostic to evaluate a program's mission risks

Understand some options for implementing these concepts

RISK MANAGEMENT: *KEY CONCEPTS*

What Is Risk?

The likelihood of loss

A measure of the likelihood that a threat will lead to a loss coupled with the magnitude of the loss

Risk requires the following conditions[1]

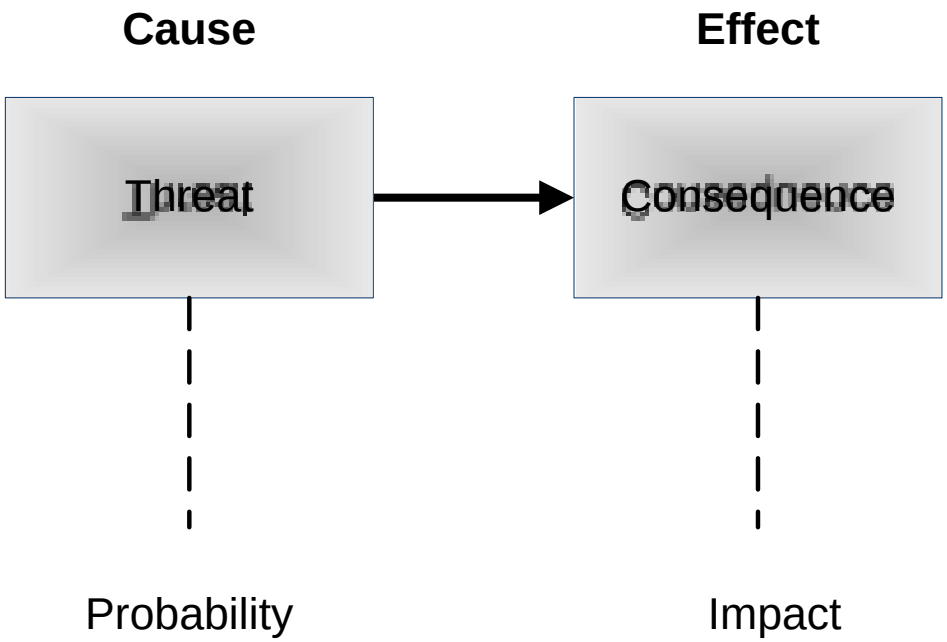
- A potential loss
- Likelihood
- Choice

1. Charette, Robert N. *Application Strategies for Risk Analysis*. New York, NY: McGraw-Hill Book Company, 1990

Components of Risk

Risk comprises two core components.

- ***Threat*** – a circumstance with the potential to produce loss
- ***Consequence*** – the loss that will occur when a threat is realized



Issue/Problem

A loss or adverse consequence that has occurred or is certain to occur

No uncertainty exists—the loss or adverse consequence has taken place or is certain to take place

An issue or problem can also lead to (or contribute to) other risks by

- Creating a circumstance that produces a new threat
- Making an existing threat more likely to occur
- Aggravating the consequences of existing risks

Opportunity

The likelihood of realizing a gain from an allocation or reallocation of resources

- Defines a set of circumstances that provides the potential for a desired gain
- Requires an investment or action to realize the desired gain (i.e., take advantage of the opportunity)

Pursuit of an opportunity can produce

- New risks or issues
- Change existing risks or issues

Tactical opportunity provides a localized gain (e.g., to program or part of a program)

Business opportunity is a gain for the organization

Types of Risk

Speculative

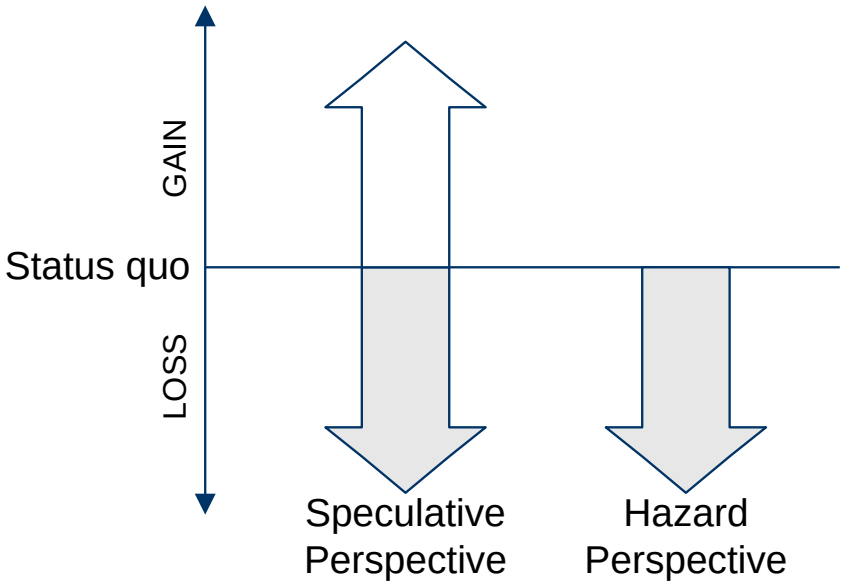
Provides the potential for gain as well as the potential for loss

Brings the potential to improve the current situation relative to the status quo

Hazard

Provides no opportunity to improve upon the current situation

Brings only the potential for loss



Widespread Use of Risk Management

Most programs and organizations implement some type of risk management approach when developing and operating software-intensive systems.

- Risk management plan
- Processes
- Tools

However, preventable failures continue to occur.

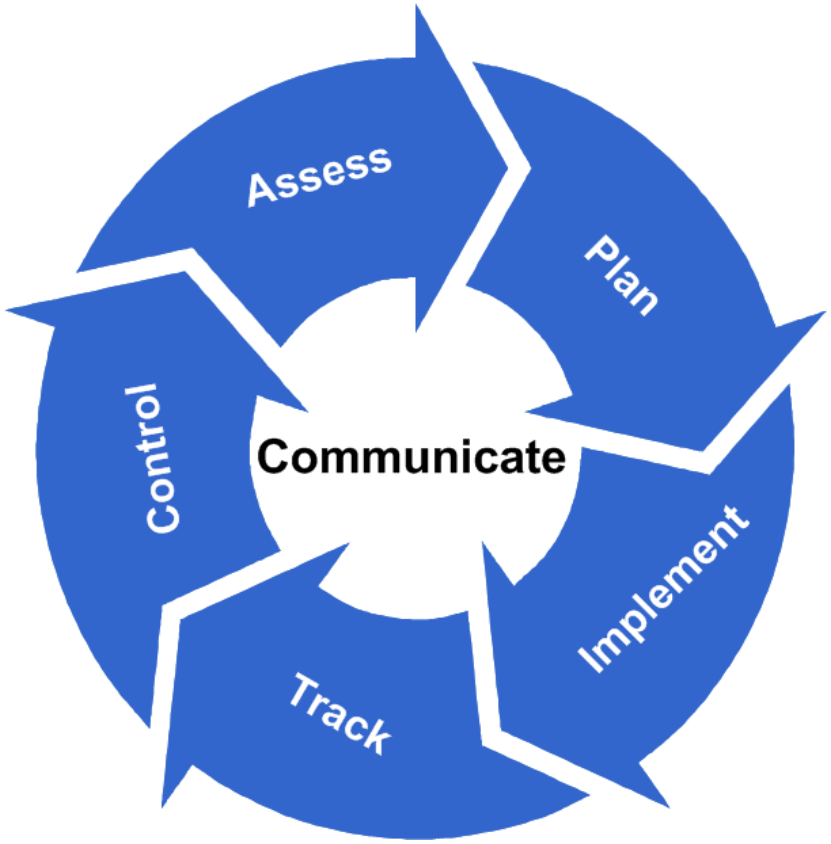
- Uneven and inconsistent application of risk-management practice
- Significant gaps in risk-management practice
- Ineffective integration of risk-management practice
- Increasingly complex management environment
- Confusion among issues, risks, and opportunities

What Is Traditional Risk Management?

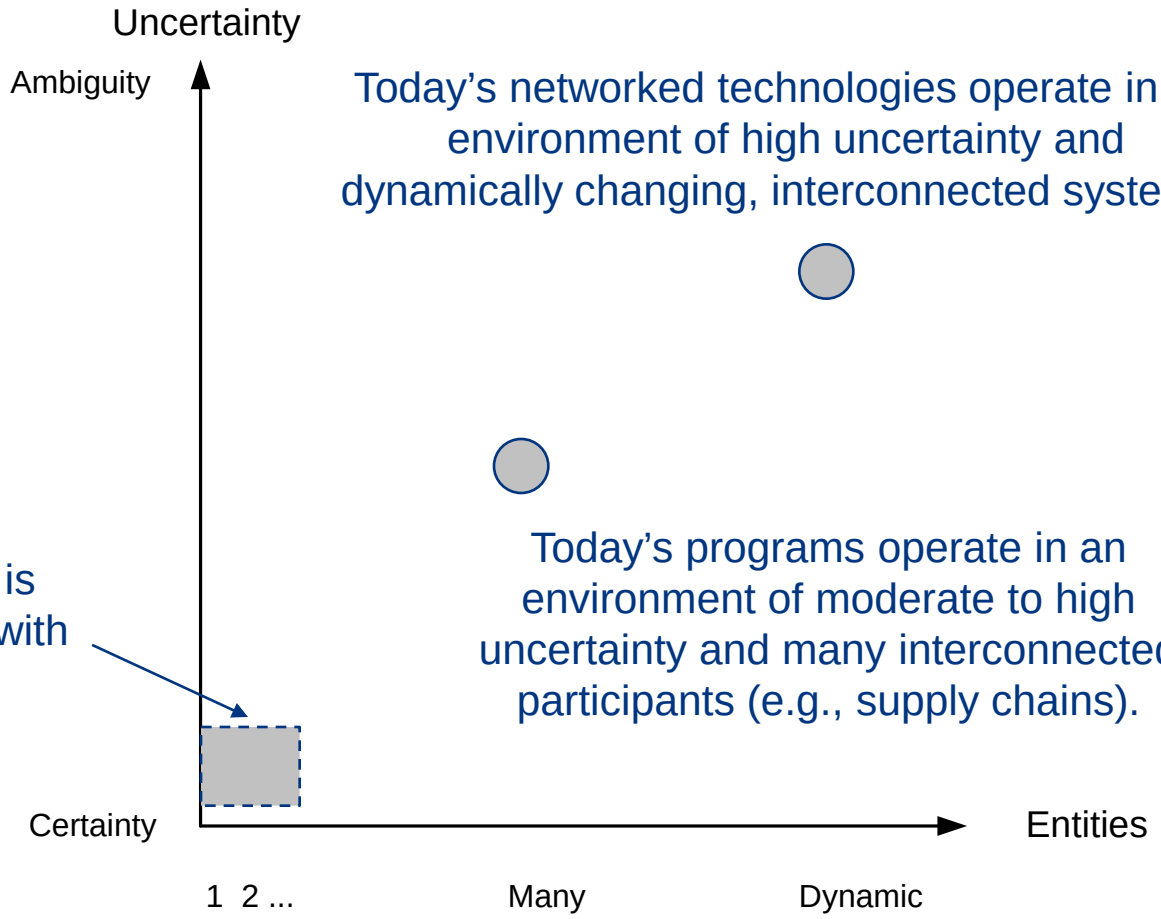
In a systems context, risk management is traditionally viewed as a proactive, disciplined approach for

- Assessing what can go wrong—risks caused by a range of threats
- Determining which risks are important to address
- Implementing actions to deal with the highest priority risks

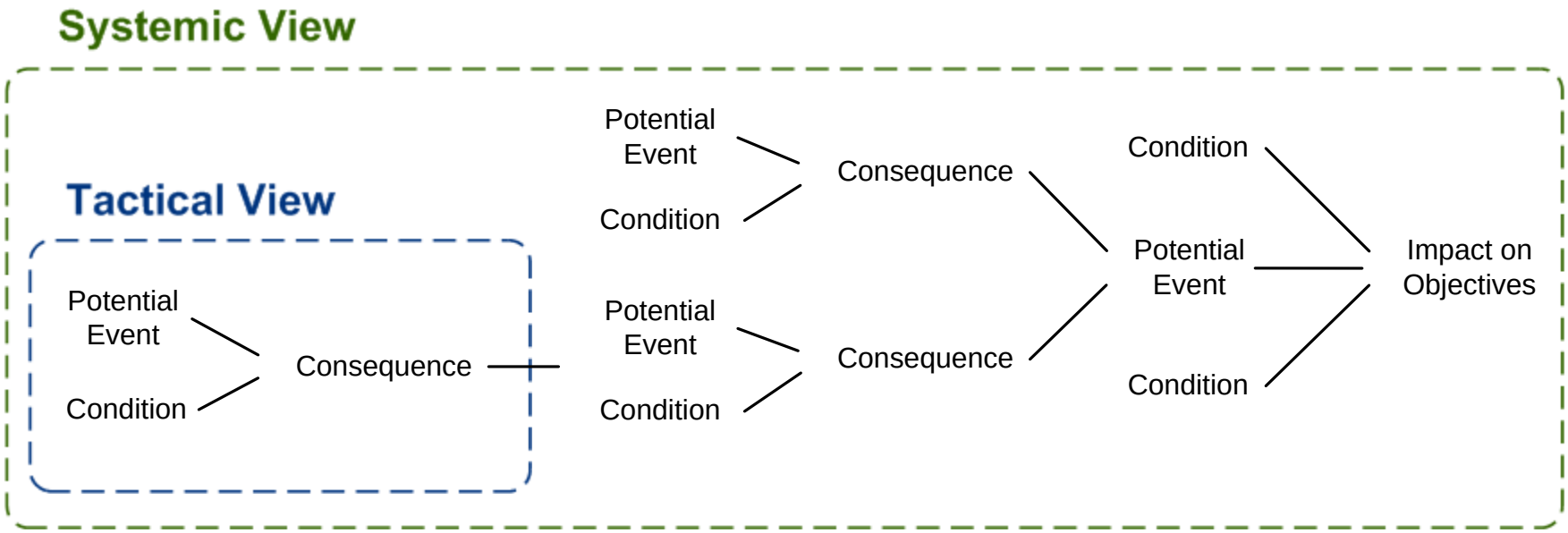
Traditional risk management is generally considered to be *tactical* in nature.



Tactical Risk Management and Complex Environments



Tactical and Systemic Approaches



Tactical Approaches for Analyzing Risk - 1

Have traditionally been used when developing and operating software-intensive systems

View a threat as a potential event that might or might not occur and is focused on the direct consequences of that threat

- Threat directly affects program performance
- The impact on a program's key objectives is an indirect consequence

Employ bottom-up analysis (based on the causes of risk)

Lead to the development of many distinct point solutions, where each is intended to mitigate a specific risk statement

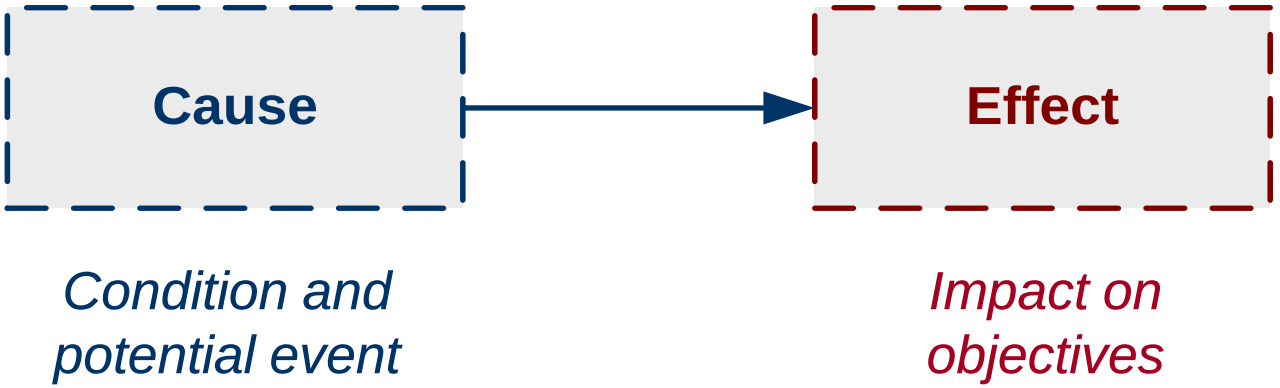
Tactical Approaches for Analyzing Risk - 2

Require a separate statement to be documented for each risk

- Some programs identify hundreds of risk statements.
- Interrelationships and dependencies among conditions and events are not usually established.
- It can be time consuming to aggregate individual risk statements into risk groups.

Implement Pareto analysis to generate a Top N list of risk statements

Tactical Analysis of Risk



Tactical risk analysis views a risk as a simple cause-and-effect pair.

The cause is the combination of a condition and a potential event.

The effect is the impact on objectives.

If-Then Risk Statement

	If	Then
Risk 1	If we miss our next milestone	Then the program will fail to achieve its product, cost, and schedule objectives
Risk 2	If our subcontractor is late in getting their modules completed on time	Then the program's schedule will slip

probability

Condition-Concern Risk Statement

	Condition	Concern
Risk 1	Data indicate that some tasks are behind schedule and staffing levels may be inadequate.	The program could fail to achieve its product, cost, and schedule objectives.
Risk 2	Our subcontractor has not provided much information regarding the status of its tasks.	The program's schedule could slip.

probability

NOTE: Some risk management methods refer to a condition-concern statement as a *condition-consequence* statement

Condition-Event-Consequence Risk Statement

	Condition	Event	Consequence
Risk 1	Data indicate that some tasks are behind schedule and staffing levels may be inadequate.	We could miss our next milestone.	The program will fail to achieve its product, cost, and schedule objectives.
Risk 2	The subcontractor has not provided much information regarding the status of its tasks.	The subcontractor could be late in getting its modules completed on time.	The program's schedule will slip.

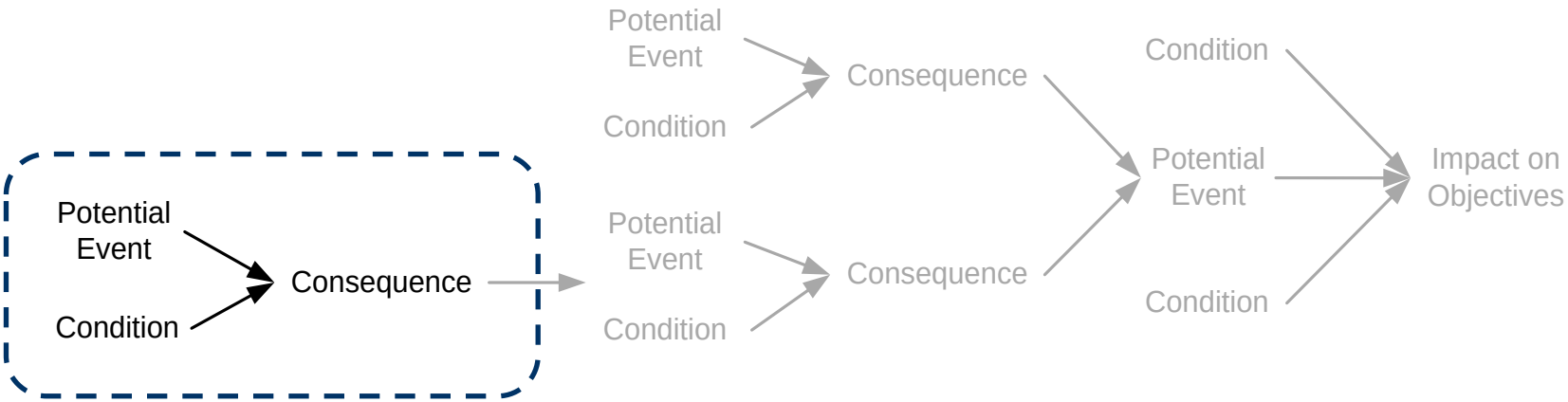
probability

NOTE: This is similar to a vulnerability-threat-consequence statement.

Question: *Risk Statements*

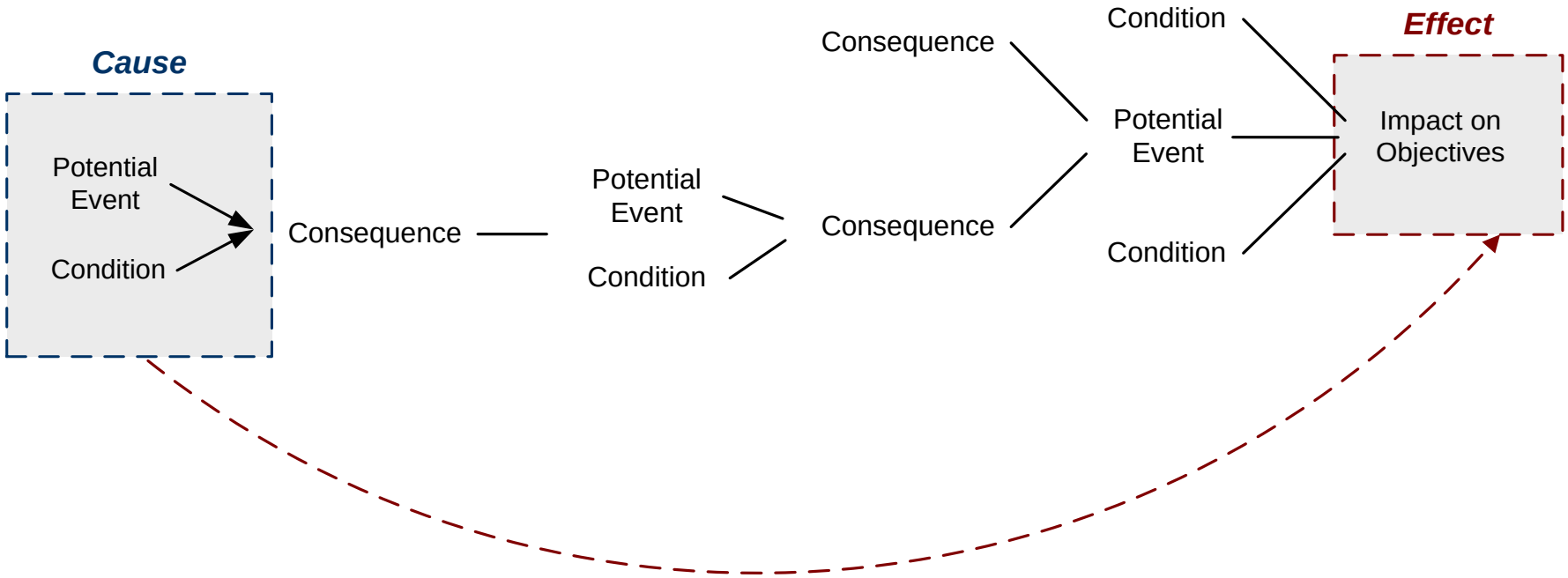
What type of risk statements do you use?

Limitations of Tactical Analysis - 1



The tactical risk can miss the real impact on objectives and lead to localized mitigation efforts.

Limitations of Tactical Analysis - 2



The tactical view assumes a direct connection between a risk's cause and its impact on objectives, which may not be true.

Risk will not be characterized effectively if the connection between a risk's cause and its impact on objectives is ***indirect***.

Systemic Approaches for Analyzing Risk

Assume a holistic view of risk to objectives by examining the aggregate effects of multiple conditions and potential events

Employ top-down analysis (based on objectives)

Focus on a small (e.g., 10-20) set of mission* risks (or drivers)

- Enable mapping of multiple root causes to mission risks
- Allow for analysis of interrelationships and dependencies among root causes

Incorporate a system view of risk that is

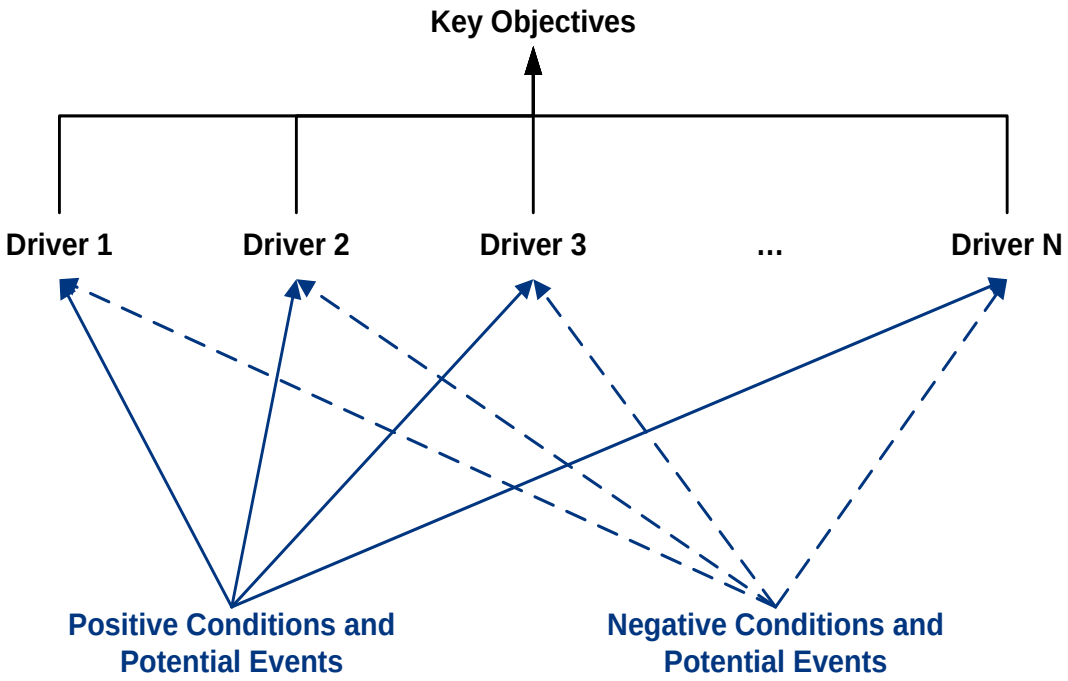
- Holistic
- Broad-based

* Systemic and mission risk are used synonymously in this tutorial

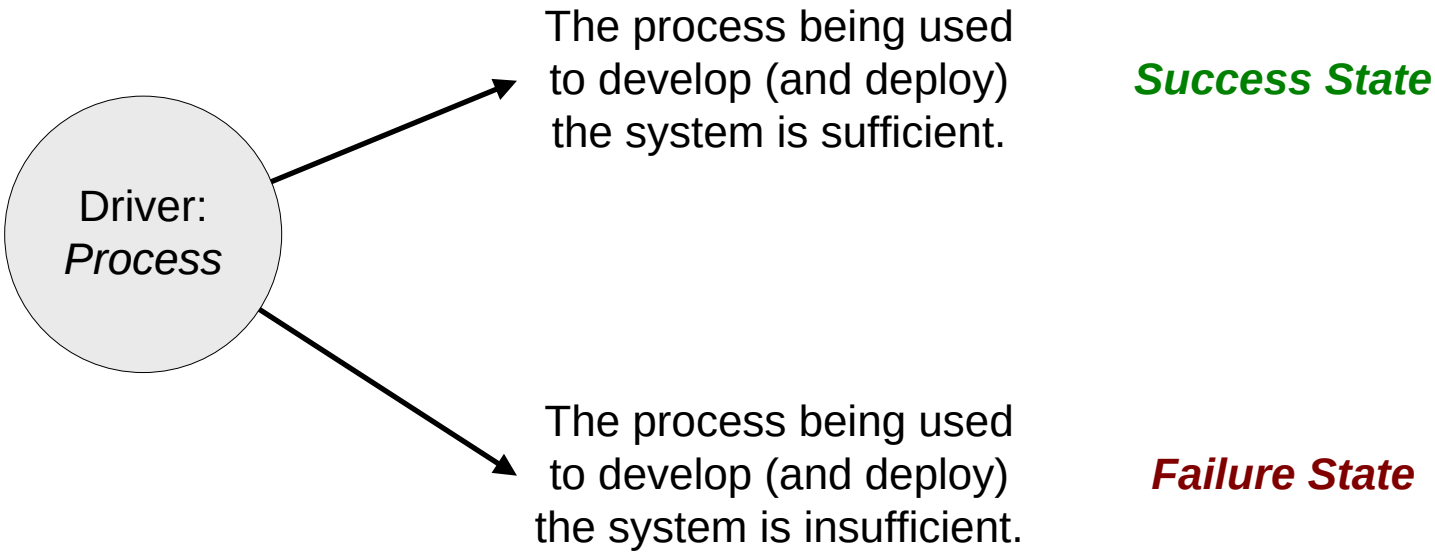
Drivers Aggregate Positive and Negative Aspects

A driver is a factor that has a strong influence on the eventual outcome or result.

Drivers enable a systemic approach to risk management by aggregating the effects of conditions and potential events.



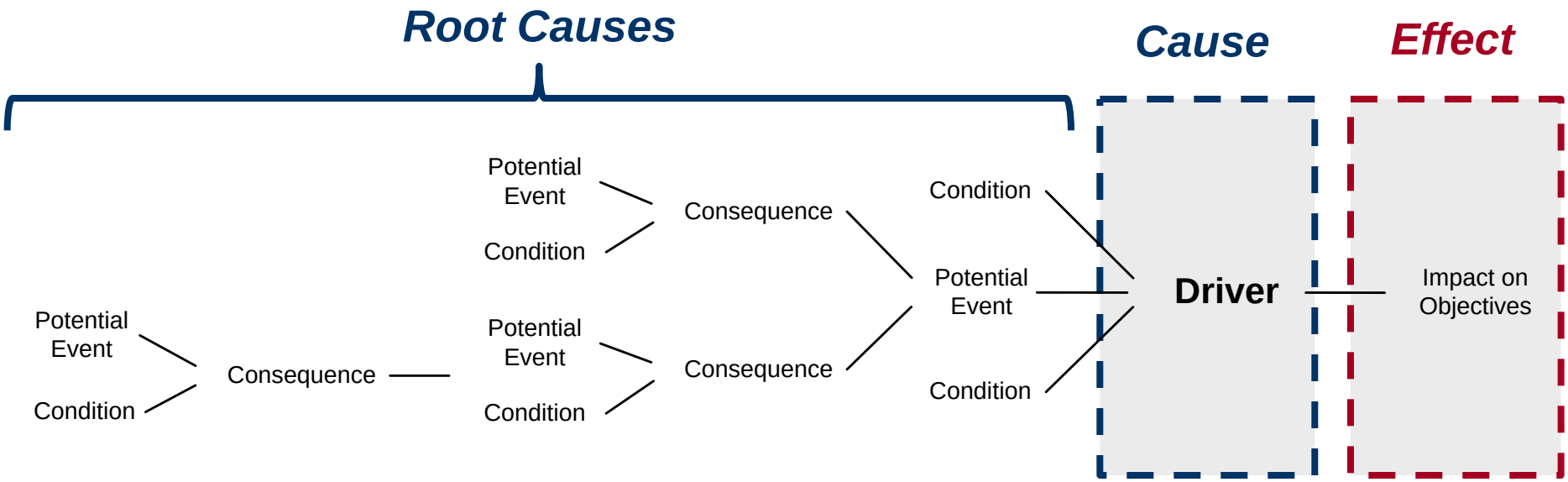
Drivers: *Success and Failure States*



A driver can guide the outcome toward key objectives (success state) or away from them (failure state).

A driver's current state determines whether it is acting as a success or failure driver.

Systemic Analysis of Risk



A driver is a factor that has a strong influence on the eventual outcome or result.

By definition, a driver has a direct connection to the impact on objectives.

Conditions and potential events form the root causes of a systemic risk.

Exercise One

Refer to Tutorial Workbook, Exercise 1

1. Read the Scenario

2. Consider:
   - What led to the program's failure?
   - Who should have been responsible for resolving these issues and preventing this failure?

A DIFFERENT PERSPECTIVE

Mosaic

What

A systemic approach for managing risk and uncertainty across the life cycle and supply chain

Why

To provide a risk management approach **that meets the needs of today's complex programs**

Core Technologies

Risk Management Framework

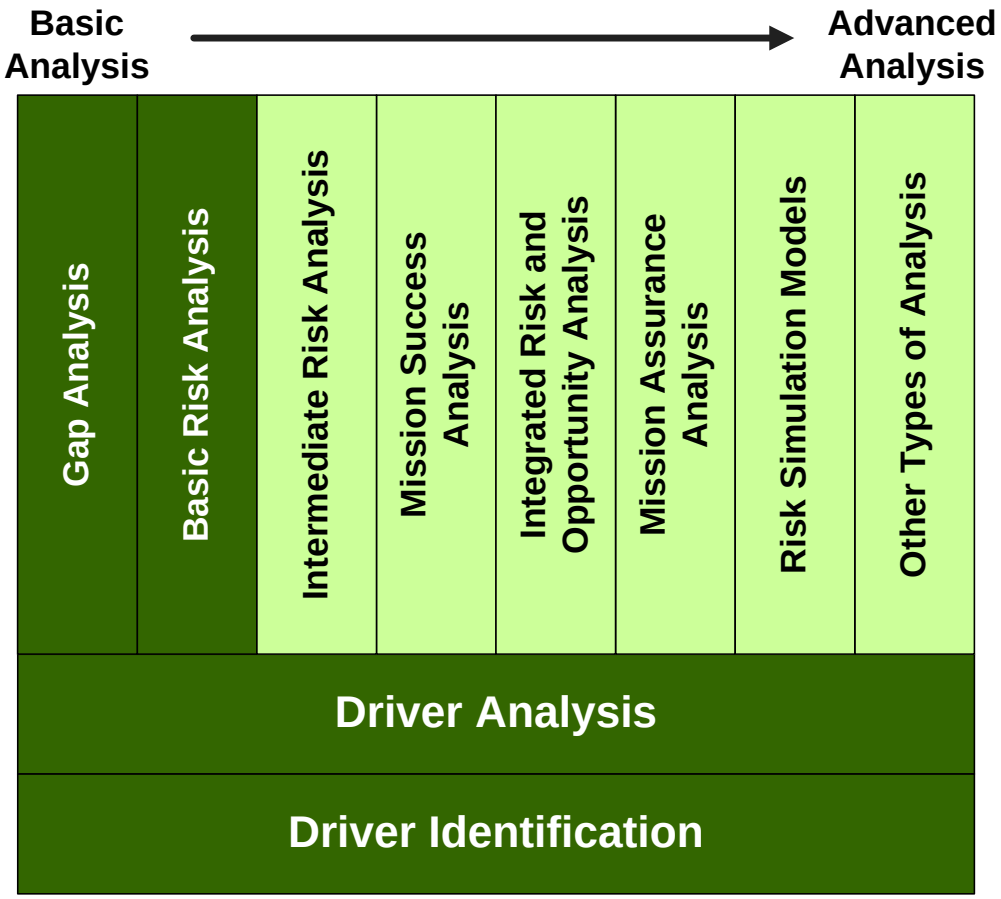
Suite of Assessment Methods

Suite of Assessment Methods on a Common Foundation

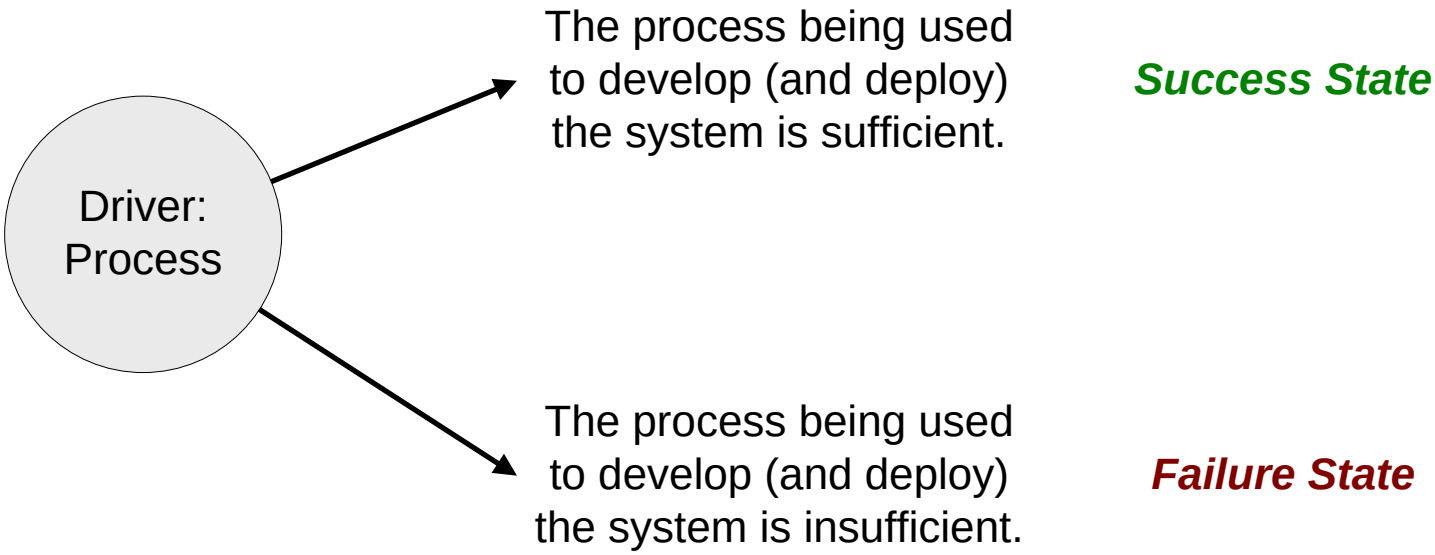
Driver identification and analysis provide a common foundation for multiple back-end analyses

This tutorial will focus on the first two types of assessment

- Gap Analysis: Mission Diagnostic
- Basic Risk Analysis: Risk Diagnostic

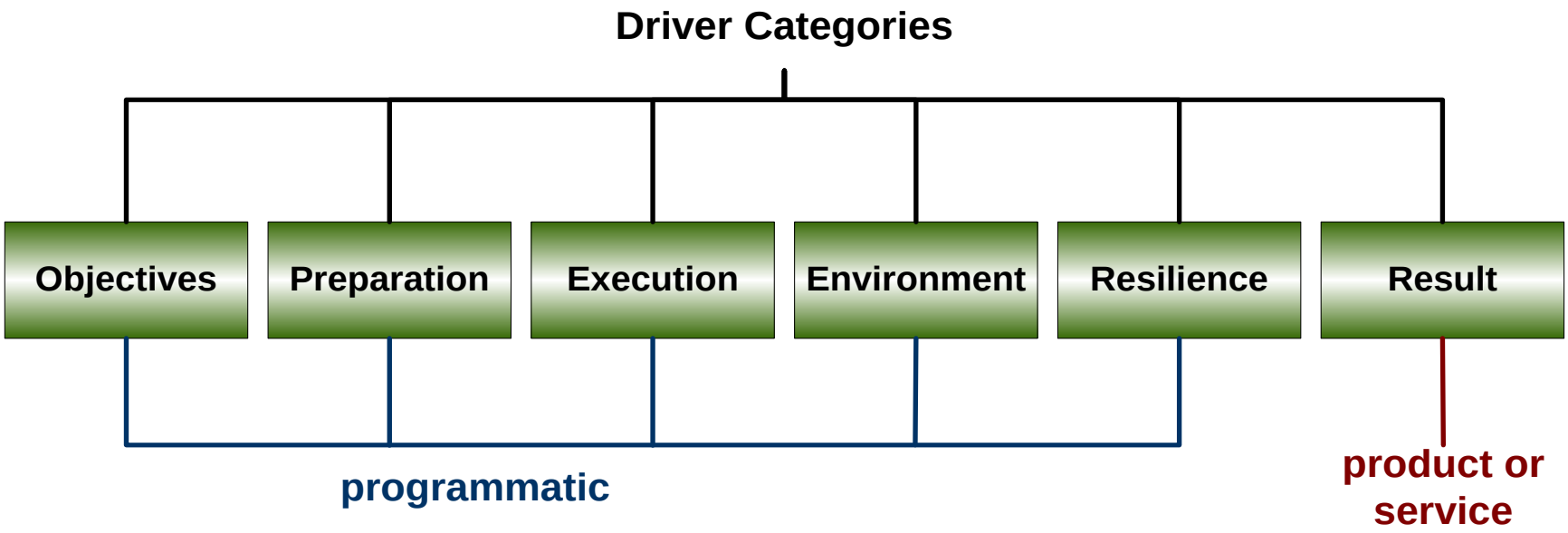


Reminder: *Drivers*



A driver can guide the outcome toward key objectives (success state) or away from them (failure state).

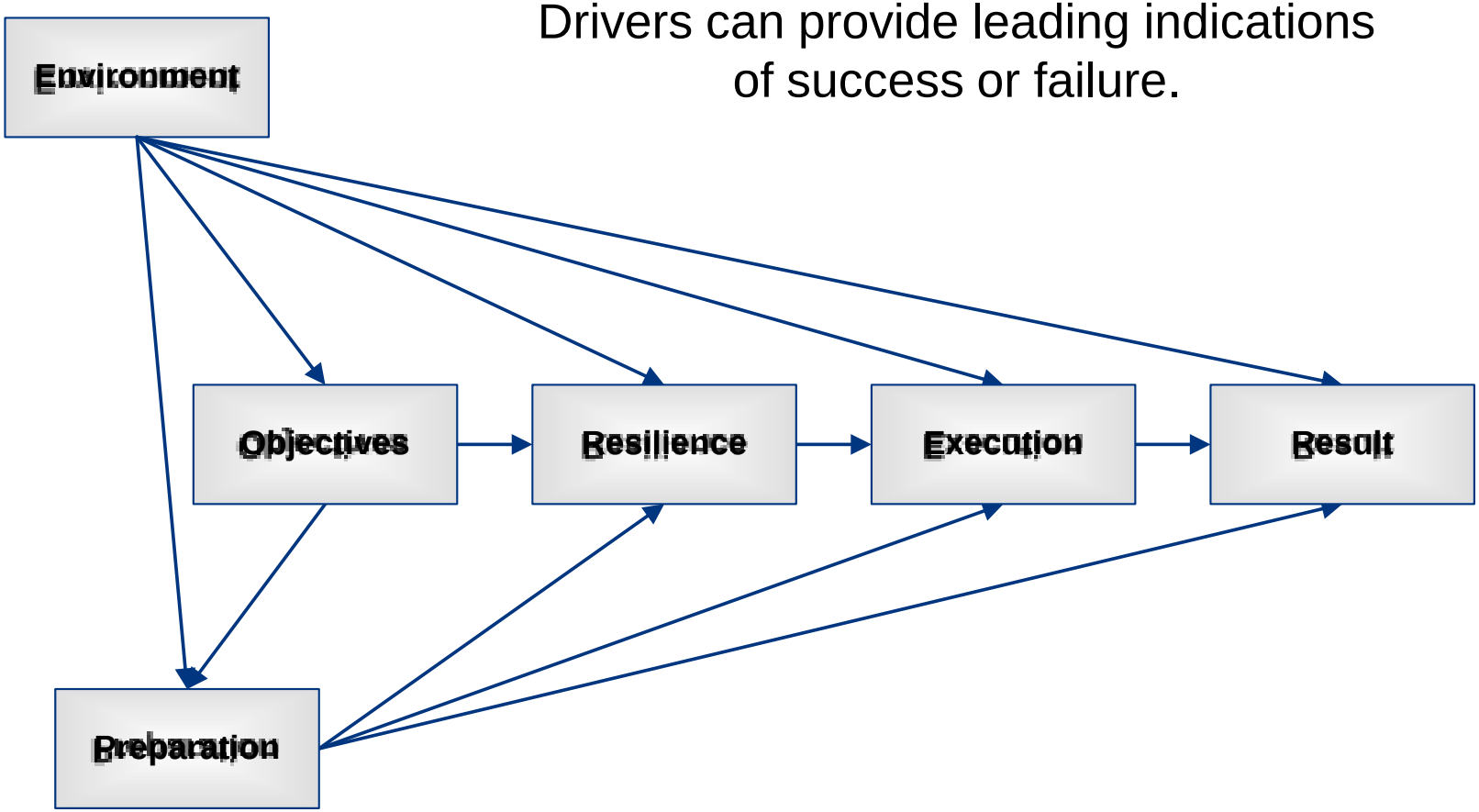
Driver Framework



The driver framework is a common structure for classifying a set of drivers.

Primary Relationships among Driver Categories

Drivers can provide leading indications of success or failure.



Standard Set of Drivers for Software/System Development and Deployment

Objectives

1. Program Objectives

Preparation

2. Plan
3. Process

Execution

4. Task Execution
5. Coordination
6. External Interfaces
7. Information Management
8. Technology
9. Facilities and Equipment

(Programmatic drivers)

Environment

10. Organizational Conditions
11. Compliance

Resilience

12. Event Management

Result

13. Requirements
14. Design and Architecture
15. System Capability
16. System Integration
17. Operational Support
18. Adoption Barriers
19. Operational Preparedness
20. Certification and Accreditation

Drivers: *Multiple Format Variations*

Variations for drivers include the following:

- Each driver is embodied in a yes/no question, where each question is phrased from the ***success perspective***.
- Each driver is embodied in a yes/no question, where each question is phrased from the ***failure perspective***.
- Each driver's ***success state*** is used as a true/false statement.
- Each driver's ***failure state*** is used as a true/false statement.

For the Mission Diagnostic, we convert drivers into yes/no questions that are phrased from the success perspective.

For Risk Diagnostic, we use the failure state as a true/false statement and you determine the probability that the failure state exists.

Driver 1: *Program Objectives*

Are program objectives (product, cost, schedule) realistic and achievable?

Considerations:

- Alignment of technical, cost, and schedule objectives
- Inherent technical risk
- Technology maturity
- Resources available

Driver 2: *Plan*

Is the plan for developing and deploying the system sufficient?

Considerations:

- Acquisition or development strategy
- Program plan
- Resources
- Funding
- Schedule
- Roles and responsibilities

Driver 3: *Process*

Is the process being used to develop and deploy the system sufficient?

Considerations:

- Process design
- Measurements and controls
- Process efficiency and effectiveness
- Acquisition and development life cycles
- Training

Driver 4: *Task Execution*

Are tasks and activities performed effectively and efficiently?

Considerations:

- Experience and expertise of management and staff
- Staffing levels
- Experience with the acquisition and development life cycles

Driver 5: *Coordination*

Are activities within each team and across teams coordinated appropriately?

Considerations:

- Communication
- Information sharing
- Dependencies
- Relationships
- Partners and collaborators

Driver 6: *External Interfaces*

Will work products from suppliers, partners, or collaborators meet the program's quality and timeliness requirements?

Considerations:

- Applications
- Software
- Systems or sub-systems
- Hardware

Driver 7: *Information Management*

Is the program's information managed appropriately?

Considerations:

- Usability
- Confidentiality
- Integrity
- Availability

Driver 8: *Technology*

Does the program team have the tools and technologies it needs to develop the system and transition it to operations?

Considerations:

- Software applications
- Infrastructure
- Systems
- Databases

Driver 9: *Facilities and Equipment*

Are facilities and equipment sufficient to support the program?

Considerations:

- Building
- Physical work spaces
- Support equipment
- Supplies
- Other resources

Driver 10: *Organizational Conditions*

Are enterprise, organizational, and political conditions facilitating completion of program activities?

Considerations:

- Stakeholder sponsorship
- Actions of upper management
- Effect of laws, regulations, and policies

Driver 11: *Compliance*

Does the program comply with all relevant policies, laws, and regulations?

Considerations:

- Policies
- Laws
- Regulations
- Standards of care

Driver 12: *Event Management*

Does the program have sufficient capacity and capability to identify and manage potential events and changing circumstances?

Considerations:

- Risk management plan, process, and tools
- Schedule slack
- Funding reserve
- Risk mitigation plans
- Program continuity and contingency plans
- Opportunity management plan, process, and tools

Driver 13: *Requirements*

Are system requirements well understood?

Considerations:

- Customer, user, and stakeholder requirements and needs
- Functional and non-functional requirements
- Operational requirements
- System growth and expansion needs
- Technology maturity

Driver 14: *Design and Architecture*

Are the design and architecture sufficient to meet system requirements and provide the desired operational capability?

Considerations:

- Interfaces
- Dependencies
- Software and system architecture
- Operational requirements
- Technology maturity

Driver 15: *System Capability*

Will the system satisfactorily meet its requirements?

Considerations:

- Functional
- Performance
- Operational
- Reliability
- Security
- Safety
- Usability
- Maintainability
- Technology maturity

Driver 16: *System Integration*

Will the system sufficiently integrate and interoperate with other systems when deployed?

Considerations:

- Interfaces
- Applications
- Tools
- Hardware
- Data
- Technology maturity

Driver 17: *Operational Support*

Will the system effectively support operations?

Considerations:

- Business and operational workflows
- Support of organizational and enterprise missions
- Operational risk mitigation
- Disaster recovery, contingency and business continuity plans
- Technology maturity

Driver 18: *Adoption Barriers*

Have barriers to customer/user adoption of the system been managed appropriately?

Considerations:

- User acceptance
- Stakeholder sponsorship
- Transition to operations
- User support

Driver 19: *Operational Preparedness*

Will people be prepared to operate, use, and maintain the system?

Considerations:

- Policies
- Procedures
- Training

Driver 20: *Certification and Accreditation*

Will the system be appropriately certified and accredited for operational use?

Considerations:

- Compliance with policies, laws, and regulations
- Acceptable mitigation of risk

Exercise Two

Refer to Tutorial Workbook, Exercise #2 and the Scenario from Exercise #1

Consider the following question:

- Which failure drivers contributed to the problems experienced by the program?

THE MISSION DIAGNOSTIC

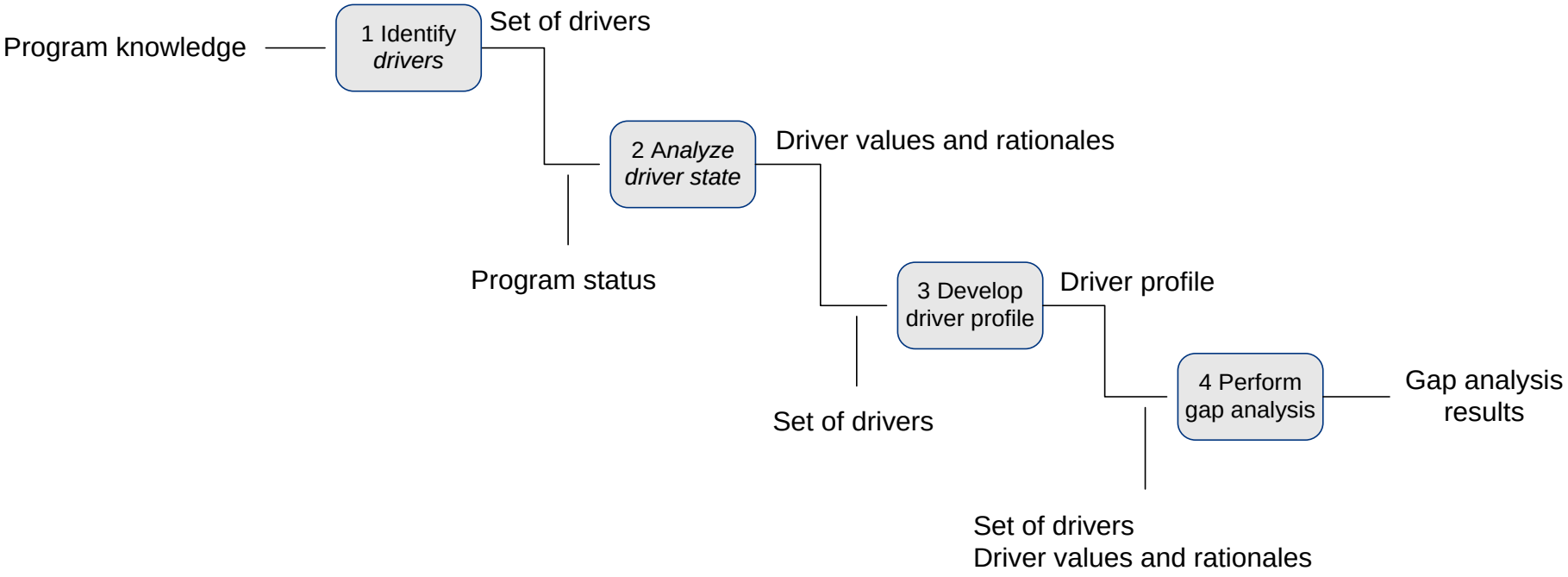
What Is a Mission?

The term ***mission*** has multiple meanings, depending on the context in which it is used.

For example, mission is used to describe any of the following:

- Purpose of an organization
- Goals of a specific department or group within a larger organization
- Objectives of each activity in a work process
- Function of each technology (e.g., a software-intensive system) that supports a project or process
- Specific result being pursued when executing a project or process

Core Mission Diagnostic Activities



Who Performs the Mission Diagnostic?

External, independent team:

- Outside the organization
- Provide unbiased results
- Will need to gather considerable data

Internal, independent team

- Inside the organization
- Provide unbiased results
- Will likely need to gather less data than an external team

Project team:

- Part of the project
- For routine, frequent applications
- Will need to gather considerably less data, if any

The Mission Diagnostic

WHAT SET OF DRIVERS?

Identifying Drivers: *Two Basic Steps*

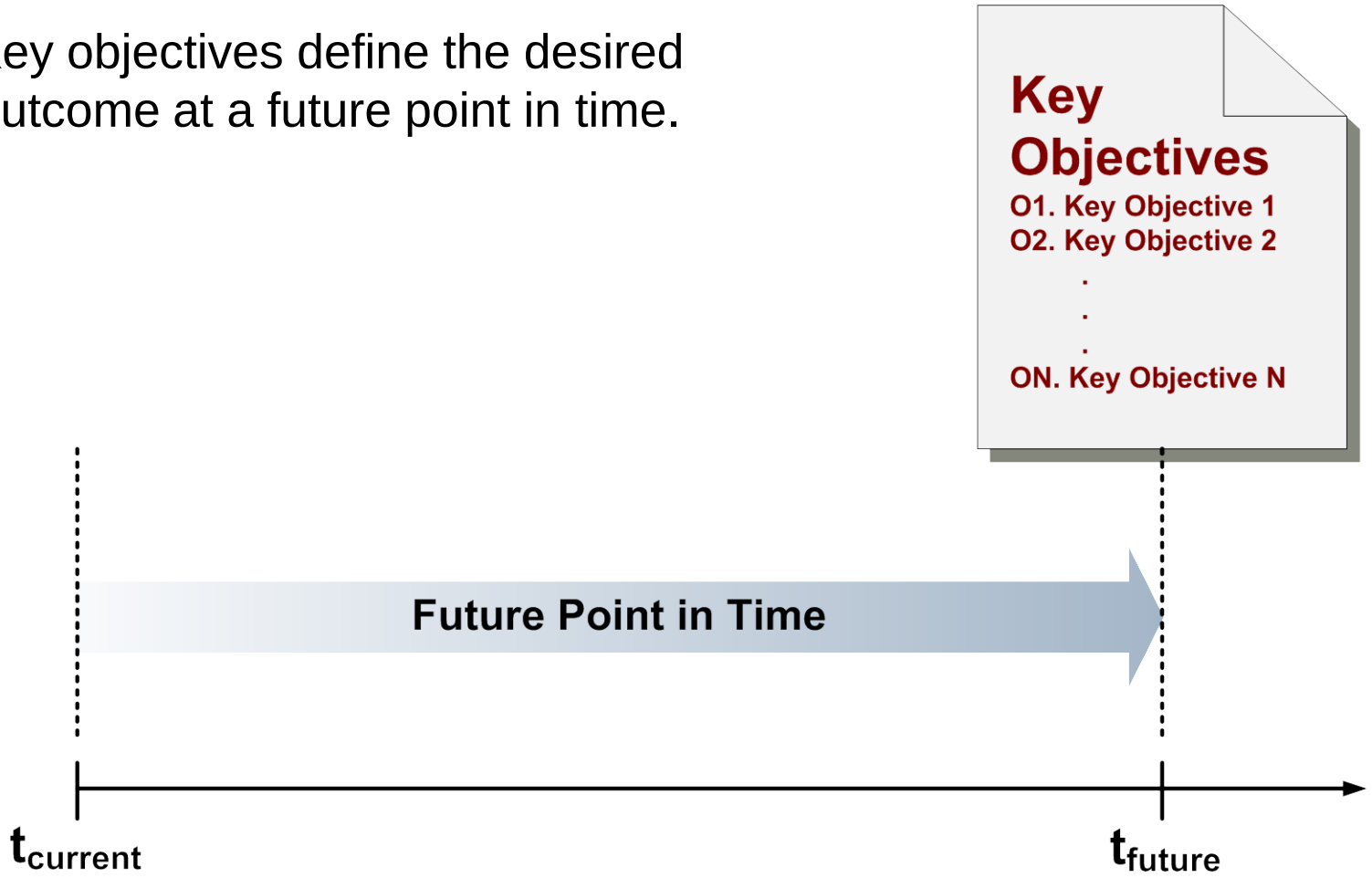
Establish key objectives

Identify set of drivers to use

- Deriving a set of drivers
- Tailoring a set of drivers

Establishing Key Objectives

Key objectives define the desired outcome at a future point in time.



Types of Key Program Objectives

Product Objectives

- Define the nature of the products produced (or services provided)
- For software-intensive systems, the product (i.e., technical) objectives minimally define

Cost Objectives

- Define the budget allocated to developing a product (or providing a service)

Schedule Objectives

- Define the time period allocate to developing a product (or providing a service)

Other Objectives

- Define additional goals of a program, e.g., business, financial, or compliance

Identifying Drivers: *Deriving Drivers*

To establish a set of drivers for specific objectives, talk to people with ***experience*** and ***expertise*** relevant to those objectives.

Ask the experts the following types of questions:

- What circumstances, conditions, and events will drive your program toward a *successful* outcome?
- What circumstances, conditions, and events will driver your program toward a *failed* outcome?

Organize the information they provided (i.e., circumstances, conditions, and events) into approximately 10-20 groups that share a central idea or theme.

- The driver is the central idea or theme of each group.
- Make sure to include at least one driver for each of the six driver categories

Identifying Drivers: *Tailoring - 1*

Select a predefined set of drivers consistent with the program's key objectives to use as the basis for tailoring.

Meet with management and staff from the program to

- Learn about what the program is trying to accomplish
- Gain an appreciation for its unique context and characteristics

Identifying Drivers: *Tailoring - 2*

Based on the program's key objectives and the data that you have gathered

- Determine which drivers do not apply to the program; eliminate extraneous drivers from the set.
- Establish whether any drivers are missing from the list; add those drivers to the set.
- Decide if multiple drivers from the set should be combined into a single, high-level driver; replace those drivers with a single driver that combines them.
- Decide if any drivers should be decomposed into multiple, more detailed drivers; recompose each of those drivers into multiple drivers.

Adjust the wording of each driver attribute to be consistent with the program's terminology and language.

Questions: *Tailoring Drivers*

For the starter set of drivers, consider the following questions:

- Which drivers would you decompose? Why?
- Which drivers would you consolidate? Why?
- For which drivers would you change the wording? Why?

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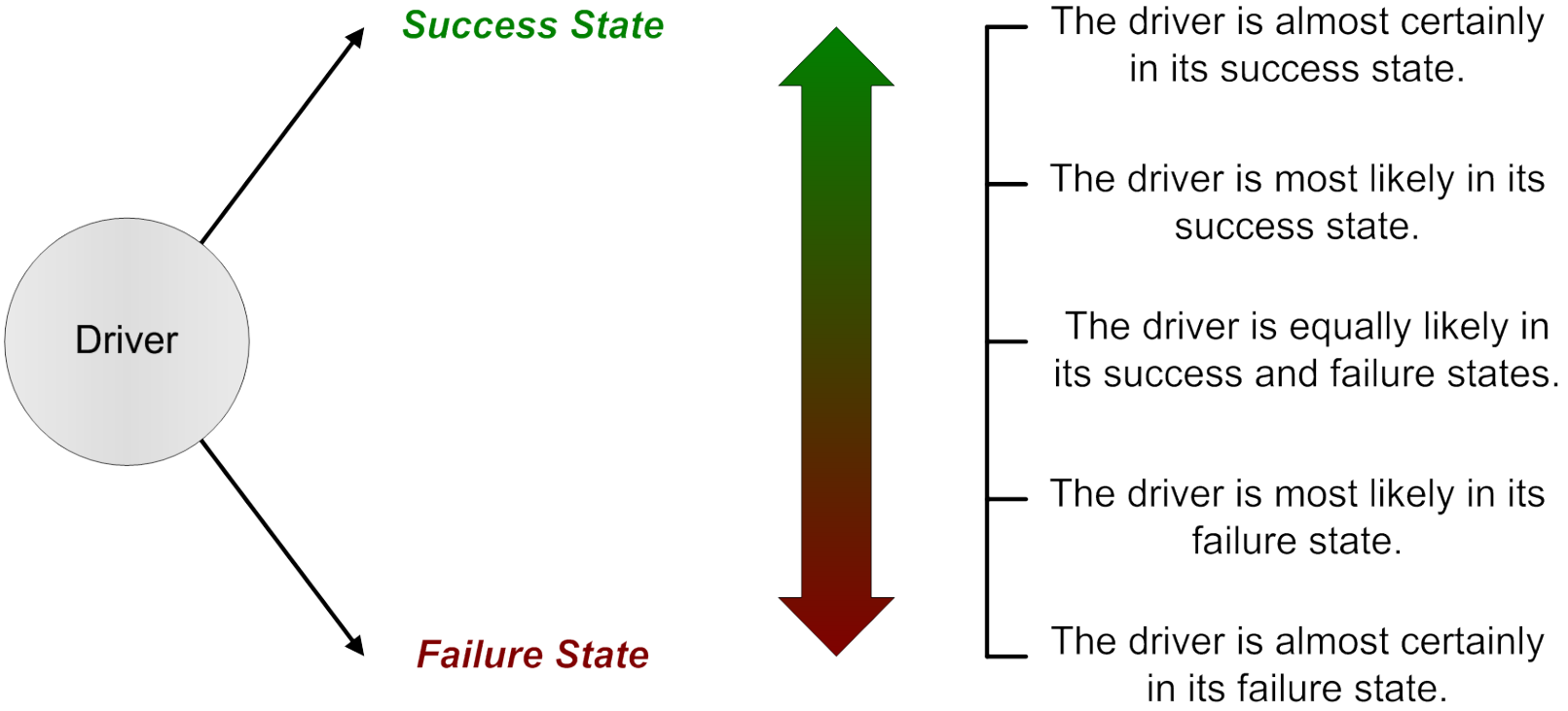
The Mission Diagnostic

ANALYZING DRIVERS

Analyzing Driver State



The objective when analyzing a driver's state is to determine how each driver is currently acting.

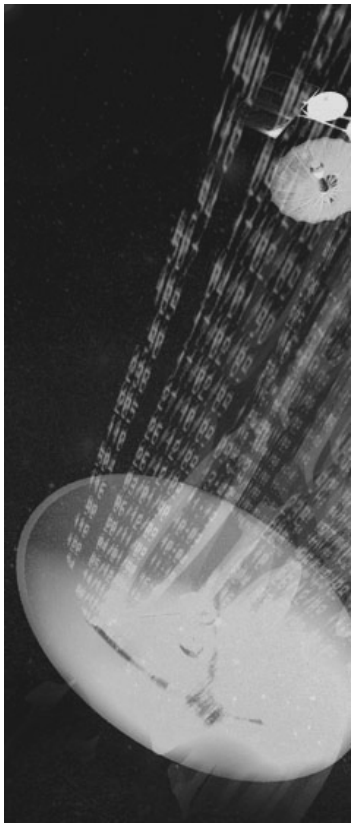
Collect Information

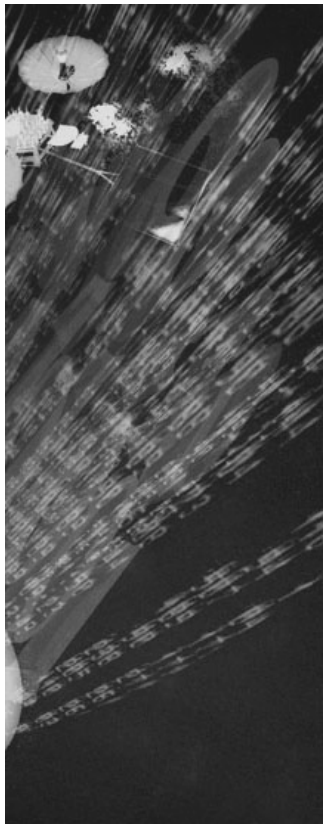
To analyze a driver, you need information from

- Program personnel, all levels and groups
- Program documentation
- Other sources

Gather information from

- Interviews
- Documentation reviews
- Group meetings to reach consensus on drivers





Data Collection: *Obtaining Status Information*

When analyzing drivers, you need information about the program's current status.

- Positive conditions (i.e., what is working well)
- Potential events that could improve program performance
- Negative conditions (i.e., what is *not* working well)
- Negative events that could degrade program performance

Sometimes separate tasks are required to get sufficient information about a program's current status.

- External team with little knowledge of the program
- Internal, independent team with minimal knowledge of program
- Program team with need to supplement their knowledge

Data Collection: *Techniques for Obtaining Status Information*

Two main techniques are used to obtain status information.

- Gather data from people
- Generate data from documentation

There is usually some connection and iteration between these two activities.

- The organization chart and overall program information is used to explain the nature of the program and identify good candidates for interviews
- Documentation reviews can identify additional groups of people to interview
- Interviews can identify additional documents to collect

Another technique, *observe task execution*, is used in some cases to acquire information about actual performance of specific, key tasks or activities.

Data Collection: *Candidate People*

Status information can be gathered from people who perform program activities, such as

- Managers
- Programmers
- Customers
- Contractors and partner organizations
- Staff responsible for the infrastructure
- Staff responsible for training
- Other relevant groups (e.g., human resources, legal, contracting)

Data Collection: *Techniques for Gathering Data from People*

Technique	Description	Use When
Workshops	Facilitated session with groups of people who work together	Need a less structured format to encourage more free form discussion or to encourage discussion of previously unidentified topics.
Interviews	Facilitated session where participants answer a series of specific questions asked by one or more interviewers	Have structured set of questions and a finite amount of time. Need formal structure to control the process of getting data.
Surveys	Electronic or paper-based surveys are distributed and collected, with or without any follow-on discussion	Need to quickly gather data from large number of people. Surveys are very clear and not subject to misinterpretation.

Data Collection: *Generating Data From Documentation*

A comprehensive review of documents can be used to obtain information about a program's current status to supplement or verify the information gathered from people.

The nature of the documentation reviewed depends upon the

- Specific program being assessed
- Objectives of the program
- Scope of the assessment

Normally, a small team of experienced people reviews documents and records relevant status information.

Example: *Program Documents*

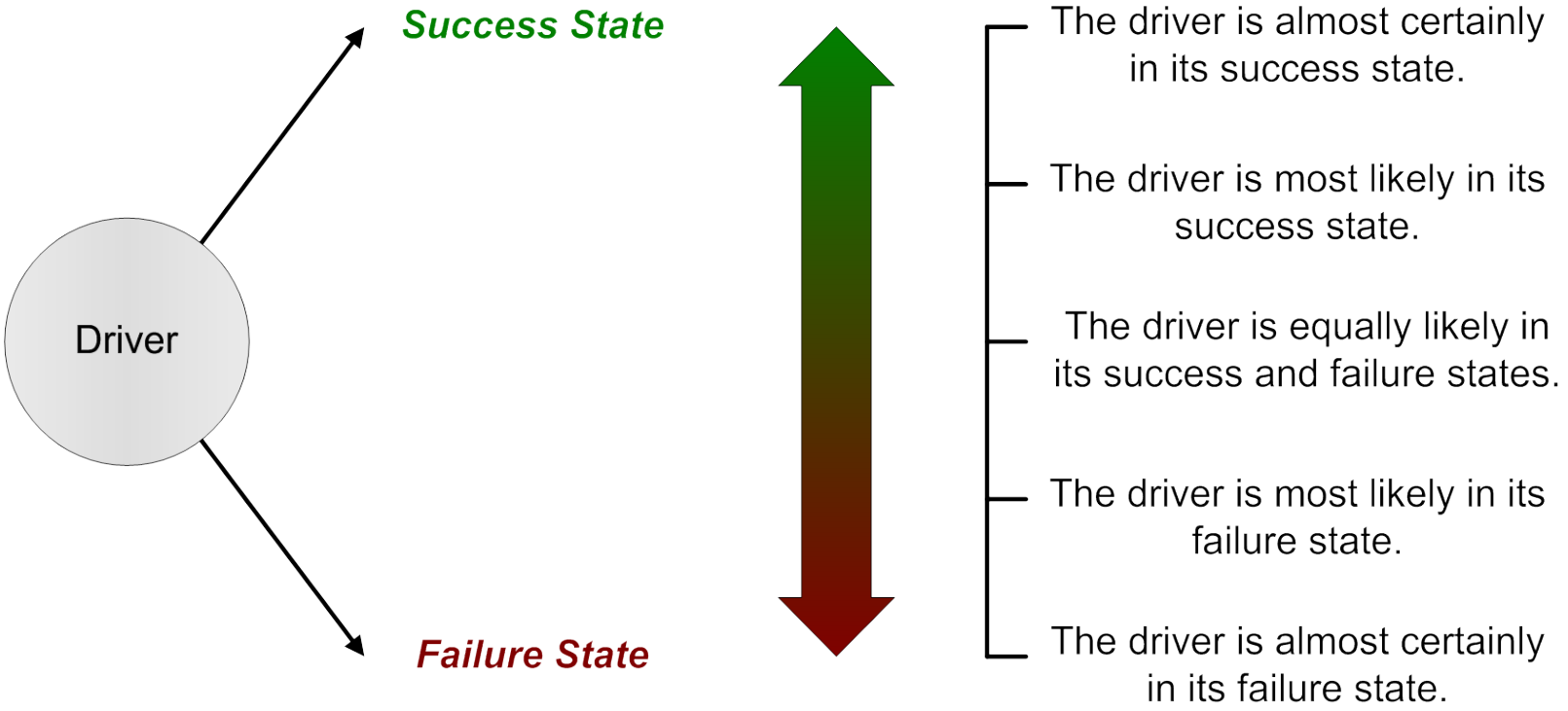
Document Type	Document Type
Plans, such as program plan, deployment plan, integration plan, testing plan, contingency plan • Tasks • Budget • Schedule • Roles and responsibilities	Requirements specifications for • Software and system • Interfaces to other applications, infrastructure, databases • Supporting infrastructure and technologies
Design and architecture documentation	User guides
Training materials for users, operators, maintainers, installers, etc.	Procedures for installation, maintenance, use, etc.

Data Collection: *Techniques for Generating Data from Documentation*

Technique	Description	Strategies
Document Identification	Gather written information, such as policies, procedures, reports, and work products	Ask for all documentation Ask for a focused list of documents
Document Analysis	Analyze the gathered information to transform raw, unfiltered information into data that are usable during the assessment	Have a set of questions or focal points to guide analysis Use expertise and experience to find relevant data*

* In practice, both of these techniques are generally used together.

Use Data to Analyze Driver State



Example: *Driver Question*

Directions: Select the appropriate response to the driver question.

Driver Question	Response
3. Is the process being used to develop and deploy the system sufficient? *Consider:* Process design; measurements and controls; process efficiency and effectiveness; acquisition and development life cycles; training	❑ Yes ❑ Likely Yes ❑ Equally Likely ❑ Likely No ❑ No ❑ Don't Know ❑ Not Evaluated

These driver questions are phrased from the success perspective.

Probability is incorporated into the range of answers for each driver.

Example: *Driver Value Criteria*

Each driver is evaluated against predefined criteria.

Response	Description
Yes	The answer is almost certainly “yes.” Almost no uncertainty exists. There is little or no probability that the answer could be “no.” (~ > 95% probability of yes)
Likely yes	The answer is most likely “yes.” There is some chance that the answer could be “no.” (~ 75% probability of yes)
Equally Likely	The answer is just as likely to be “yes” or “no.” (~ 50% probability of yes)
Likely no	The answer is most likely “no.” There is some chance that the answer could be “yes.” (~ 25% probability of yes)
No	The answer is almost certainly “no.” Almost no uncertainty exists. There is little or no probability that the answer could be “yes.” (~ < 5% probability of yes)
Don’t know	More information is needed to answer the question.
Not Evaluated	The driver question is not relevant at this point in time. It was not evaluated.

Example: *Evaluating Drivers*

Directions: Select the appropriate response to the driver question.

Driver Question	Response
3. Is the process being used to develop and deploy the system sufficient? *Consider:* Process design; measurements and controls; process efficiency and effectiveness; acquisition and development life cycles; training	❑ Yes ❑ Likely Yes ❑ Equally Likely ☒ Likely No ❑ No ❑ Don't Know ❑ Not Evaluated

Each driver is evaluated using information about the program's current status.

Documenting Rationale for Driver State

You must document the reasons underlying the analysis of each driver.

- Conditions that support an answer of ***yes***
- Conditions that support an answer of ***no***
- Potential events that support an answer of ***yes***
- Potential events that support an answer of ***no***
- Gaps in information that is available for driver analysis
- Any assumptions that have been made

Example: *Rationale for Driver Value - 1*

Driver Question	Driver Value
3. Is the process being used to develop and deploy the system sufficient?	Likely no

Rationale

Previous programs have a 90% history of delivering on-time. (+)

The process for integration testing is likely inadequate. Historically, integration testing has used “verbal” agreements between a few managers who already know each other. With this system, there are managers and team leads who have never worked together and there are other barriers in place that make “verbal” agreements tenuous. (-)

Example: *Rationale for Driver Value - 2*

Rationale (cont.)

There are a lot of brand new programmers (45%). (-)

This program required a significant change in our standard processes. There was no new training created for the new processes. (-)

QA did not have a chance to review the new and revised processes before they were put into practice. (-)

The person who developed the new processes quit last week. (-)

Option: Driver Weights

Beyond the basic driver analysis, you can also consider how important the driver is to meeting program objectives

- *Critical*
- *High*
- *Medium*
- *Low*
- *Minimal*

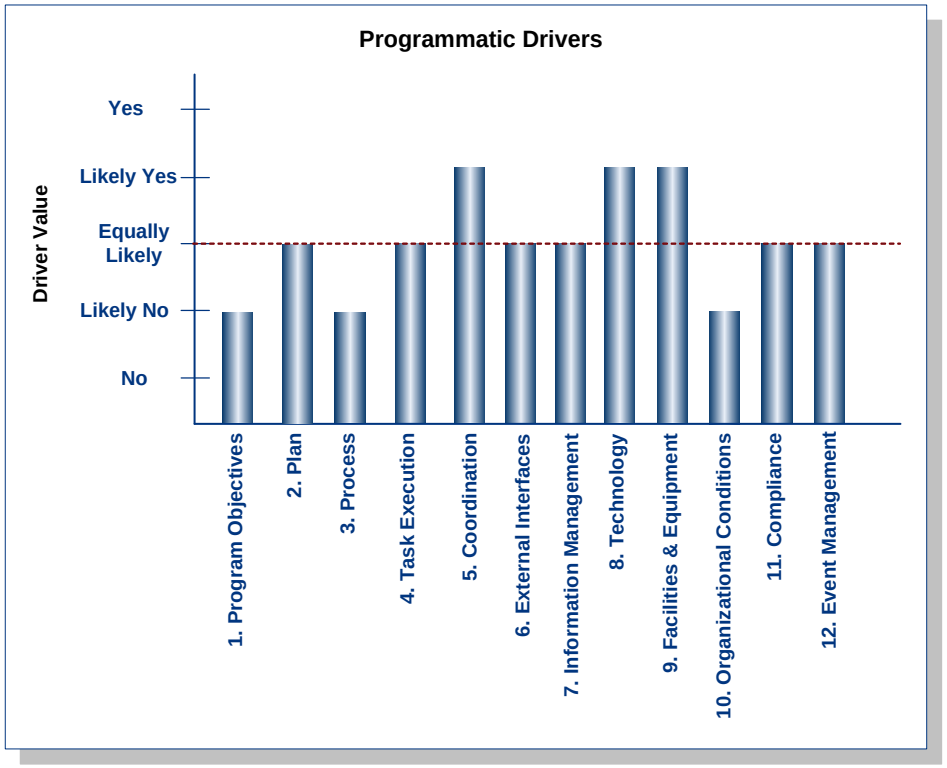
Drivers are considered to be essential to the success of the mission, therefore the starting point is that all drivers are weighted as *Critical*

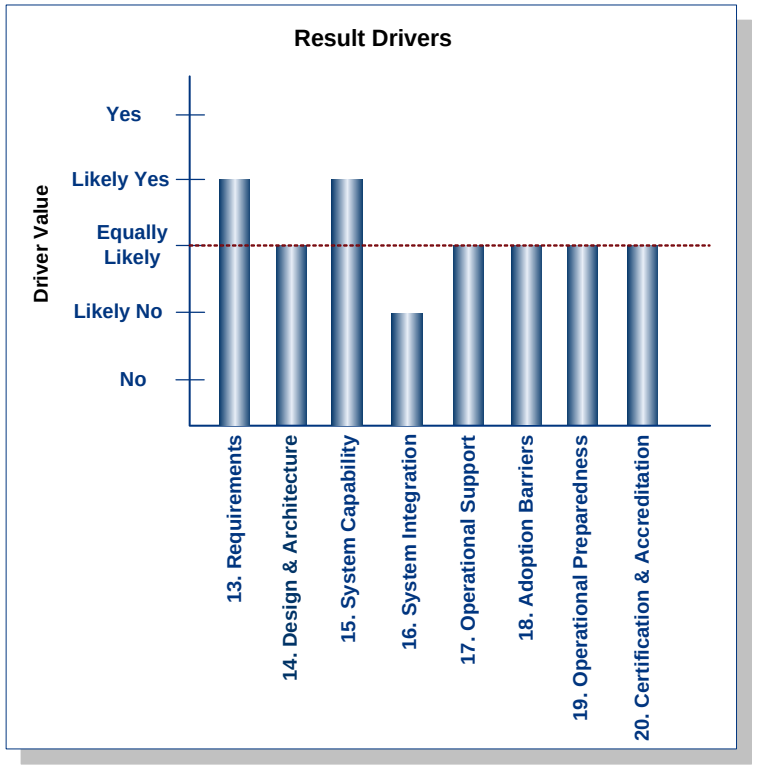
Drivers may increase or decrease their importance or weight depending on where you are in the program life cycle

The Mission Diagnostic

DRIVER PROFILE

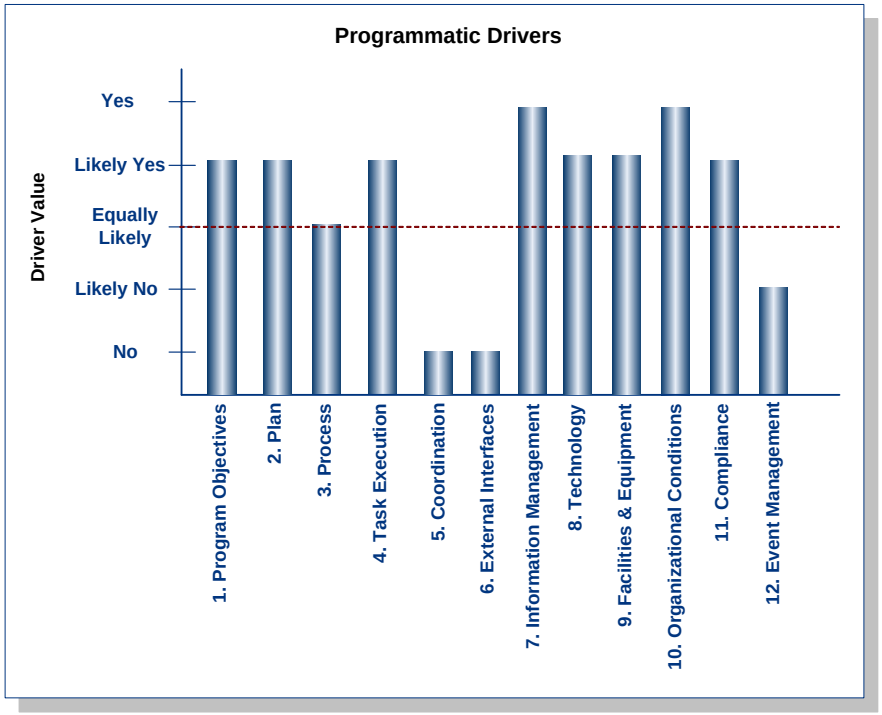
Example: *Driver Profile - 1*

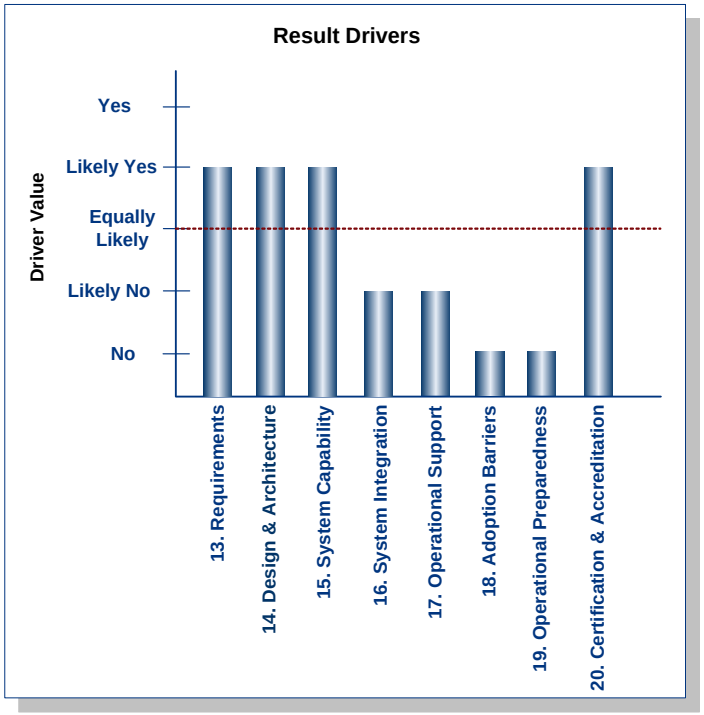




While this simple profile at first glance appears to show roughly equivalent momentum towards success and failure, notice which drivers are failure drivers.

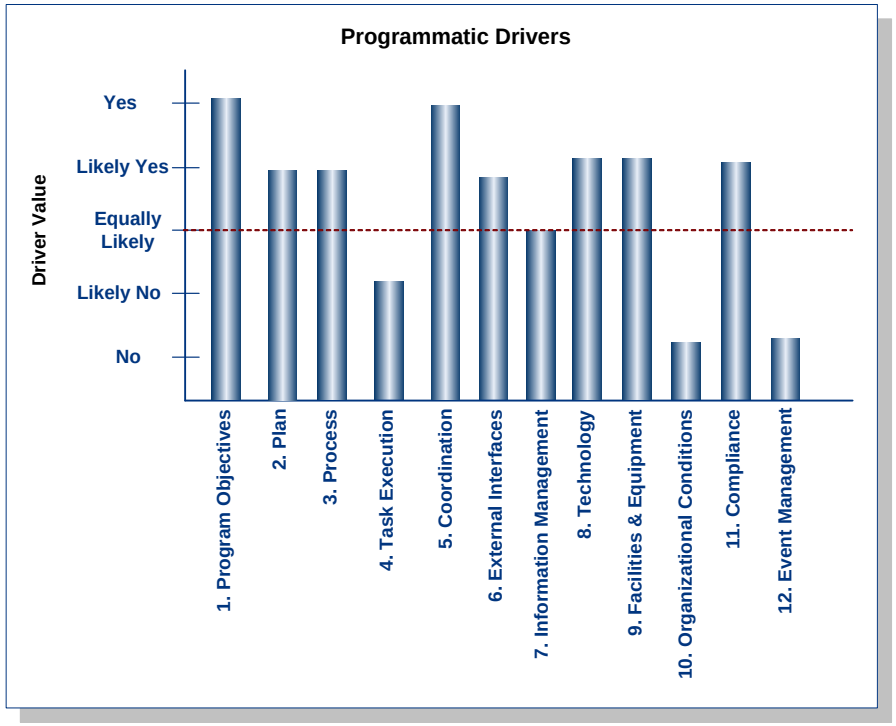
Example: *Driver Profile - 2*

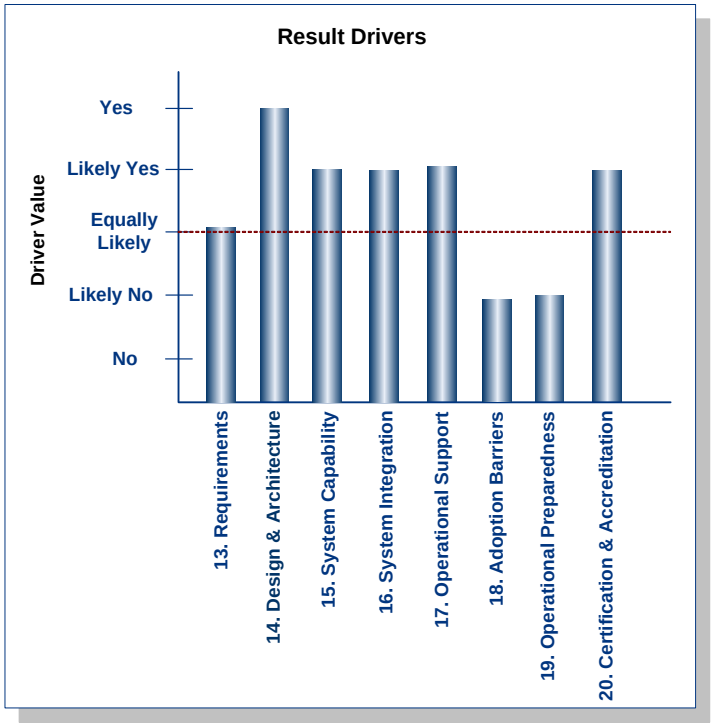




Here, it looks like the program has severe issues in coordinating and working with all external groups. This is leading to issues with integration and preparing the end users and operators to accept and use the system.

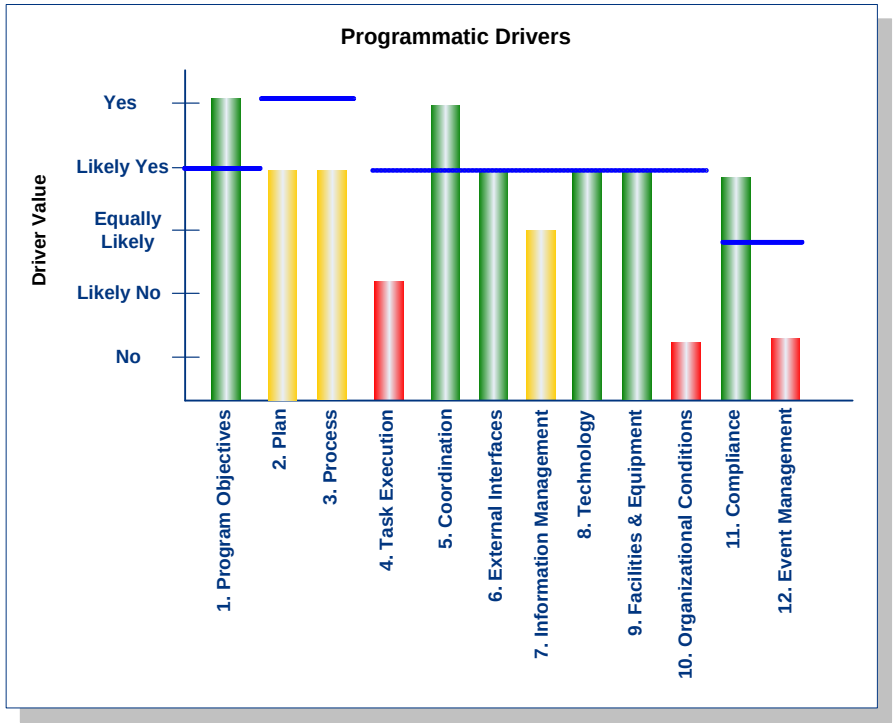
Example: *Driver Profile - 3*

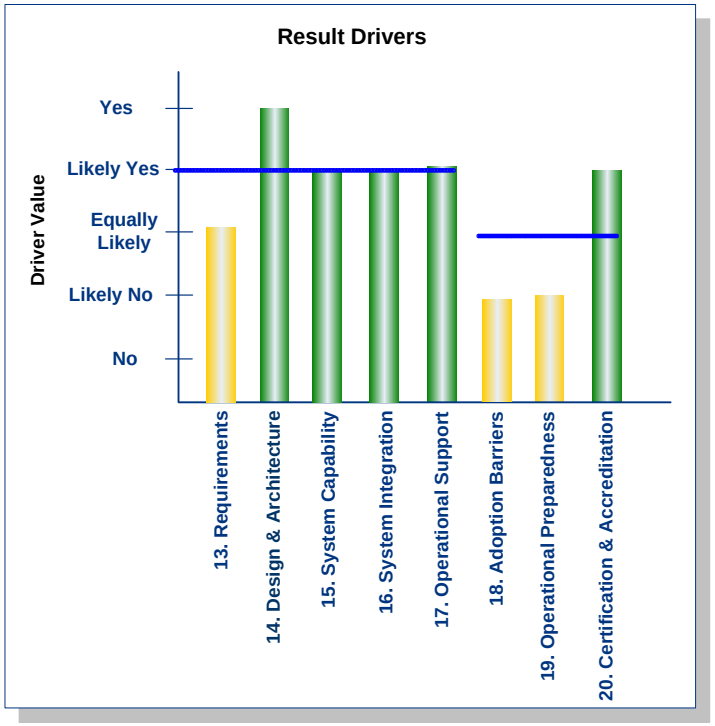




Most of this program is going well. Trouble spots are with excessive sponsor interference in 10, which has caused a lot of rework, affecting task execution and decreased the reserves (12). This particular sponsor is the user, thus the low confidence in being able to prepare users and system maintainers.

Example: *Driver Profile - 4*





This profile also shows the relationship of current value to desired value, depicted by the blue lines. Management now needs to consider whether or not their expectations also need to be adjusted as improvements are planned.

Potential for Success

The potential for success is the likelihood that key objectives will be achieved

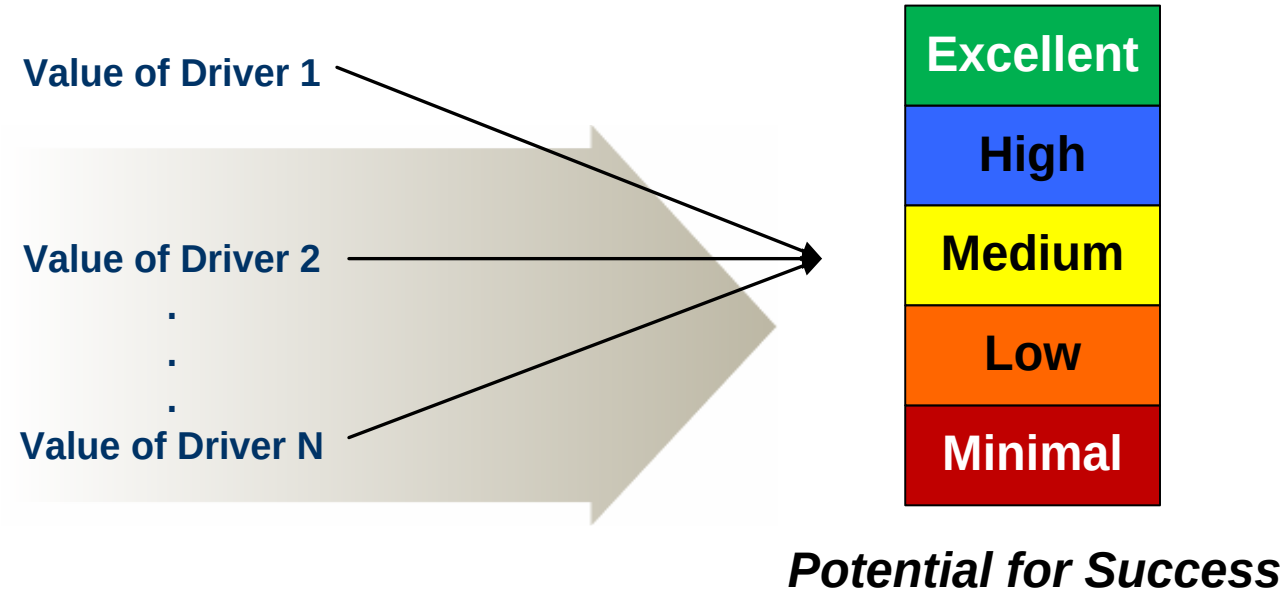
An additional analysis of the drivers is used to establish the current potential for success

- Simple aggregation of driver values
- Weighted aggregation of driver values (using driver weights)
- Mean or median driver value
- Rule-based algorithms

Example: *Success Criteria*

Measure	Description
Excellent	Current conditions are extremely favorable for a successful outcome. (~ > 95% chance of success)
High	Current conditions are favorable for a successful outcome. (~ 75% chance of success)
Medium	Current conditions are mixed, making success and failure equally likely. (~ 50% chance of success)
Low	Current conditions are not favorable for a successful outcome. (~ 25% chance of success)
Minimal	Current conditions are extremely unfavorable for a successful outcome. (~ < 5% chance of success)

Example: *Potential for Success*



An analysis of drivers is used to determine the *current potential for success* for meeting key objectives

Example: *Potential for Success*

Objectives: By the end of the initial deployment phase (6 months), the payroll application will fully support operations at the initial deployment site.

Current Potential for Success

Current likelihood of achieving these objectives is ***Low***

Rationale

- Several drivers with *Critical* weight had values of *Likely No*
- System functionality was cut to meet the deployment schedule at the initial deployment site.
- The contractor developing the payroll application has not been meeting its milestones.
- The integration task is more complicated than usual.
- ……

Mission Diagnostic: *Next Steps*

Determine what areas need

- Further investigation
- Improvement

If further investigation is needed

- Gather additional information to clarify uncertainties
- Continue decomposing drivers to get at deeper issues
- Chose alternate methods to analyze the situation

If improvement is needed

- Determine causes of weaknesses
- Develop and implement improvement plans
- Re-evaluate

The Mission Diagnostic

YOUR PROGRAM

Exercise Three: *Evaluate Your Program*

Refer to Tutorial Workbook, Exercise #3

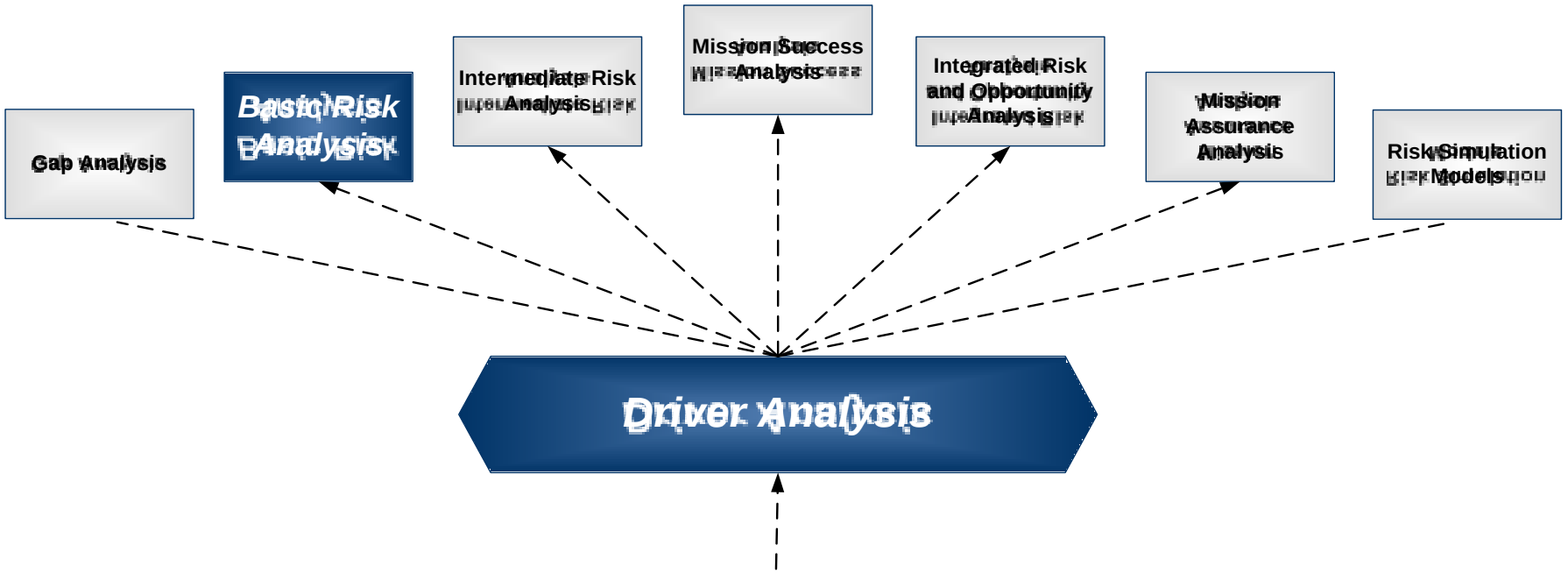
1. Select a program, project, or process with which you are knowledgeable.
2. Evaluate it using the set of drivers provided in the Workbook.
3. Sketch your risk profile.

Consider:

- *Are there some drivers for which you need more information?*
- *Where would you get that information?*

THE RISK DIAGNOSTIC

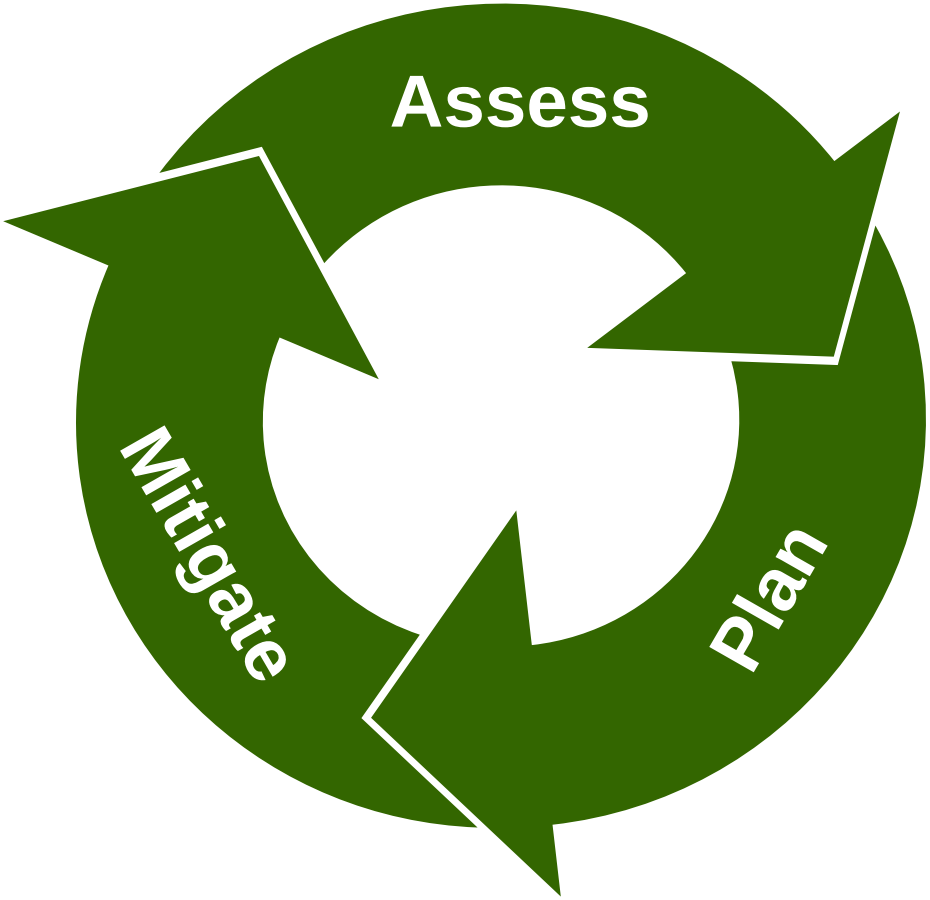
Risk Diagnostic



Risk Diagnostic incorporates a basic back-end risk analysis.

Risk Diagnostic is the focus of the this section.

Core Risk Management Activities



What is Mission Risk?

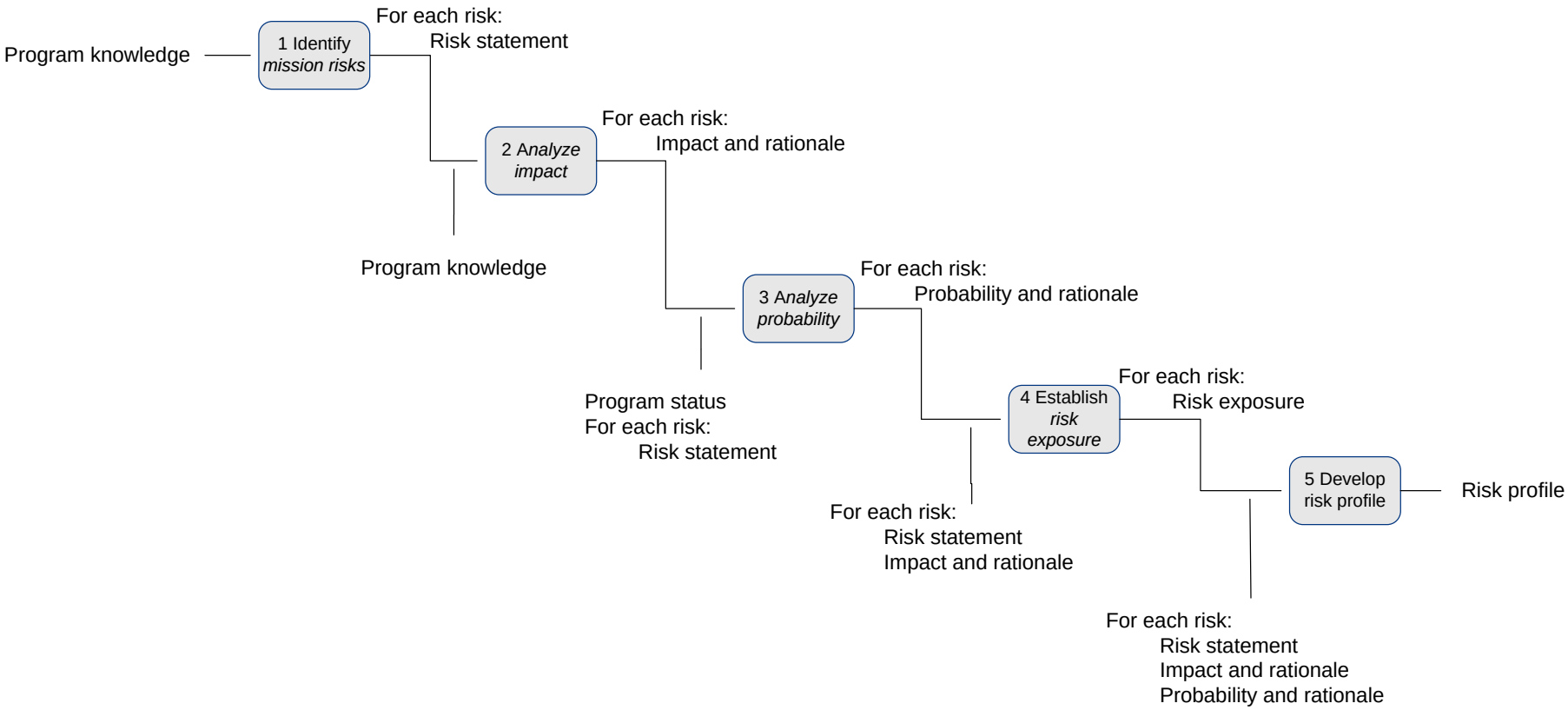
A systemic (i.e., aggregate) risk that affects a program's ability to achieve its key objectives

A measure of potential loss in relation to key objectives

- Probability that a driver is in its failure state
- Impact on objectives if a driver is in its failure state

Each driver produces a mission risk.

Risk Diagnostic Method: *Dataflow Diagram*



From Drivers to Mission Risks

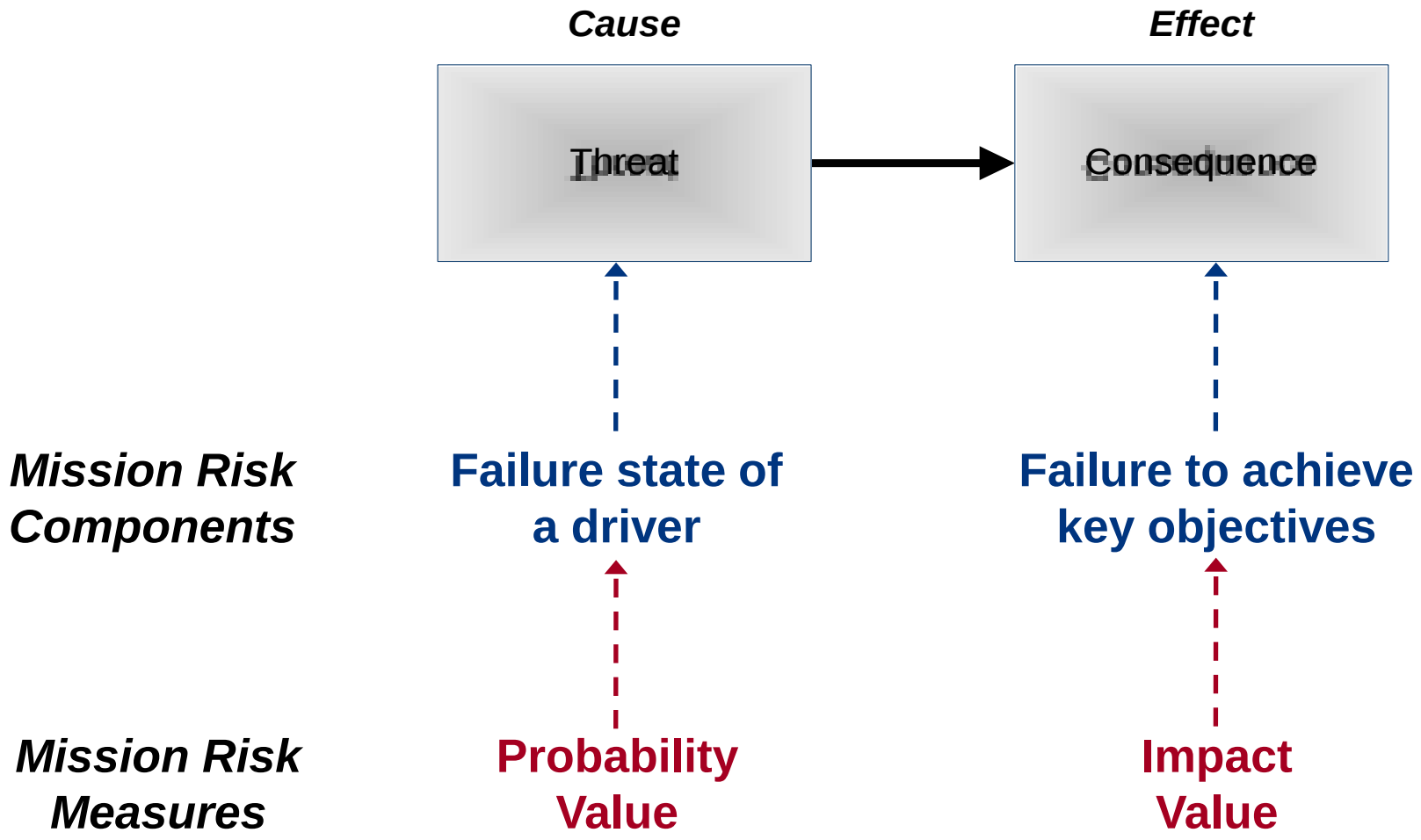
The purpose of a risk statement is to provide a unique, succinct, and meaningful descriptor of a risk using a standard format to facilitate communication.

Mosaic uses a driver's failure state as the risk statement for a mission risk.

The consequences for a mission risk are always ***failure to meet key objectives***.

Driver	Risk Statement
Process	The process being used to develop and deploy the system is insufficient.

Components of Mission Risk



Risk Analysis: *Mission Risk*

Mission Risk	Probability	Impact	Risk Exposure
3. The process being used to develop and deploy the system is insufficient.	High	Severe	High

Determined using results of driver analysis

Determined using standard risk analysis methods

Example: *Probability From Driver Response*

Driver Question	Response	Probability
3. Is the process being used to develop and deploy the system sufficient? *Consider:* Process design; measurements and controls; process efficiency and effectiveness; acquisition and development life cycles; training	❑ Yes ❑ Likely Yes ❑ Equally Likely ☒ Likely No ❑ No ❑ Don't Know ❑ Not Evaluated	❑ Minimal ❑ Low ❑ Medium ☒ High ❑ Maximum ❑ Unknown ❑ Not Evaluated

Example: *Impact from Driver Weight*

Driver	Weight	Impact
3. The process being used to develop and deploy the system	☒ Critical	☒ Severe
	❑ High	❑ High
	❑ Medium	❑ Medium
	❑ Low	❑ Low
	❑ Minimal	❑ Minimal
	❑ Don't Know	❑ Unknown

Drivers and Mission Risk Statements - 1

Driver	Mission Risk Statement
1. Program Objectives	Program objectives (product, cost, schedule) are unrealistic or unachievable.
2. Plan	The plan for developing and deploying the system is insufficient.
3. Process	The process being used to develop and deploy the system is insufficient.
4. Task Execution	Tasks and activities are performed ineffectively and inefficiently.
5. Coordination	Activities within each team and across teams are not coordinated appropriately.
6. External Interfaces	Work products from suppliers, partners, or collaborators will not meet the program's quality and timeliness requirements.
7. Information Management	The program's information is not managed appropriately.

Drivers and Mission Risks - 2

Driver	Mission Risk Statement
8. Technology	The program team does not have the tools and technologies it needs to develop the system and transition it to operations.
9. Facilities and Equipment	Facilities and equipment are insufficient to support the program.
10. Organizational Conditions	Enterprise, organizational, and political conditions are hindering completion of program activities.
11. Compliance	The program does not comply with all relevant policies, laws, and regulations.
12. Event Management	The program has insufficient capacity and capability to identify and manage potential events and changing circumstances.
13. Requirements	System requirements are not well understood.
14. Design and Architecture	The design and architecture are insufficient to meet system requirements and provide the desired operational capability.

Drivers and Mission Risks - 3

Driver	Mission Risk Statement
15. System Capability	The system will not satisfactorily meet its requirements.
16. System Integration	The system will not sufficiently integrate and interoperate with other systems when deployed.
17. Operational Support	The system will not effectively support operations.
18. Adoption Barriers	Barriers to customer/user adoption of the system have not been managed appropriately.
19. Operational Preparedness	People will not be prepared to operate, use, and maintain the system.
20. Certification and Accreditation	The system will not be appropriately certified and accredited for operational use.

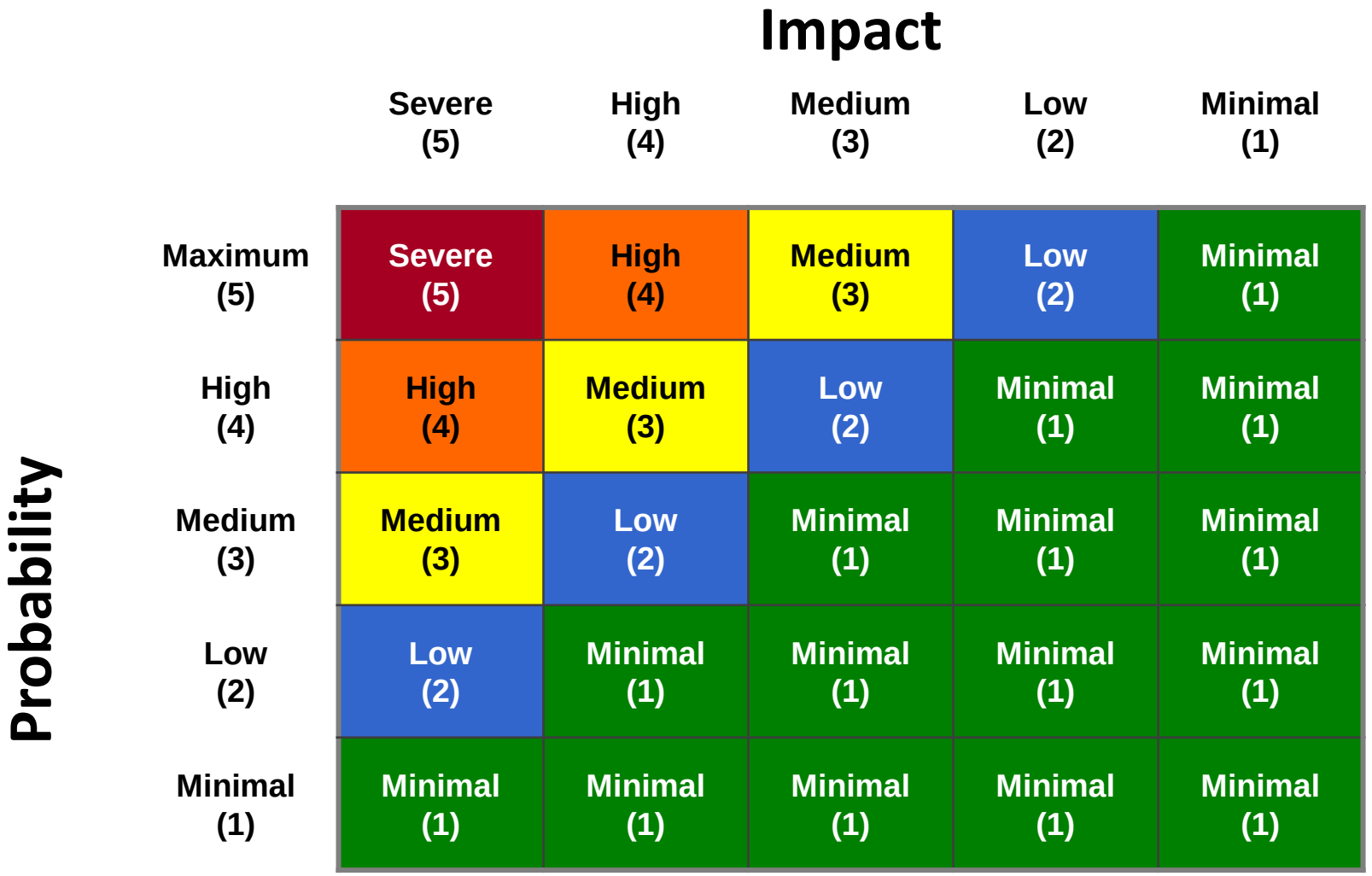
Example: *Probability Criteria for Mission Risks*

Probability	Description
Minimal	The answer is almost certainly "yes." Almost no uncertainty exists. There is little or no probability that the answer could be "no." (~ > 95% probability of yes)
Low	The answer is most likely "yes." There is some chance that the answer could be "no." (~ 75% probability of yes)
Medium	The answer is just as likely to be "yes" or "no." (~ 50% probability of yes)
High	The answer is most likely "no." There is some chance that the answer could be "yes." (~ 25% probability of yes)
Maximum	The answer is almost certainly "no." Almost no uncertainty exists. There is little or no probability that the answer could be "yes." (~ < 5% probability of yes)
Unknown	More information is needed to answer the question.
Not Evaluated	The driver question is not relevant at this point in time. It was not evaluated.

Example: *Impact Criteria for Mission Risks*

Impact	Description
Severe	The driver is vital to the program. It has an extremely strong influence on program success or failure.
High	The driver is very important to the program, but not vital. It has a strong influence on program success or failure.
Medium	The driver is moderately important to the program. It has some influence on program success or failure.
Low	The driver is somewhat important to the program. It has a weak influence on program success or failure.
Minimal	The driver is not important to the program. It has negligible influence on program success or failure.
Unknown	More information is needed to answer the question.

Mission Risk Exposure Criteria

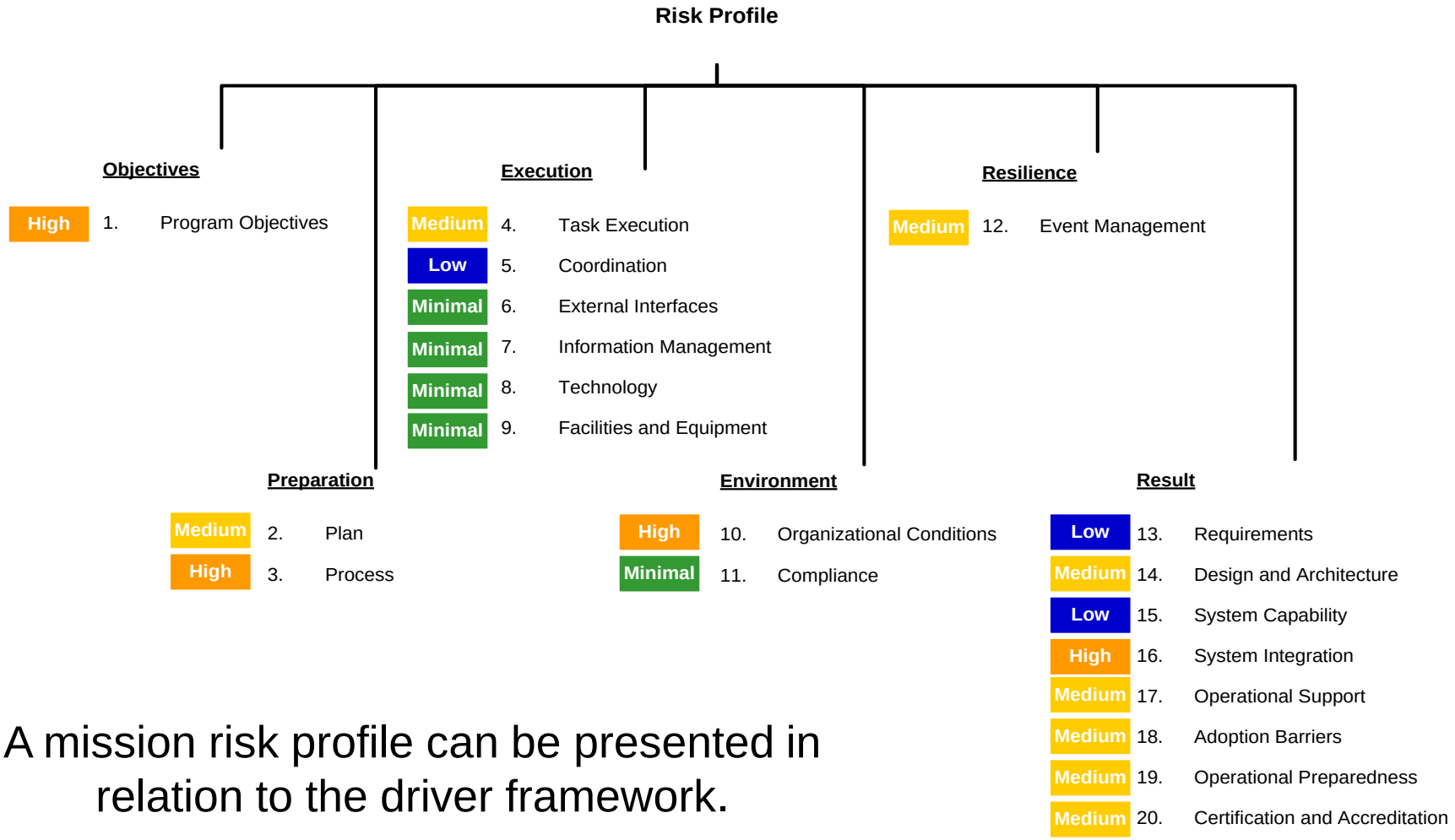


Example: *Mission Risk Profile – List View*

ID	Mission Risk Statement	Prob.	Impact	Risk Exp.
3	The process being used to develop and deploy the system is insufficient.	High (4)	Severe (5)	High (4)
11	The program does not comply with all relevant policies, laws, and regulations.	Medium (3)	Low (2)	Minimal (1)

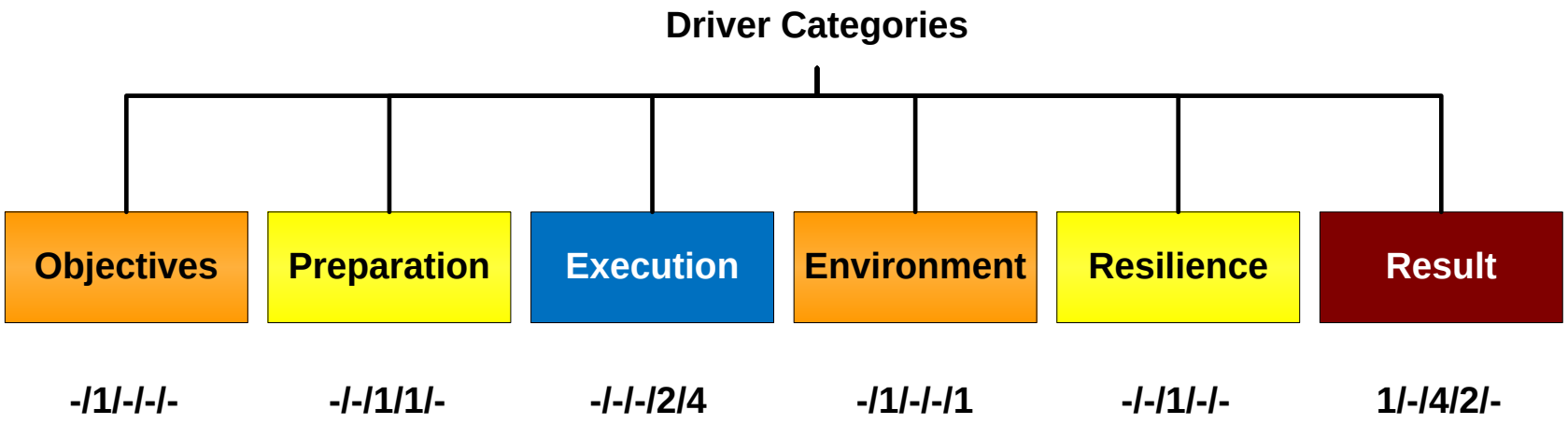
A risk profile can be presented as a list or spreadsheet.

Example: *Mission Risk Profile – Driver Framework View*



A mission risk profile can be presented in relation to the driver framework.

Example: *Mission Risk Profile – Category View*



Each driver category reflects the highest risk exposure for the mission risks associated with that category

Beneath each category is the total number of mission risks at each risk exposure level (severe/high/medium/low/minimal)

Mitigation Approaches for Mission Risks

A mitigation approach defines the strategy for addressing a risk.

Mitigation approaches for mission risks include

- ***Control*** – Actions are implemented in attempt to reduce or contain a risk.
- ***Watch*** – Reassess a risk's probability on a more frequent basis than is provided by scheduled, periodic risk assessments
- ***Defer*** – No mitigation actions will be taken at the present time. The risk will be reassessed during the next scheduled risk assessment.

Mitigation approaches should be shared with all relevant stakeholders as appropriate.

Controlling and watching mission risks require development of mitigation plans

Strategies for Controlling Mission Risks

Maintain strengths
Take action to reinforce positive conditions that are guiding drivers toward their success states.

Resolve weaknesses/issues
Take action to correct weaknesses or issues that are guiding drivers toward their failure states.

Manage tactical opportunities
Take action to leverage tactical opportunities that could guide drivers toward their success states.

Manage tactical risks
Take action to mitigate tactical risks that could guide drivers toward their failure states.

Tracking Decisions

As a mitigation plan is implemented, decisions will be required about what action(s) to take.

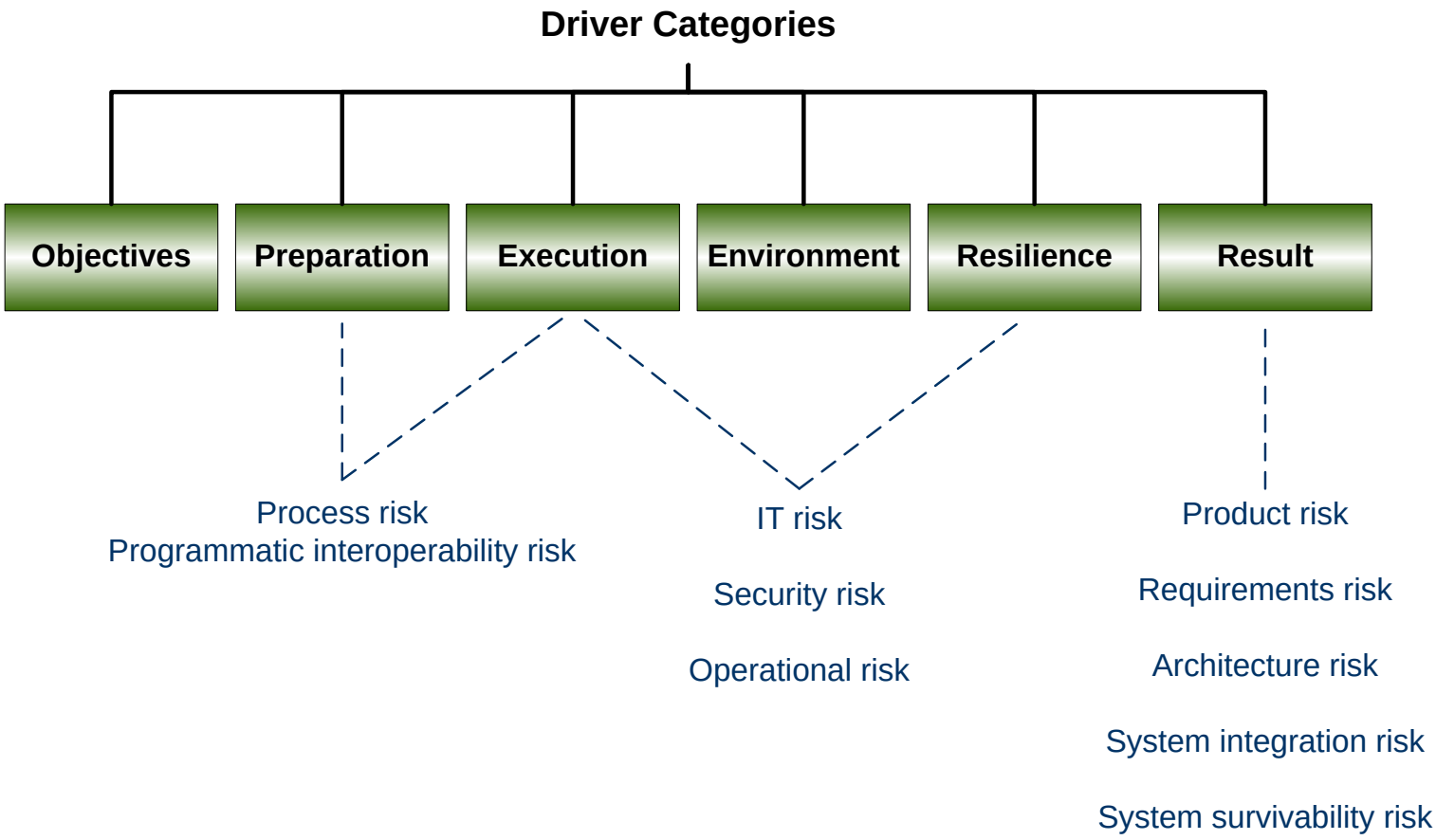
Tracking decisions include

- Continue implementing the mitigation plan as intended
- Modify the mitigation plan
- Implement the contingency plan (if one exists)
- Modify the mitigation approach and take any appropriate actions, for example change the mitigation approach from
  - *Watch* to *Control* if risk exposure exceeds a predefined threshold
  - *Control* to *Watch* or *Defer* if strategies for controlling a mission risk have been achieved

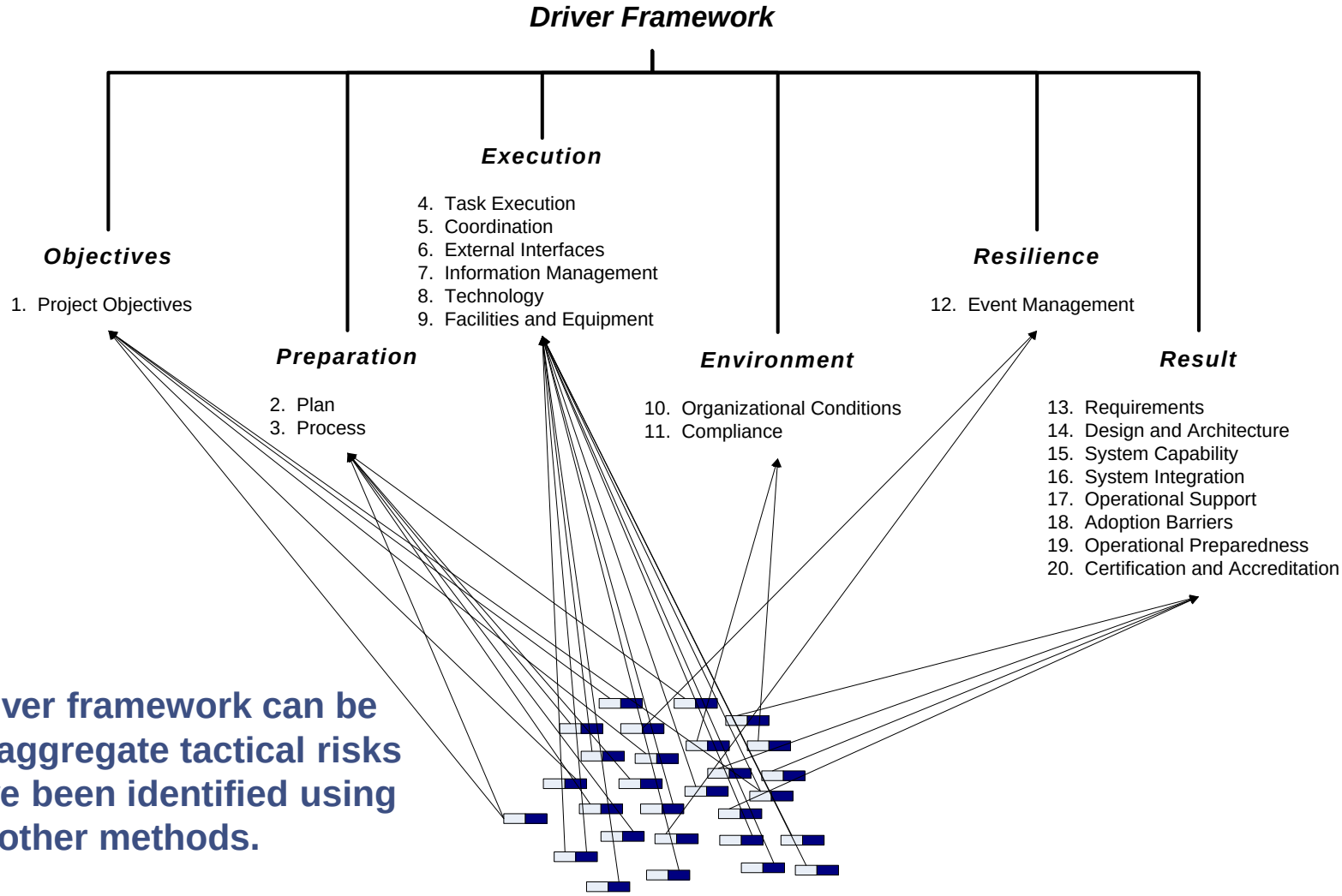
Tracking decisions should be shared with all relevant stakeholders as appropriate.

IMPLEMENTATION OPTIONS

Use Drivers to Integrate Multiple Types of Risk

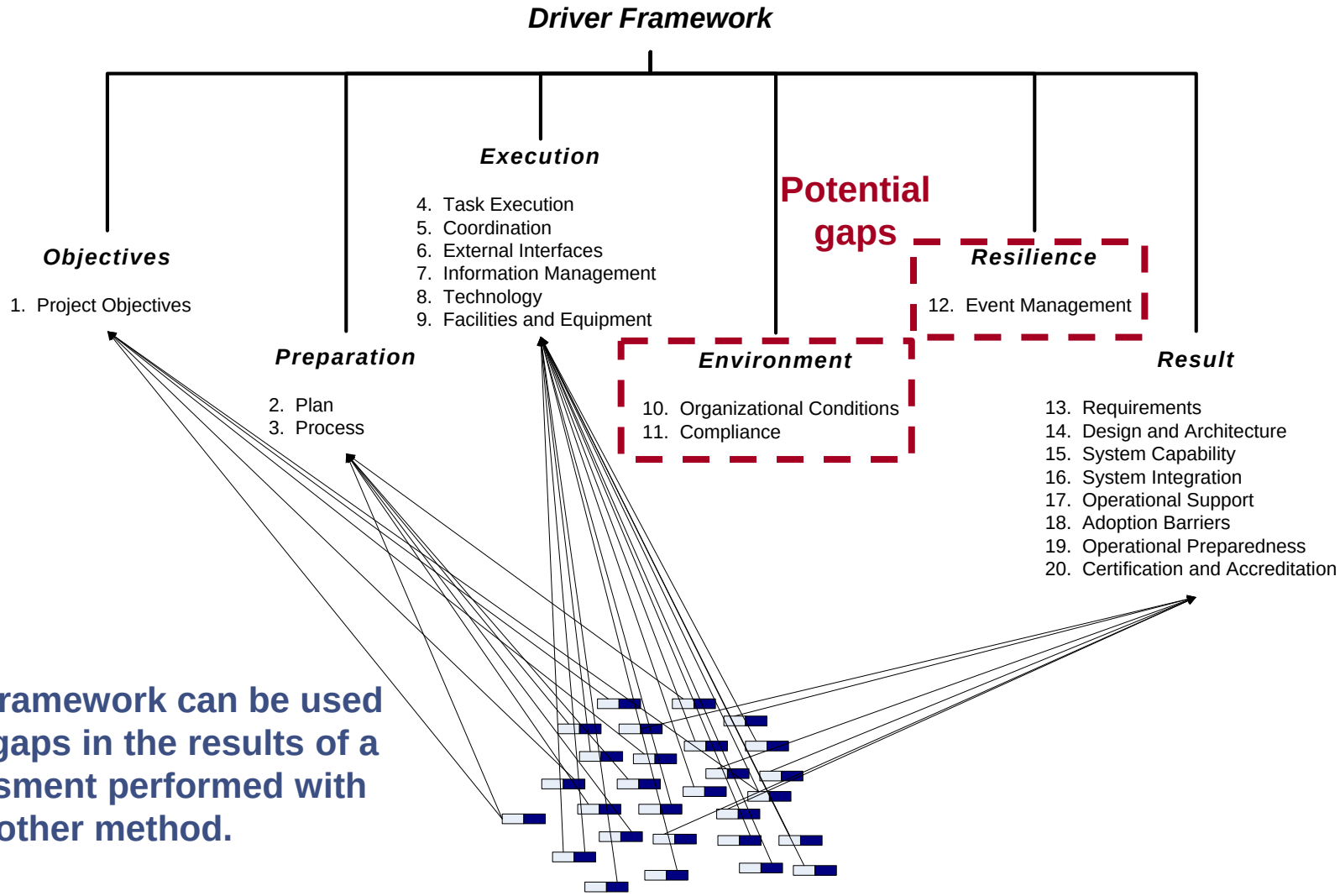


Using the Driver Framework to Aggregate Tactical Risks



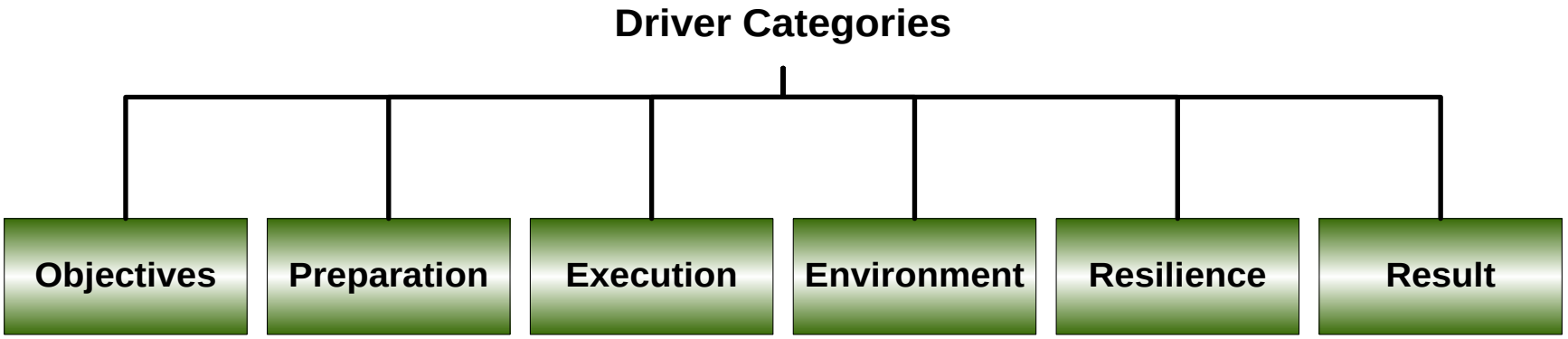
The driver framework can be used to aggregate tactical risks that have been identified using other methods.

Using the Driver Framework to Identify Gaps in Tactical Risk Assessments



The driver framework can be used to identify gaps in the results of a risk assessment performed with another method.

Using Risk Diagnostic as a Broad-Based Assessment



Mosaic provides a broad view of risk to key objectives.

Mosaic can provide context for conducting deep dives into specific areas based on the risk to key objectives.

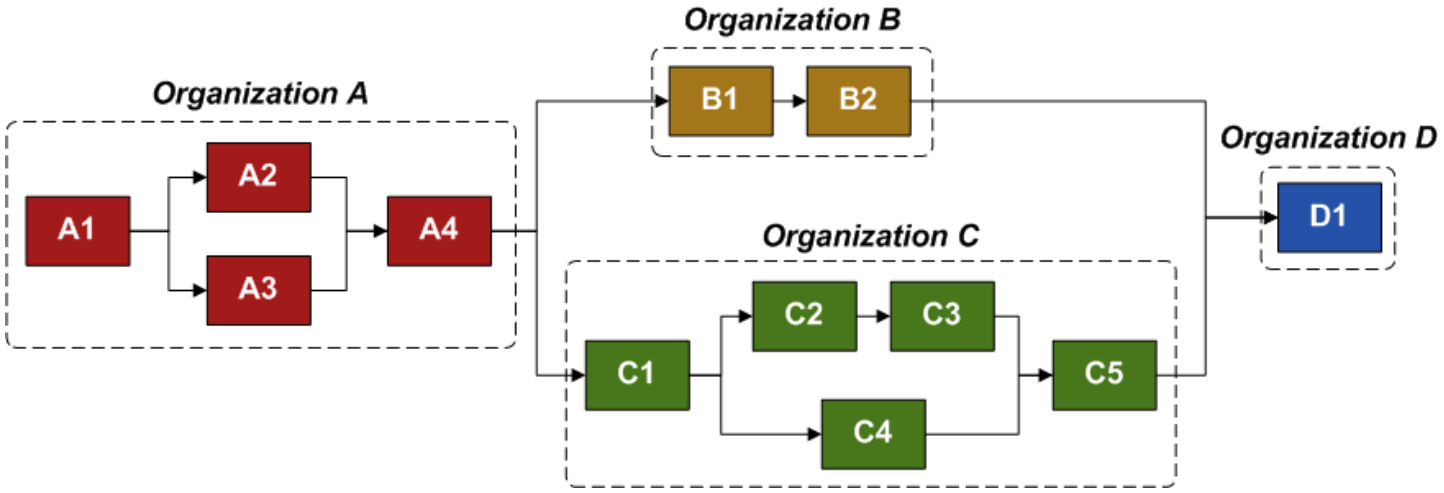
Deep dive 1
(e.g., process assessment)

Deep dive 2
(e.g., architectural analysis)

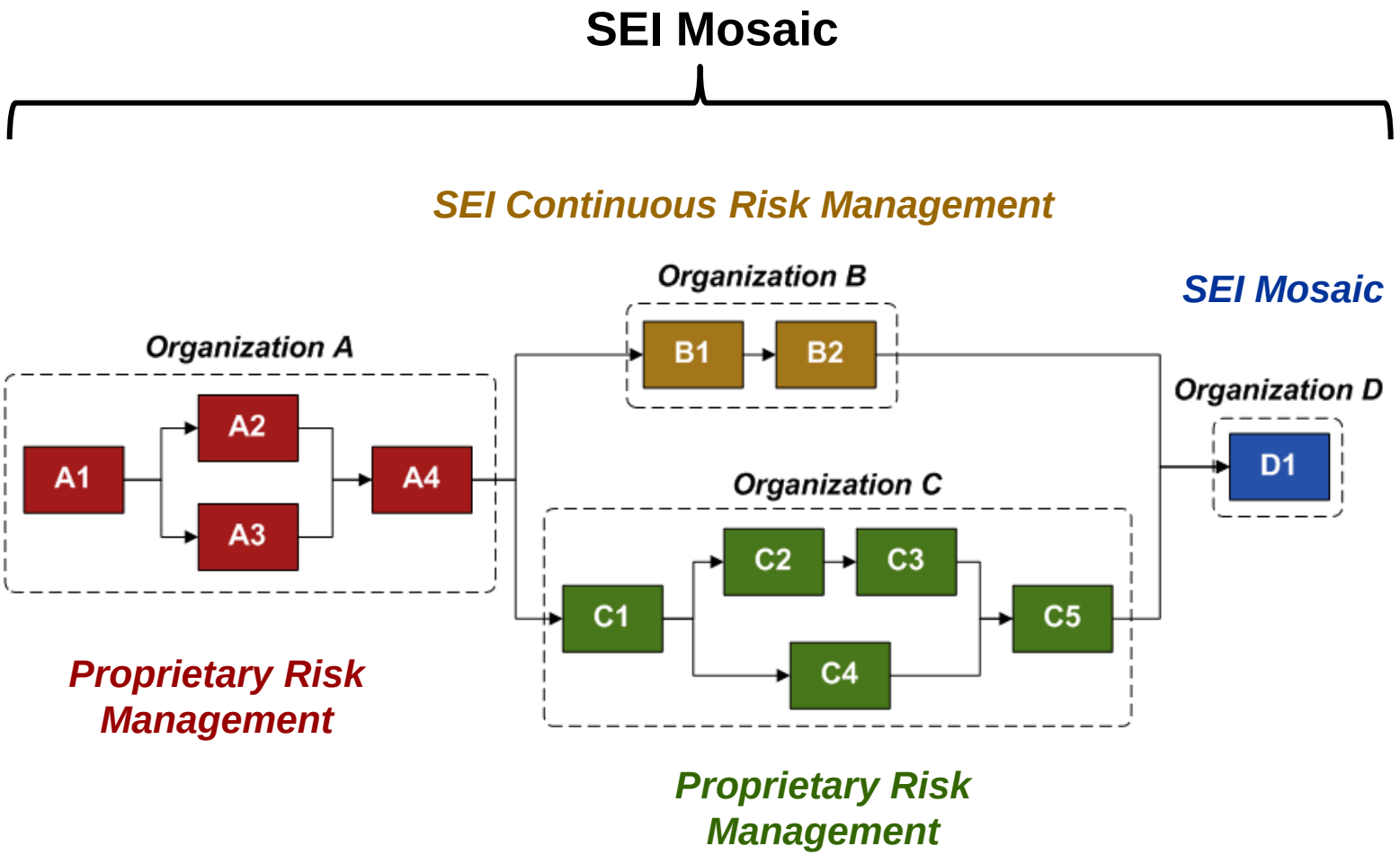
Mosaic in Multi-Enterprise Environments - 1

Distributed programs that cross multiple organizational boundaries require a systemic viewpoint when managing risk.

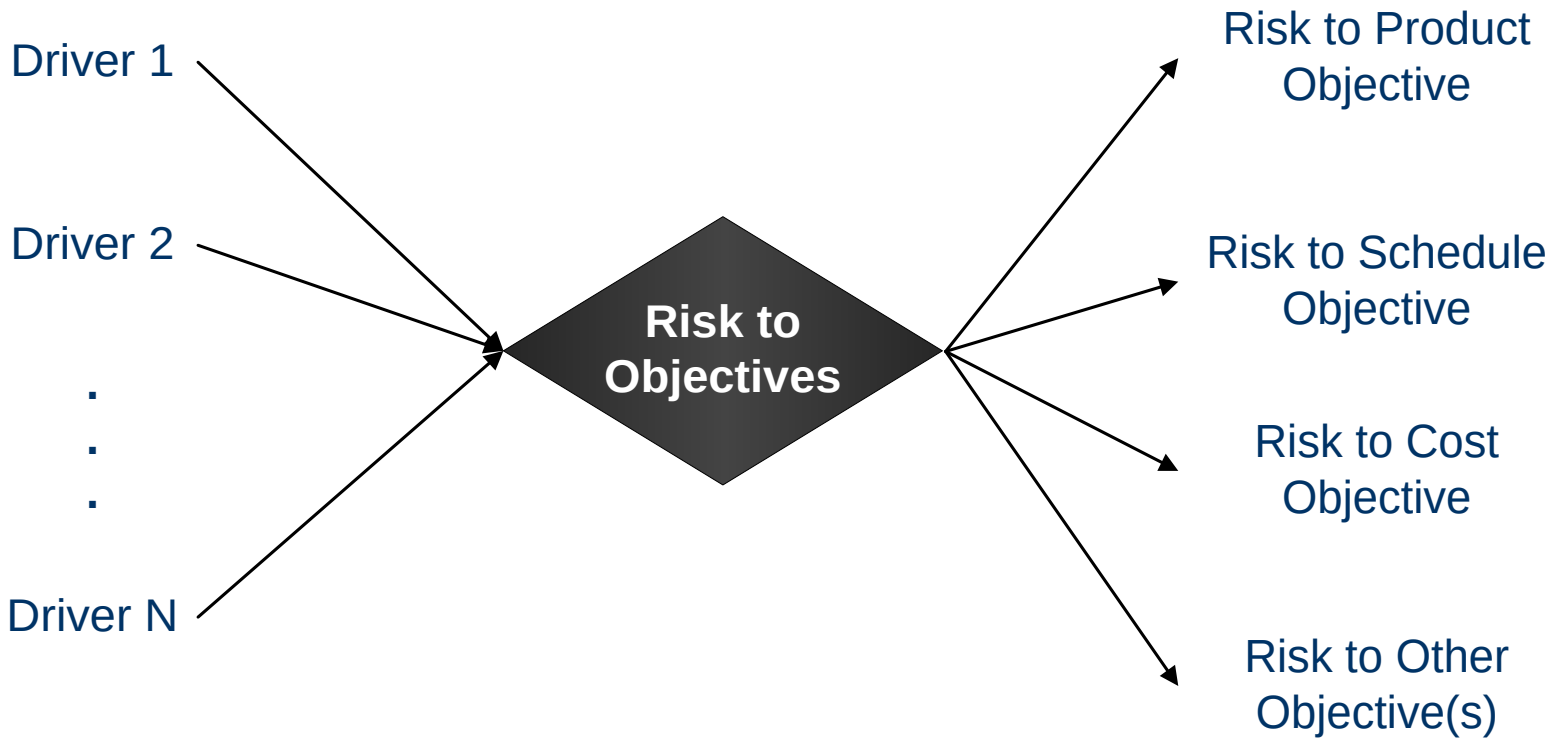
- Acquire and maintain a broad view of the impact to program objectives
- Avoid local optimization of risk that aggravates mission risk
- Keep volume of risk data to a manageable level



Mosaic in Multi-Enterprise Environments - 2



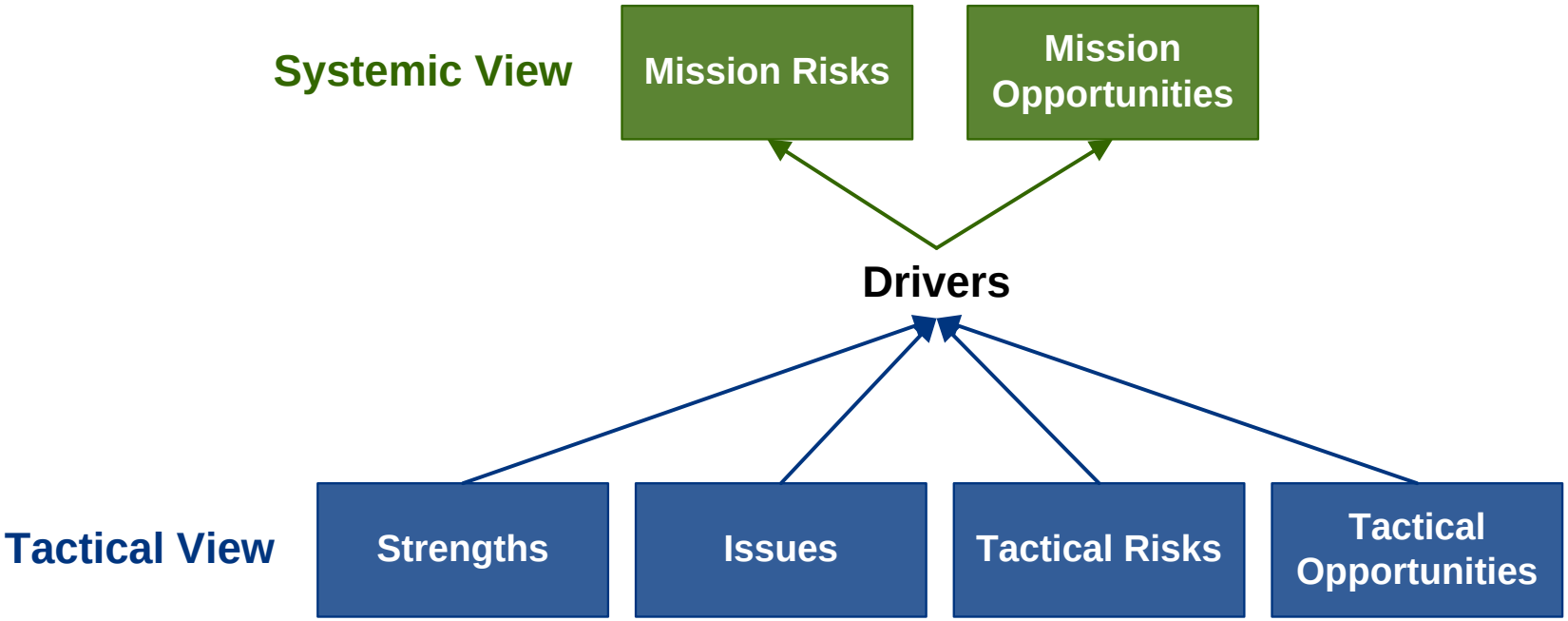
Analyze Risk to Specific Objectives



As presented in this course, basic risk analysis determines risk to objectives.

You can also establish the risk to each individual objective based on the objective's criticality to the mission.

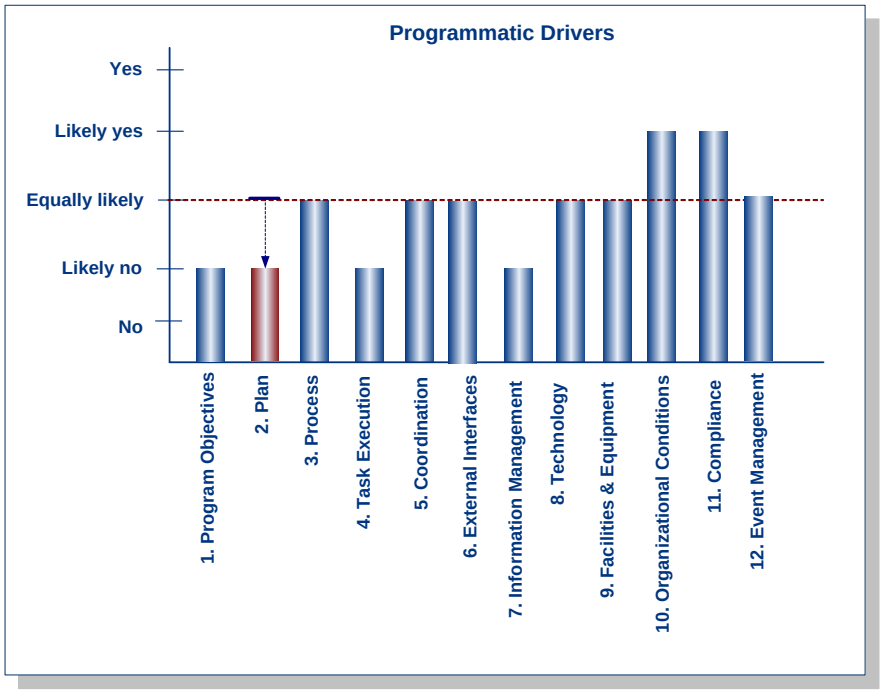
Integrated Risk and Opportunity Analysis

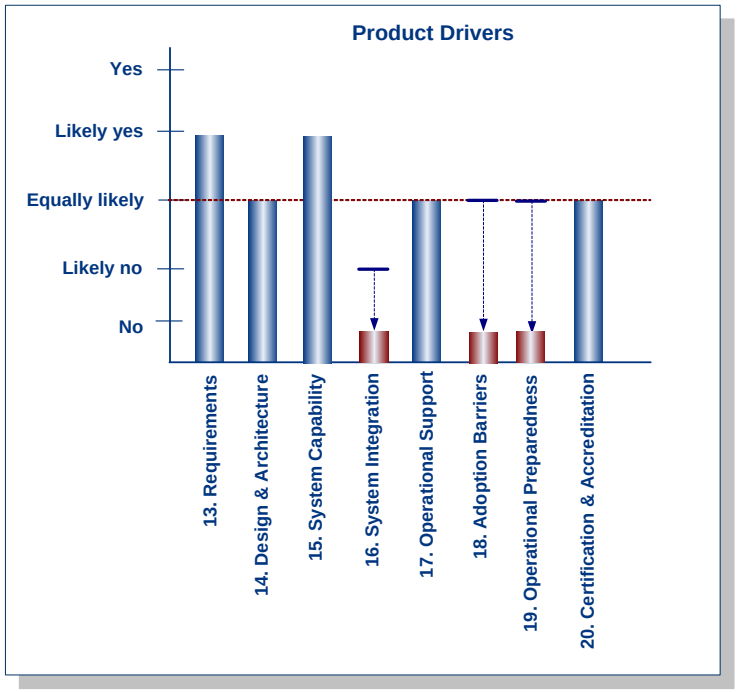


A *mission risk* is a circumstance that has the potential to cause loss from the business or mission perspective

A *mission opportunity* is a circumstance that has the potential to provide a gain from the business or mission perspective

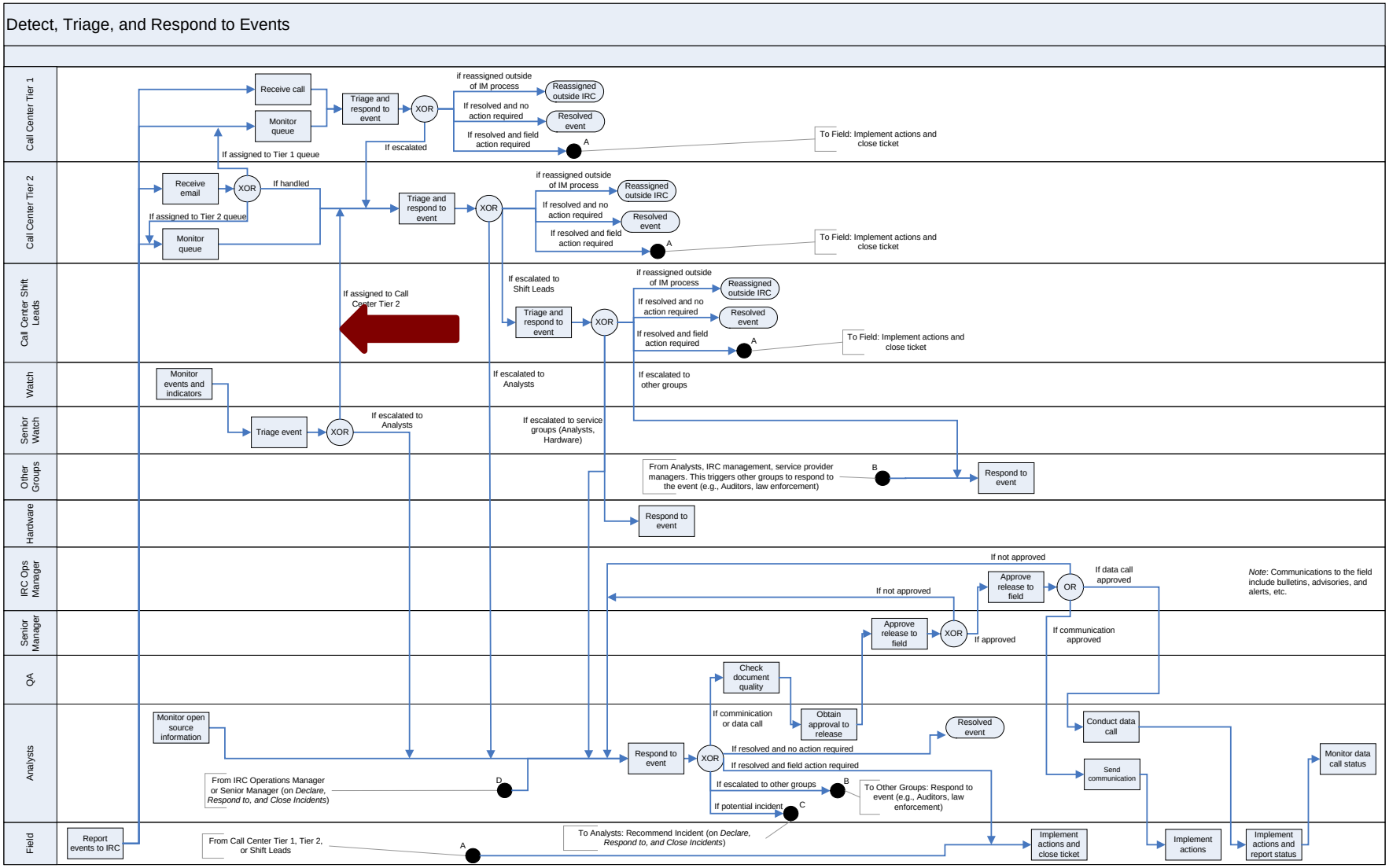
Integrated Risk and Opportunity: *Impact of Taking an Opportunity on Mission Drivers*





Here, taking an opportunity to use unexpected funds to improve the test facility has unexpectedly negative consequences on planning, system integration, adoption barriers, and operational preparedness.

Analyze Drivers At Interfaces



SUMMARY

Summary of Key Points - 1

The paradigm for managing software programs is changing.

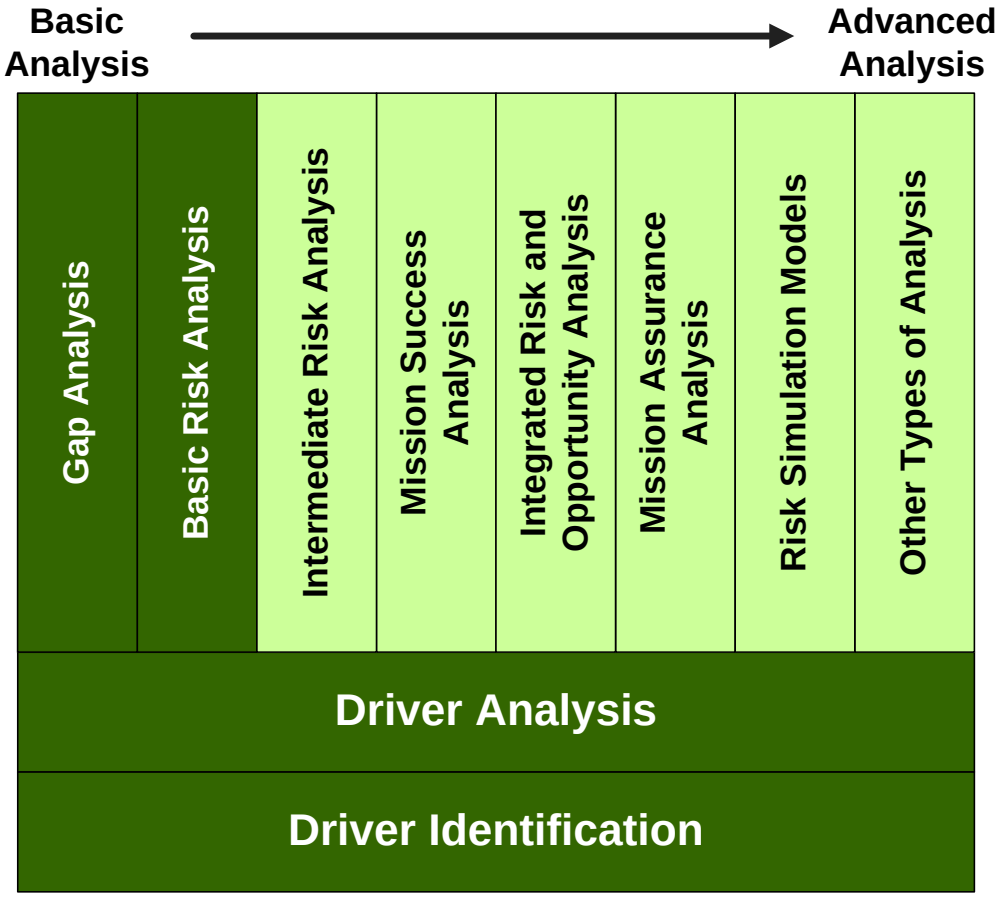
- Increased complexity
- Distributed knowledge, experience, and expertise
- Multiple points of management control
- Focus on communication and coordination

Mosaic

- Is a structured approach for assessing and managing in distributed environments.
  - Systemic focus
  - Top-down analysis
- Uses the risk to objectives to create a single, integrated view of the current state across multiple, disparate entities

Summary of Key Points - 2

Driver identification and analysis provide a common foundation for multiple back-end analyses



Summary of Key Points - 3

The Mission Diagnostic

- Provides a time-efficient means of assessing a program's success/failure drivers

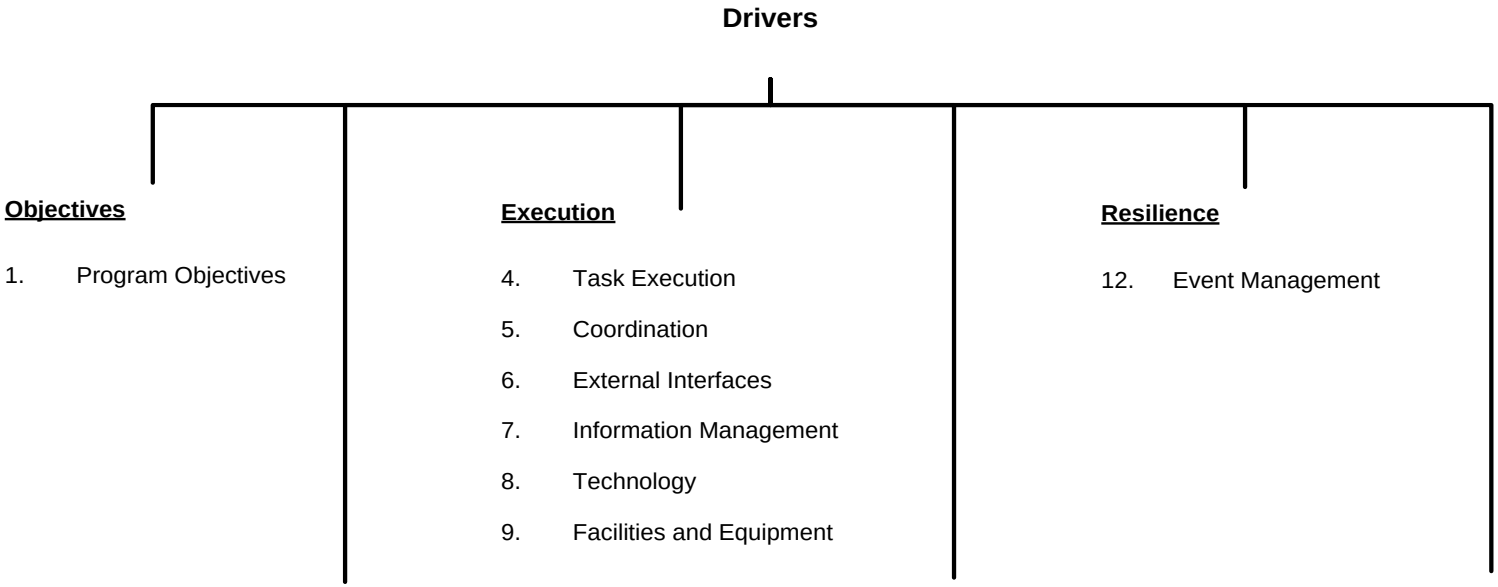
The Risk Diagnostic

- Provides a time-efficient means of assessing mission risks to program objectives
- Based on a set of key drivers

Drivers can be the foundation for a variety of deeper analyses.

Drivers can be used to integrate tactical information from a variety of sources.

Drivers for Software/System Development and Deployment



Additional Materials Available

1. Streamlined Mission Diagnostic Method
   - Set of worksheets in the form of a short workbook
2. Streamlined Risk Diagnostic Method
   - Set of worksheets in the form of a short workbook

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Software Engineering Institute

Rethinking Risk Management: *Workbook*

NDIA Systems Engineering Conference 2009

Mission Success in Complex Environments

Carnegie Mellon

This report was prepared for the

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Exercise 1: *Program Failure*

Directions

Please read the following scenario and answer the accompanying two questions.

Scenario

Program Overview

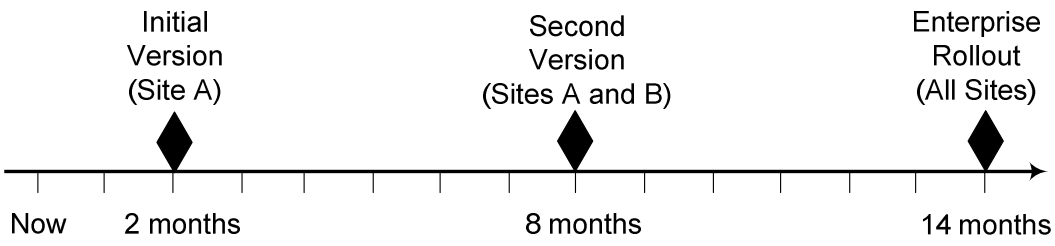
Company Z has 4,000 employees at 11 sites. For many years, each site has had its own information technology (IT) infrastructure and applications, with limited sharing of data and functions between sites. A new initiative sponsored by the CIO is rolling out a common IT infrastructure for all sites. In addition, several enterprise applications are being upgraded to take advantage of the capabilities provided by the new IT infrastructure. A new payroll application, called EveryPay, is scheduled to be the first new application deployed across the enterprise.

Key Program Aspects

The following describes key aspects of the EveryPay application program:

- **Complex interfaces**
  EveryPay relies heavily on the new infrastructure for messaging and other basic functions. EveryPay also requires accurate, up-to-date data from 18 other existing applications, most of which exist in one form or another at each site. None of these other applications are centrally managed nor have the same degree of configuration control as EveryPay.
- **Deployment plan for EveryPay**
  The initial version of EveryPay will be deployed at Site A in two months. Six months later, the second version of EveryPay will be deployed at Sites A and B. The enterprise-wide rollout of the production version of EveryPay will begin six months after that. IT staff and business analysts at Site A have been working closely with the developers to ensure the application meets their site needs and there are no delays in issuing paychecks.

Deployment Timeline for EveryPay



- **High profile**
  The CIO promised the governing board of Company Z that EveryPay will reduce costs by 25% and will be deployed on schedule. She recently invited key board members to attend an official demonstration at Site A to be held three weeks after the initial version of EveryPay is deployed.

  A month after the CIO made her promise to the board, the program team encountered several problems that put program several months behind schedule. Fearing repercussions if her promise were not kept, the CIO made it clear to the program manager that he must have something to demonstrate to the board members when they visit Site A. To ensure the schedule will be met, the CIO and program manager agreed to reduce the scope of the initial version of EveryPay and defer several key functions to the second version.
- **Funding**
  EveryPay's program manager has received all of the funding he needs to develop the application. He also has been quietly negotiating with other programs and funding upgrades to some of their applications that must interface with EveryPay at Sites A and B. These support applications need to be updated to ensure that they integrate properly with EveryPay.

  However, the program manager does not have sufficient authority to make sure that all support applications are updated as required. Unfortunately, no one with sufficient management authority understands the importance of this integration issue, and no corporate funds have been provided to ensure that the integration occurs.
- **Training**
  The training department has worked with Site A to develop training for the revised payroll work processes. This training is targeted at payroll administrators. The training department will also create an on-line training module for all Company Z personnel, which will enable them to access their payroll information using an internal website. Just-in-time training will be provided to payroll administrators at each site when EveryPay is deployed.
- **Developer**
  The developer of EveryPay, SWDesigns, Inc., has enjoyed the challenge of developing production grade software for the first time and expects to deliver the application to Site A on schedule. SWDesigns specializes in business process reengineering and requirements development for software-intensive systems. They have in-house developers who create custom applications for SWDesigns' internal use and, on occasion, have developed prototype applications for customers.

  Originally, SWDesigns was only contracted by Company Z to develop requirements for EveryPay. However, because a contract was already in place and staff from SWDesigns had developed good working relationships with staff from Company Z, the management at Company Z extended SWDesigns' contract to also include systems development and deployment.

Result

Management had agreed to reduce the scope of the initial version and defer several key functions to the second version in order to meet the CIO's promised schedule for deployment. However, additional problems surfaced when SWDesigns was unexpectedly late in delivering a working copy of the application for integration testing.

To offset this additional delay, the CIO and program manager decided to compress the testing schedule. A typical application at Company Z has historically required 8-10 builds during integration testing. This program, which is considerably more complex than average, only had time to test 2 builds of the application. In addition, several support applications were being upgraded, and the versions of those applications used in integration testing would be different than those deployed in production.

The program team was unable to deploy the initial version on schedule at site A. EveryPay could not properly access the work schedules of half of the departments because of integration problems with several support applications. In addition, payroll administrators could not figure out how to coordinate existing work processes with the new EveryPay work process. To make matters worse, the new infrastructure would not let them keep old applications open at the same time as the new EveryPay application. As a result, administrators would have to keep opening and closing applications. The manager of the payroll administrators estimated that EveryPay would decrease efficiency as much as 50%.

Questions

The CIO blamed the failure on technical problems and on the performance of SWDesigns. She argued that no one could have foreseen these problems. The board is concerned about another high-profile program failure on its watch. It has hired you, an outside consultant, to investigate. The board has asked you to answer the following two questions:

1. What led to the program's failure?

2. Who should have been responsible for resolving these issues and preventing this failure?

Use the next page to write your answers.

Answers

Standard Drivers for Software/System Development and Deployment

Questions for Programmatic Drivers

	Driver Question	Category
1.	Are program objectives (product, cost, schedule) realistic and achievable? Consider: Alignment of technical, cost, and schedule objectives; inherent technical risk; technology maturity; resources available	Objectives
2.	Is the plan for developing and deploying the system sufficient? Consider: Acquisition or development strategy; program plan; resources; funding; schedule; roles and responsibilities	Preparation
3.	Is the process being used to develop and deploy the system sufficient? Consider: Process design; measurements and controls; process efficiency and effectiveness; acquisition and development life cycles; training	Preparation
4.	Are tasks and activities performed effectively and efficiently? Consider: Experience and expertise of management and staff; staffing levels; experience with the acquisition and development life cycles	Execution
5.	Are activities within each team and across teams coordinated appropriately? Consider: Communication; information sharing; dependencies; relationships; partners and collaborators	Execution
6.	Will work products from suppliers, partners, or collaborators meet the program's quality and timeliness requirements? Consider: Applications; software; systems or sub-systems; hardware	Execution
7.	Is the program's information managed appropriately? Consider: Usability; confidentiality; integrity; availability	Execution
8.	Does the program team have the tools and technologies it needs to develop the system and transition it to operations? Consider: Software applications; infrastructure; systems; databases	Execution
9.	Are facilities and equipment sufficient to support the program? Consider: Building; physical work spaces; support equipment; supplies; other resources	Execution
10.	Are enterprise, organizational, and political conditions facilitating completion of program activities? Consider: Stakeholder sponsorship; actions of upper management; effect of laws, regulations, and policies	Environment
11.	Does the program comply with all relevant policies, laws, and regulations? Consider: policies; laws; regulations; standards of care	Environment
12.	Does the program have sufficient capacity and capability to identify and manage potential events and changing circumstances? Consider: Risk management plan, process, and tools; schedule slack; funding reserve; risk mitigation plans; program continuity and contingency plans; opportunity management plan, process, and tools	Resilience

Questions for Product Drivers

	Driver Question	Category
13.	Are system requirements well understood? Consider: Customer, user, and stakeholder requirements and needs; functional and non-functional requirements; operational requirements; system growth and expansion needs; technology maturity	Result
14.	Are the design and architecture sufficient to meet system requirements and provide the desired operational capability? Consider: Interfaces; dependencies; software and system architecture; operational requirements; technology maturity	Result
15.	Will the system satisfactorily meet its requirements? Consider: Functional; performance; operational; reliability; security; safety; usability; maintainability; technology maturity	Result
16.	Will the system be sufficiently integrated and interoperable with other systems when deployed? Consider: Interfaces; applications; tools; hardware; data; technology maturity	Result
17.	Will the system effectively support operations? Consider: Business and operational workflows; support of organizational and enterprise missions; operational risk mitigation; disaster recovery, contingency and business continuity plans; technology maturity	Result
18.	Have barriers to customer/user adoption of the system been managed appropriately? Consider: User acceptance; stakeholder sponsorship; transition to operations; user support	Result
19.	Will people be prepared to operate, use, and maintain the system? Consider: policies; procedures; training	Result
20.	Will the system be appropriately certified and accredited for operational use? Consider: compliance with policies, laws, and regulations; acceptable mitigation of risk	Result

Exercise 2: *Failure Drivers*

Directions

Consider the following question in relation to the EveryPay program: *Which failure drivers contributed to the problems experienced by the program?*

Based on the background materials for the previous exercises, check (√) each failure driver that contributed to the problems experienced by the EveryPay program.

		Failure Drivers
❑	1.	Program objectives (technical, cost, schedule) were unrealistic or unachievable. Consider: alignment of technical, cost, and schedule objectives; inherent technical risk; resources available
❑	2.	The plan for developing (and deploying) the system was insufficient. Consider: acquisition or development strategy; program plan; resources; funding; schedule; roles and responsibilities
❑	3.	The process being used to develop (and deploy) the system was insufficient. Consider: process design; measurements and controls; process efficiency and effectiveness; acquisition and development life cycles; training
❑	4.	Tasks and activities were not performed effectively and efficiently. Consider: experience and expertise of management and staff; staffing levels; experience with the acquisition and development life cycles
❑	5.	Activities within each team and across teams were not coordinated appropriately. Consider: communication; information sharing; dependencies; relationships; partners and collaborators
❑	6.	Work products from suppliers, partners, or collaborators did not meet the program's quality and timeliness requirements. Consider: applications; software; systems or sub-systems; hardware
❑	7.	The program's information was not managed appropriately. Consider: usability; confidentiality; integrity; availability
❑	8.	The program team did not have the tools and technologies it needed to develop the system and transition it to operations. Consider: software applications; infrastructure; systems; databases
❑	9.	Facilities and equipment were not sufficient to support the program. Consider: building; physical work spaces; support equipment; supplies; other resources
❑	10.	Enterprise, organizational, and political conditions were not facilitating completion of program activities. Consider: stakeholder sponsorship; actions of upper management; effect of laws, regulations, and policies

Failure Drivers (con't)		
❑	11.	The program did not comply with all relevant policies, laws, and regulations. Consider: policies; laws; regulations; standards of care
❑	12.	The program did not have sufficient capacity and capability to identify and manage potential events and changing circumstances. Consider: risk management plan, process, and tools; schedule slack; funding reserve; risk mitigation plans; program continuity and contingency plans; opportunity management plan, process, and tools
❑	13.	System requirements were not understood. Consider: customer, user, and stakeholder requirements and needs; functional and non-functional requirements; operational requirements; system growth and expansion needs, technology maturity
❑	14.	The design and architecture were not sufficient to meet system requirements and provide the desired operational capability. Consider: interfaces; dependencies; software and system architecture; operational requirements, technology maturity
❑	15.	The system satisfactorily did not meet its requirements. Consider: functional; performance; operational; reliability; security; safety; usability; maintainability, technology maturity
❑	16.	The system was not sufficiently integrated and interoperable with other systems. Consider: interfaces, applications, tools, hardware, data, technology maturity
❑	17.	The system did not effectively support operations. Consider: business and operational workflows; support of organizational and enterprise missions; operational risk mitigation; disaster recovery, contingency and business continuity plans, technology maturity
❑	18.	Barriers to customer/user adoption of the system had not been managed appropriately. Consider: user acceptance; stakeholder sponsorship; transition to operations; user support
❑	19.	People were not prepared to operate, use, and maintain the system. Consider: policies; procedures; training
❑	20.	The system was not appropriately certified and accredited for operational use. Consider: compliance with policies, laws, and regulations; acceptable mitigation of risk

Exercise 3A: *Evaluating Your Program*

Directions

You will be using the set of drivers for software programs to evaluate your own programs. Answer the driver questions using the driver criteria provided below. Make sure to document the rationale for each answer in the space provided. If you are uncertain about a particular driver, make your best guess or check the box for "Equally Likely." If a driver is not applicable to your program, check the "Not Applicable" box.

Driver Value Criteria

Answer	Definition
Yes	The answer is almost certainly "yes." Almost no uncertainty exists. There is little or no probability that the answer could be "no." ~ > 95% probability of yes
Likely yes	The answer is most likely "yes." There is some chance that the answer could be "no." ~ 75% probability of yes
Equally likely	The answer is just as likely to be "yes" or "no." ~ 50% probability of yes
Likely no	The answer is most likely "no." There is some chance that the answer could be "yes." ~ 25% probability of yes
No	The answer is almost certainly "no." Almost no uncertainty exists. There is little or no probability that the answer could be "yes." ~ < 5% probability of yes
Not applicable	The question is not applicable to your program.

Example

Driver Question	Answer						Rationale
	No	Likely no	Equally likely	Likely yes	Yes	Not Applicable	
1. Are program objectives (technical, cost, schedule) realistic and achievable? Consider: alignment of technical, cost, and schedule objectives; inherent technical risk; resources available	❑	❑	☒	❑	❑	❑	+ The program team has a good sense of its requirements and responsibilities. - Technical objectives do not sufficiently consider integration and functionality issues. - The current set of objectives for the initial deployment phase is not documented or well-communicated to program team. - Plans for the initial deployment phase are driven by the schedule and not by the need to deliver an effective operational capability.

Exercise 3

Driver Questions	Answer						Rationale
	No	Likely no	Equally likely	Likely yes	Yes	Not Applicable	
1. Are program objectives (product, cost, schedule) realistic and achievable? Consider: Alignment of technical, cost, and schedule objectives; inherent technical risk; technology maturity; resources available	❑	❑	❑	❑	❑	❑	
2. Is the plan for developing and deploying the system sufficient? Consider: Acquisition or development strategy; program plan; resources; funding; schedule; roles and responsibilities	❑	❑	❑	❑	❑	❑	
3. Is the process being used to develop and deploy the system sufficient? Consider: Process design; measurements and controls; process efficiency and effectiveness; acquisition and development life cycles; training	❑	❑	❑	❑	❑	❑	
4. Are tasks and activities performed effectively and efficiently? Consider: Experience and expertise of management and staff; staffing levels; experience with the acquisition and development life cycles	❑	❑	❑	❑	❑	❑	
5. Are activities within each team and across teams coordinated appropriately? Consider: Communication; information sharing; dependencies; relationships; partners and collaborators	❑	❑	❑	❑	❑	❑	

Exercise 3

Driver Questions	Answer						Rationale
	No	Likely no	Equally likely	Likely yes	Yes	Not Applicable	
6. Will work products from suppliers, partners, or collaborators meet the program's quality and timeliness requirements? Consider: Applications; software; systems or sub-systems; hardware	❑	❑	❑	❑	❑	❑	
7. Is the program's information managed appropriately? Consider: Usability; confidentiality; integrity; availability	❑	❑	❑	❑	❑	❑	
8. Does the program team have the tools and technologies it needs to develop the system and transition it to operations? Consider: Software applications; infrastructure; systems; databases	❑	❑	❑	❑	❑	❑	
9. Are facilities and equipment sufficient to support the program? Consider: Building; physical work spaces; support equipment; supplies; other resources	❑	❑	❑	❑	❑	❑	
10. Are enterprise, organizational, and political conditions facilitating completion of program activities? Consider: Stakeholder sponsorship; actions of upper management; effect of laws, regulations, and policies	❑	❑	❑	❑	❑	❑	

Exercise 3

Driver Questions	Answer						Rationale
	No	Likely no	Equally likely	Likely yes	Yes	Not Applicable	
11. Does the program comply with all relevant policies, laws, and regulations? Consider: policies; laws; regulations; standards of care	❑	❑	❑	❑	❑	❑	
12. Does the program have sufficient capacity and capability to identify and manage potential events and changing circumstances? Consider: Risk management plan, process, and tools; schedule slack; funding reserve; risk mitigation plans; program continuity and contingency plans; opportunity management plan, process, and tools	❑	❑	❑	❑	❑	❑	
13. Are system requirements well understood? Consider: Customer, user, and stakeholder requirements and needs; functional and non-functional requirements; operational requirements; system growth and expansion needs; technology maturity	❑	❑	❑	❑	❑	❑	
14. Are the design and architecture sufficient to meet system requirements and provide the desired operational capability? Consider: Interfaces; dependencies; software and system architecture; operational requirements; technology maturity	❑	❑	❑	❑	❑	❑	
15. Will the system satisfactorily meet its requirements? Consider: Functional; performance; operational; reliability; security; safety; usability; maintainability; technology maturity	❑	❑	❑	❑	❑	❑	

Exercise 3

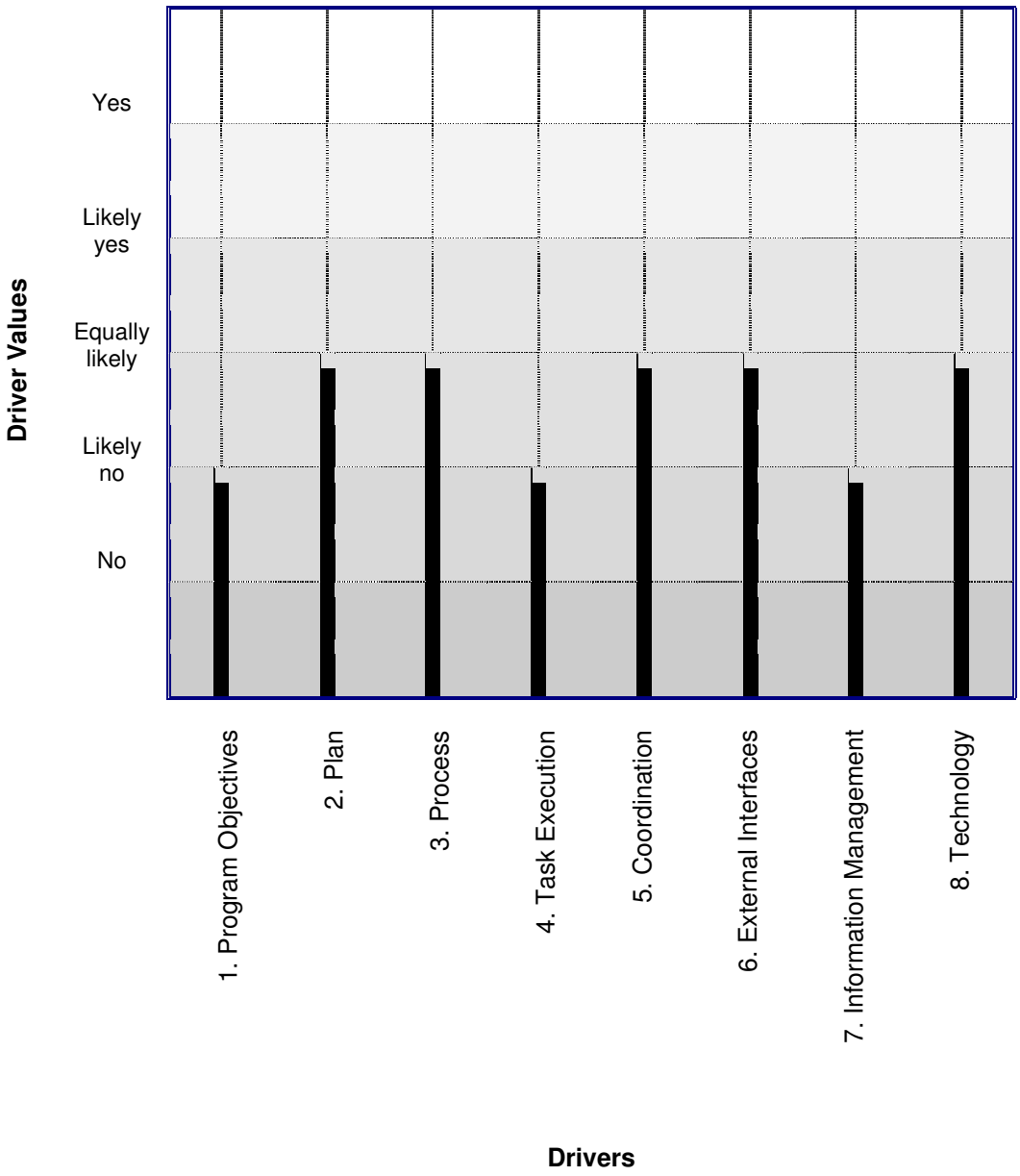
Driver Questions	Answer						Rationale
	No	Likely no	Equally likely	Likely yes	Yes	Not Applicable	
16. Will the system be sufficiently integrated and interoperable with other systems when deployed? Consider: Interfaces; applications; tools; hardware; data; technology maturity	❑	❑	❑	❑	❑	❑	
17. Will the system effectively support operations? Consider: Business and operational workflows; support of organizational and enterprise missions; operational risk mitigation; disaster recovery, contingency and business continuity plans; technology maturity	❑	❑	❑	❑	❑	❑	
18. Have barriers to customer/user adoption of the system been managed appropriately? Consider: User acceptance; stakeholder sponsorship; transition to operations; user support	❑	❑	❑	❑	❑	❑	
19. Will people be prepared to operate, use, and maintain the system? Consider: policies; procedures; training	❑	❑	❑	❑	❑	❑	
20. Will the system be appropriately certified and accredited for operational use? Consider: compliance with policies, laws, and regulations; acceptable mitigation of risk	❑	❑	❑	❑	❑	❑	

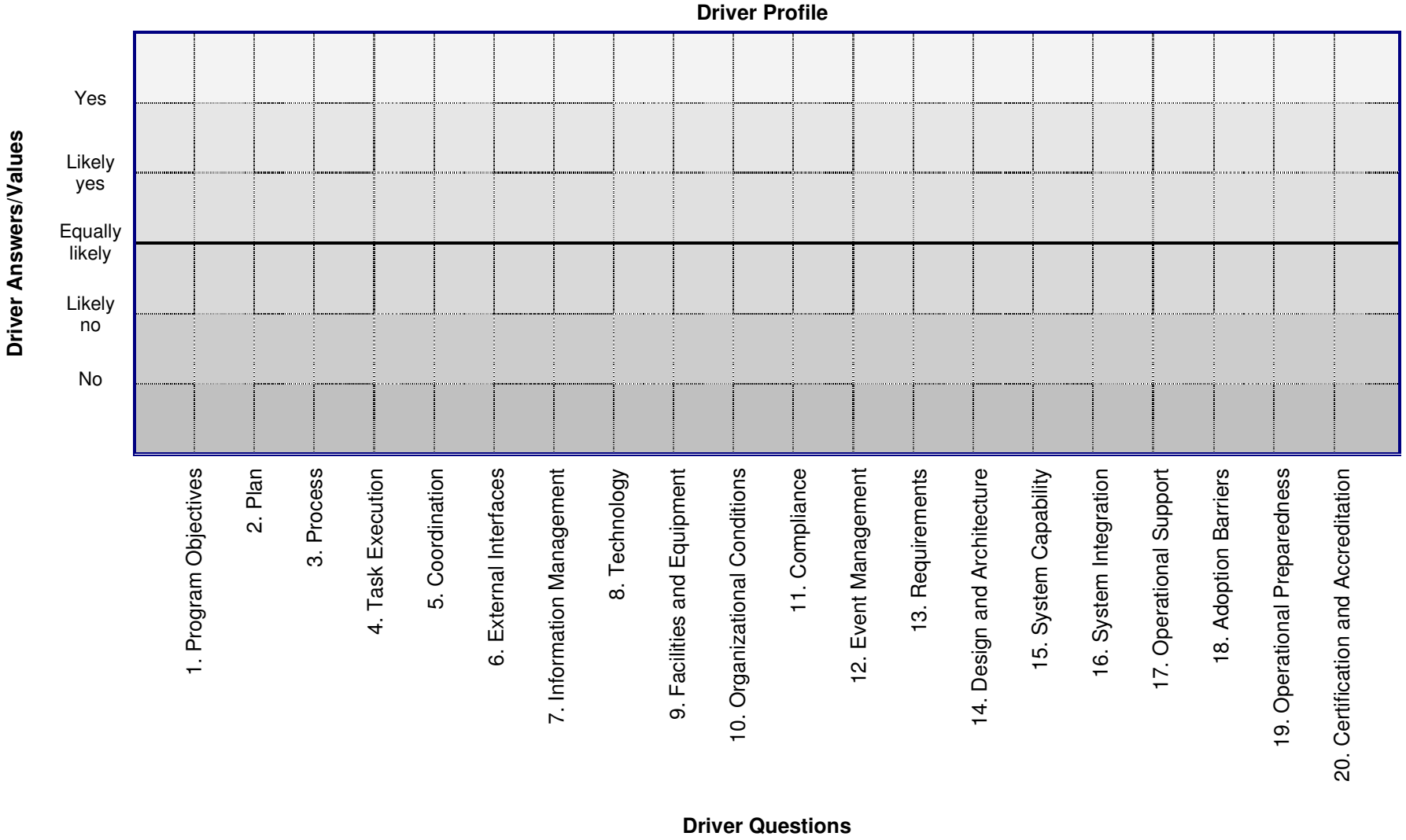
Exercise 3B: *Graphing Results*

Directions

In this exercise, you will record the driver values from Exercise 6 on bar graphs. You will find blank bar graphs on the next two pages. Record your driver values on the graphs provided. If you marked any drivers as "Not Applicable" in Exercise 6, do not record any values for those drivers on your bar graphs. Below is an example of a completed bar graph for this exercise.

Partial Example





Software Engineering Institute

Rethinking Risk Management: Additional Material #1

Evaluating Your Program: Streamlined Version of the Mission Diagnostic Method

Mission Success in Complex Environments

Carnegie Mellon

This report was prepared for the

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Introduction

This workbook provides a streamlined version of the basic Mission Diagnostic method, which is designed to enable you to quickly assess a program's potential for success based on a set of success/failure drivers. The worksheets in this workbook are based on a standard set of drivers. This set has 20 standard drivers of success and failure for software development and acquisition programs that managers or an evaluation team should generally be able to answer *and* be able to prove or justify their answers.

The workbook is divided into two parts. Part 1 provides worksheets for analyzing the value for each driver. Part 2 provides a worksheet for summarizing the results of Part 1 in a driver profile in a bar chart and provides some basic guidance for next steps.

Part 1: Evaluating Mission Drivers

Directions

Answer the questions using the criteria provided below. Make sure to provide the rationale for each answer in the space provided, using any relevant positive and negative points. If you are uncertain about a particular driver, make your best guess or check the box for "Equally Likely." If you have no idea at all what the answer could be, use Don't Know. There is an example on the next page.

Criteria

Answer	Definition
Yes	The answer is almost certainly "yes." Almost no uncertainty exists. There is little or no probability that the answer could be "no."
Likely yes	The answer is most likely "yes." There is some chance that the answer could be "no."
Equally likely	The answer is just as likely to be "yes" or "no."
Likely no	The answer is most likely "no." There is some chance that the answer could be "yes."
No	The answer is almost certainly "no." Almost no uncertainty exists. There is little or no probability that the answer could be "yes."
Don't Know	More information is needed to answer the question.

Example

Driver Question	Answer						Rationale
	No	Likely no	Equally likely	Likely yes	Yes	Don't Know	
1. Are program objectives (technical, cost, schedule) realistic and achievable? Consider: alignment of technical, cost, and schedule objectives; inherent technical risk; resources available	❑	❑	☒	❑	❑	❑	+ The program team has a good sense of its requirements and responsibilities. - Technical objectives do not sufficiently consider integration and functionality issues. - The current set of objectives for the initial deployment phase is not documented or well-communicated to program team. - Plans for the initial deployment phase are driven by the schedule and not by the need to deliver an effective operational capability.

Mission Drivers								
Driver Questions		**Answer**						**Rationale**
		No	Likely no	Equally likely	Likely yes	Yes	Don't Know	
1	Are program objectives (product, cost, schedule) realistic and achievable? Consider: Alignment of technical, cost, and schedule objectives; inherent technical risk; technology maturity; resources available	❑	❑	❑	❑	❑	❑	
2	Is the plan for developing and deploying the system sufficient? Consider: Acquisition or development strategy; program plan; resources; funding; schedule; roles and responsibilities	❑	❑	❑	❑	❑	❑	
3	Is the process being used to develop and deploy the system sufficient? Consider: Process design; measurements and controls; process efficiency and effectiveness; acquisition and development life cycles; training	❑	❑	❑	❑	❑	❑	
4	Are tasks and activities performed effectively and efficiently? Consider: Experience and expertise of management and staff; staffing levels; experience with the acquisition and development life cycles	❑	❑	❑	❑	❑	❑	
5	Are activities within each team and across teams coordinated appropriately? Consider: Communication; information sharing; dependencies; relationships; partners and collaborators	❑	❑	❑	❑	❑	❑	
6	Will work products from suppliers, partners, or collaborators meet the program's quality and timeliness requirements? Consider: Applications; software; systems or sub-systems; hardware	❑	❑	❑	❑	❑	❑	
7	Is the program's information managed appropriately? Consider: Usability; confidentiality; integrity; availability	❑	❑	❑	❑	❑	❑	
8	Does the program team have the tools and technologies it needs to develop the system and transition it to operations? Consider: Software applications; infrastructure; systems; databases	❑	❑	❑	❑	❑	❑	

Mission Drivers								
Driver Questions		**Answer**						**Rationale**
		No	Likely no	Equally likely	Likely yes	Yes	Don't Know	
9	Are facilities and equipment sufficient to support the program? Consider: Building; physical work spaces; support equipment; supplies; other resources	❑	❑	❑	❑	❑	❑	
10	Are enterprise, organizational, and political conditions facilitating completion of program activities? Consider: Stakeholder sponsorship; actions of upper management; effect of laws, regulations, and policies	❑	❑	❑	❑	❑	❑	
11	Does the program comply with all relevant policies, laws, and regulations? Consider: policies; laws; regulations; standards of care	❑	❑	❑	❑	❑	❑	
12	Does the program have sufficient capacity and capability to identify and manage potential events and changing circumstances? Consider: Risk management plan, process, and tools; schedule slack; funding reserve; risk mitigation plans; program continuity and contingency plans; opportunity management plan, process, and tools	❑	❑	❑	❑	❑	❑	
13	Are system requirements well understood? Consider: Customer, user, and stakeholder requirements and needs; functional and non-functional requirements; operational requirements; system growth and expansion needs; technology maturity	❑	❑	❑	❑	❑	❑	
14	Are the design and architecture sufficient to meet system requirements and provide the desired operational capability? Consider: Interfaces; dependencies; software and system architecture; operational requirements; technology maturity	❑	❑	❑	❑	❑	❑	
15	Will the system satisfactorily meet its requirements? Consider: Functional; performance; operational; reliability; security; safety; usability; maintainability; technology maturity	❑	❑	❑	❑	❑	❑	

Mission Drivers								
Driver Questions		**Answer**						**Rationale**
		No	Likely no	Equally likely	Likely yes	Yes	Don't Know	
16	Will the system be sufficiently integrated and interoperable with other systems when deployed? Consider: Interfaces; applications; tools; hardware; data; technology maturity	❑	❑	❑	❑	❑	❑	
17	Will the system effectively support operations? Consider: Business and operational workflows; support of organizational and enterprise missions; operational risk mitigation; disaster recovery, contingency and business continuity plans; technology maturity	❑	❑	❑	❑	❑	❑	
18	Have barriers to customer/user adoption of the system been managed appropriately? Consider: User acceptance; stakeholder sponsorship; transition to operations; user support	❑	❑	❑	❑	❑	❑	
19	Will people be prepared to operate, use, and maintain the system? Consider: policies; procedures; training	❑	❑	❑	❑	❑	❑	
20	Will the system be appropriately certified and accredited for operational use? Consider: compliance with policies, laws, and regulations; acceptable mitigation of risk	❑	❑	❑	❑	❑	❑	

Part 2: Driver Profile and Next Steps

Directions

A driver profile is a graphical summary of the current state of the mission drivers. Below is a partial example of a driver profile. Your driver profile shows helps you identify which drivers have an unacceptable value. In the example, assume the program manager wanted all of the drivers to have at least an Equally Likely value. In this example, only one driver had an answer better than Equally Likely Yes, indicating this program has strength in the area of process, but also has a lot of weaknesses that need improvement.

Possible next steps include addressing the weaknesses while maintaining the existing strength. Some cost-benefit analysis of alternative improvement plans will be needed to ensure the usually scarce funds and resources for improvement are effectively applied. In particular, if drivers such as Program Objectives and Plan have low scores, they are clear candidates for the first improvement efforts as any changes in objectives and plans will impact the rest of the drivers and any planned efforts to improve them.

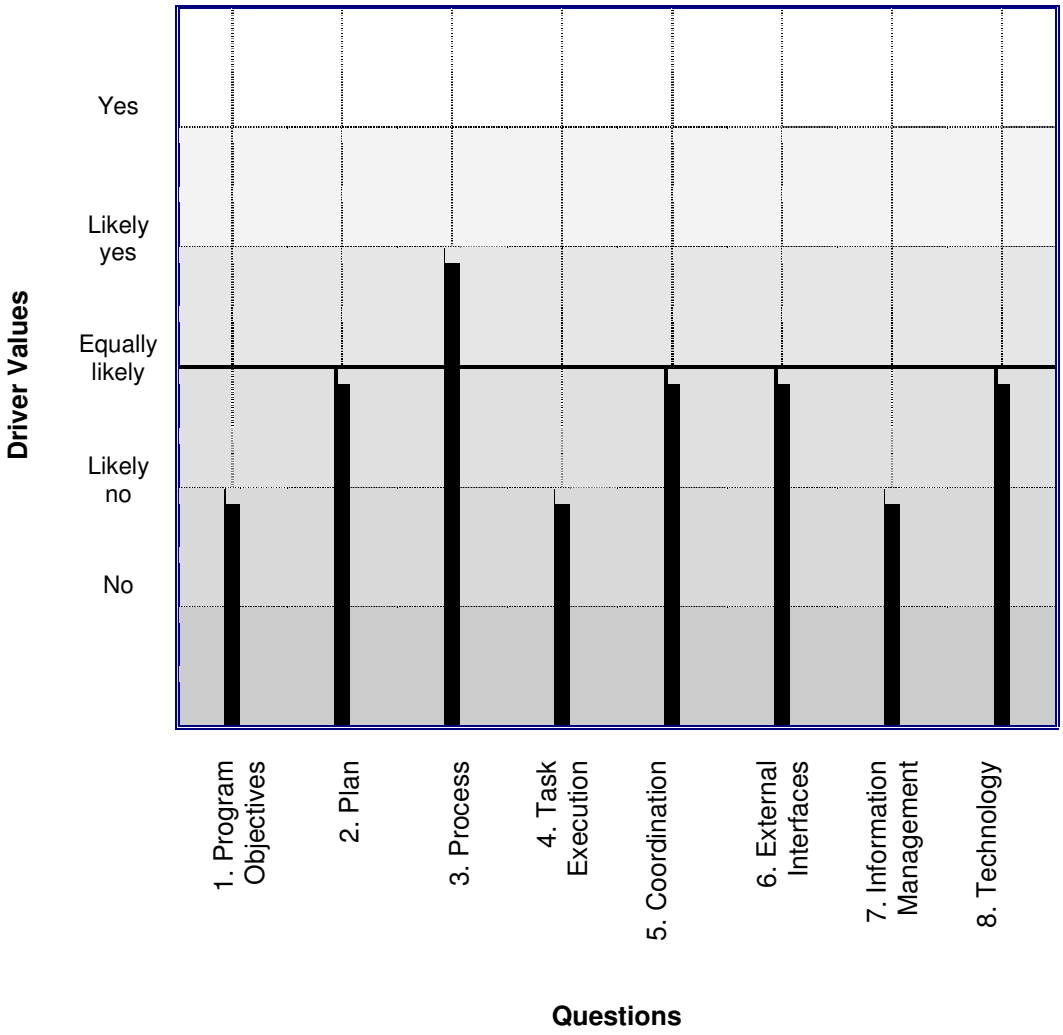
The blank driver profile worksheet is for you to use to provide a visual summary of your answers to the driver questions. Record your question answers on the graphs provided. If you marked any questions as “Don’t Know”, do not record any answers for those questions on your bar graphs. Your summary will show you, at a high level, areas in your program that may need to be improved.

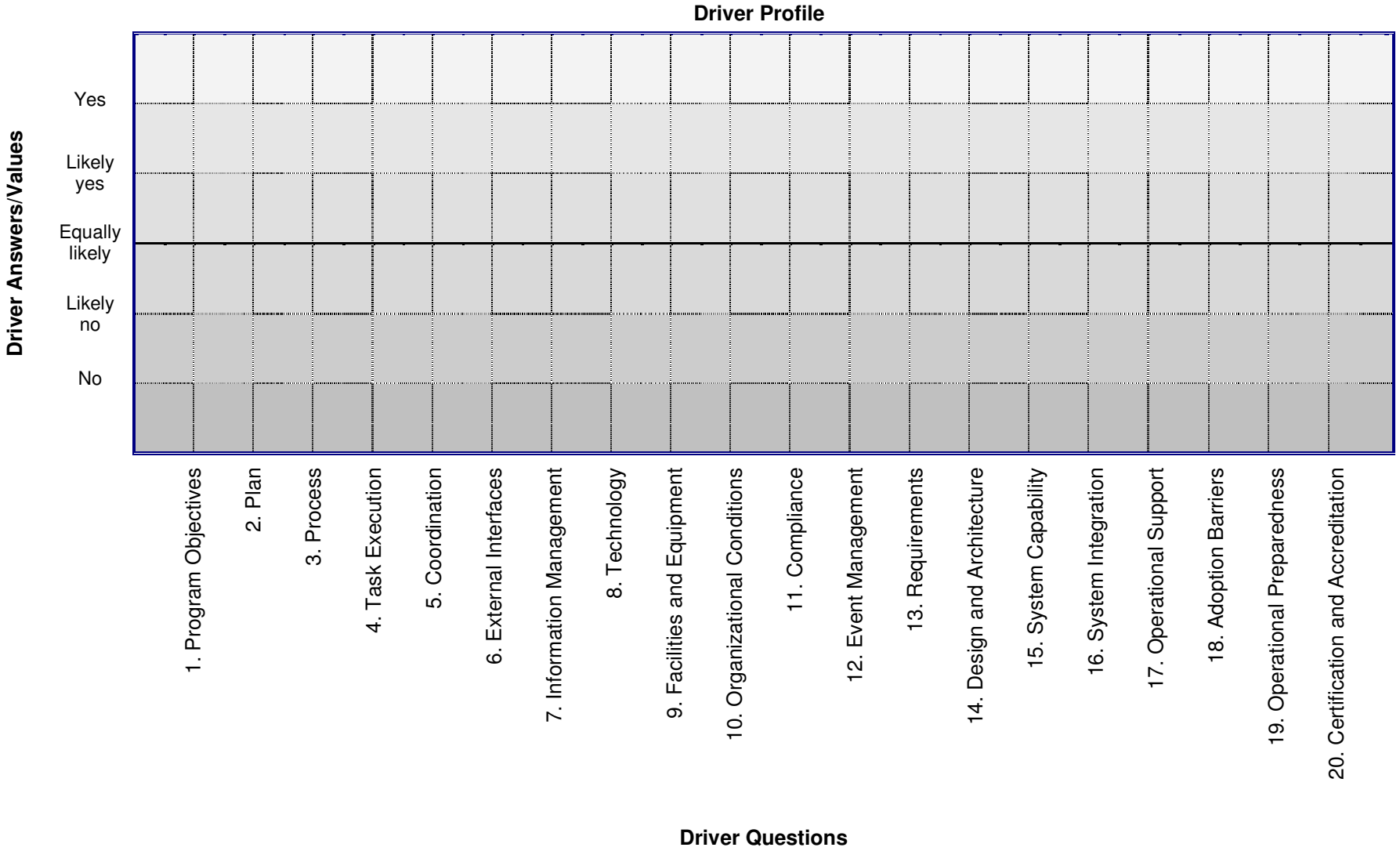
On the final workbook page, you have space to record some of your next steps. Consider:

- Which drivers have values that are unacceptable?
- Which unacceptably low value drivers should be considered first for improvements?
- Which drivers represent strengths that can be used to help other drivers?

For each driver record a few notes about any actions that should be taken to improve (or sustain) the driver’s value.

Example Driver Profile (Partial)





Next Steps for Drivers		
	Driver Questions	**Next Steps**
1	Are program objectives (product, cost, schedule) realistic and achievable? Consider: Alignment of technical, cost, and schedule objectives; inherent technical risk; technology maturity; resources available	
2	Is the plan for developing and deploying the system sufficient? Consider: Acquisition or development strategy; program plan; resources; funding; schedule; roles and responsibilities	
3	Is the process being used to develop and deploy the system sufficient? Consider: Process design; measurements and controls; process efficiency and effectiveness; acquisition and development life cycles; training	
4	Are tasks and activities performed effectively and efficiently? Consider: Experience and expertise of management and staff; staffing levels; experience with the acquisition and development life cycles	
5	Are activities within each team and across teams coordinated appropriately? Consider: Communication; information sharing; dependencies; relationships; partners and collaborators	
6	Will work products from suppliers, partners, or collaborators meet the program's quality and timeliness requirements? Consider: Applications; software; systems or sub-systems; hardware	
7	Is the program's information managed appropriately? Consider: Usability; confidentiality; integrity; availability	
8	Does the program team have the tools and technologies it needs to develop the system and transition it to operations? Consider: Software applications; infrastructure; systems; databases	
9	Are facilities and equipment sufficient to support the program? Consider: Building; physical work spaces; support equipment; supplies; other resources	
10	Are enterprise, organizational, and political conditions facilitating completion of program activities? Consider: Stakeholder sponsorship; actions of upper management; effect of laws, regulations, and policies	
11	Does the program comply with all relevant policies, laws, and regulations? Consider: policies; laws; regulations; standards of care	

Next Steps for Drivers		
	Driver Questions	**Next Steps**
12	Does the program have sufficient capacity and capability to identify and manage potential events and changing circumstances? Consider: Risk management plan, process, and tools; schedule slack; funding reserve; risk mitigation plans; program continuity and contingency plans; opportunity management plan, process, and tools	
13	Are system requirements well understood? Consider: Customer, user, and stakeholder requirements and needs; functional and non-functional requirements; operational requirements; system growth and expansion needs; technology maturity	
14	Are the design and architecture sufficient to meet system requirements and provide the desired operational capability? Consider: Interfaces; dependencies; software and system architecture; operational requirements; technology maturity	
15	Will the system satisfactorily meet its requirements? Consider: Functional; performance; operational; reliability; security; safety; usability; maintainability; technology maturity	
16	Will the system be sufficiently integrated and interoperable with other systems when deployed? Consider: Interfaces; applications; tools; hardware; data; technology maturity	
17	Will the system effectively support operations? Consider: Business and operational workflows; support of organizational and enterprise missions; operational risk mitigation; disaster recovery, contingency and business continuity plans; technology maturity	
18	Have barriers to customer/user adoption of the system been managed appropriately? Consider: User acceptance; stakeholder sponsorship; transition to operations; user support	
19	Will people be prepared to operate, use, and maintain the system? Consider: policies; procedures; training	
20	Will the system be appropriately certified and accredited for operational use? Consider: compliance with policies, laws, and regulations; acceptable mitigation of risk	

Software Engineering Institute

Rethinking Risk Management: Additional Material #2

Evaluating Your Program: Streamlined Version of the Risk Diagnostic Method

Mission Success in Complex Environments

Carnegie Mellon

This report was prepared for the

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Introduction

This workbook provides a streamlined version of the Risk Diagnostic method, which is designed to enable you to quickly assess a program's mission risks. The worksheets in this workbook are based on the standard set of drivers for software development and deployment which are the basis for the standard set of mission risks. The workbook is divided into two parts. Part 1 provides worksheets for analyzing impact, probability, and risk exposure for each mission risk. Part 2 provides a worksheet for summarizing the results of Part 1 in a tabular risk profile format.

Part 1: Analyzing Mission Risks

Complete the four steps described in the directions below. Criteria for evaluating probability (called *Mission Risk Probability Criteria*), impact (called *Mission Risk Impact Criteria*), and risk exposure (called *Mission Risk Exposure Matrix*) are provided on the next two pages. The criteria are used when completing Steps 1-3 below.

Directions for Part 1

Step 1	Before conducting this step, review the following two items: (1) the worksheets provided for Part 1 (starting on p. 7) and (2) the *Mission Risk Probability Criteria* provided on the next page. Refer to the *Part 1 Example* on p. 6 for an example of a completed worksheet for this step. Select a mission risk to evaluate, and review the mission risk statement provided. Evaluate the likelihood that the mission risk statement is true by selecting the most appropriate response. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value, if needed. Document the rationale for your selection of the probability value.
Step 2	Before conducting this step, review the following two items: (1) the worksheet provided for Part 1 (starting on p. 7) and (2) the *Mission Risk Impact Criteria* provided on the next page. Refer to *Part 1 Example* on p. 6 for an example of a completed worksheet for this step. Review the mission risk statement for the mission risk you are evaluating. Evaluate the magnitude of the impact on key objectives by selecting the most appropriate response. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value, if needed. Document the rationale for your selection of the impact value. Note that the impact of each mission risk is assumed to be *severe*. You are only required to document a rationale for impact if (1) the impact is less than *severe*, (2) you are unable to determine the impact value (i.e., *unknown*), or (3) you choose not to evaluate the impact value (i.e., *not evaluated*).
Step 3	Before conducting this step, review the following two items: (1) the worksheet provided for Part 1 (starting on p. 7) and (2) the *Mission Risk Exposure Matrix* provided on p. 5. Refer to *Part 1 Example* on p. 6 for an example of a completed worksheet for this step. Locate (1) the row in the *Mission Risk Exposure Matrix* corresponding to the probability value you determined in Step 1 and (2) the column in the matrix corresponding to the impact value you determined in Step 2. The mission risk exposure is the value in the box representing the intersection of the values of impact and probability. If either the probability or impact value is *unknown* or *not evaluated*, you cannot determine risk exposure for the mission risk; in this case, select either *unknown* or *not evaluated* as the value of risk exposure.
Step 4	Complete Steps 1-3 for each driver.

Mission Risk Probability Criteria

Probability	Description
Maximum	The mission risk statement is almost certainly true. Almost no uncertainty exists.
High	The mission risk statement is most likely true. There is some chance that the statement could be false.
Medium	The mission risk statement is just as likely to be true or false.
Low	The mission risk statement is most likely false. There is some chance that the statement could be true.
Minimal	The mission risk statement is almost certainly false. Almost no uncertainty exists.
Unknown	More information is needed to evaluate probability.
Not Evaluated	The mission risk is not relevant at this point in time. It was not evaluated.

Mission Risk Impact Criteria

Impact	Description
Severe	If the mission risk statement were true, the effect on program objectives would be extremely strong. The program would almost certainly fail.
High	If the mission risk statement were true, the effect on program objectives would be strong. The program would most likely fail; however a small chance of success exists.
Medium	If the mission risk statement were true, the effect on program objectives would be moderate. The program is just as likely to succeed as it is to fail.
Low	If the mission risk statement were true, the effect on program objectives would be small. The program would most likely be able to succeed; however a small chance of success exists.
Minimal	If the mission risk statement were true, the effect on program objectives would be negligible. The program would almost certainly succeed.
Unknown	More information is needed to evaluate impact.
Not Evaluated	The mission risk is not relevant at this point in time. It was not evaluated.

Mission Risk Exposure Matrix

Probability \ Impact	Severe	High	Medium	Low	Minimum
Maximum	Severe	High	Medium	Low	Minimal
High	High	Medium	Low	Minimal	Minimal
Medium	Medium	Low	Minimal	Minimal	Minimal
Low	Low	Minimal	Minimal	Minimal	Minimal
Minimum	Minimal	Minimal	Minimal	Minimal	Minimal

Part 1 Example

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the *Mission Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
1. Program objectives (product, cost, schedule) are unrealistic or unachievable. *Consider* Alignment of technical, cost, and schedule objectives; inherent technical risk; technology maturity; resources available	❑ Maximum ❑ High ❑ Medium ☒ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	☒ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ☒ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability
Worked with experts in the field to ensure technical goals were reasonable; a small stretch goals. Used independent cost/schedule estimates. Our technology is considered mature or rapidly nearing maturity. Abundance of experience and expertise available through multiple suppliers either already on contract or eager to bid. The uncertainty is with the stretch goal and the "nearing" maturity technology.

Rationale for Impact
---

1 Program Objectives

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
1. Program objectives (product, cost, schedule) are unrealistic or unachievable. *Consider* Alignment of technical, cost, and schedule objectives; inherent technical risk; technology maturity; resources available	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

2 Plan

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the *Mission Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
2. The plan for developing and deploying the system is insufficient. *Consider* Acquisition or development strategy; program plan; resources; funding; schedule; roles and responsibilities	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

3 Process

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
3. The process being used to develop and deploy the system is insufficient. *Consider* Process design; measurements and controls; process efficiency and effectiveness; acquisition and development life cycles; training	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

4 Task Execution

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
4. Tasks and activities are performed ineffectively and inefficiently. *Consider* Experience and expertise of management and staff; staffing levels; experience with the acquisition and development life cycles	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

5 Coordination

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
5. Activities within each team and across teams are not coordinated appropriately. *Consider* Communication; information sharing; dependencies; relationships; partners and collaborators	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

6 External Interfaces

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
6. Work products from suppliers, partners, or collaborators will not meet the program's quality and timeliness requirements. *Consider* Applications; software; systems or sub-systems; hardware	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

7 Information Management

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
7. The program's information is not managed appropriately. *Consider* Usability; confidentiality; integrity; availability	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

8 Technology

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
8. The program team does not have the tools and technologies it needs to develop the system and transition it to operations. *Consider* Software applications; infrastructure; systems; databases	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

9 Facilities and Equipment

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
9. Facilities and equipment are insufficient to support the program. *Consider* Building; physical work spaces; support equipment; supplies; other resources	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

10 Organizational Conditions

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
10. Enterprise, organizational, and political conditions are hindering completion of program activities. *Consider* Stakeholder sponsorship; actions of upper management; effect of laws, regulations, and policies	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

11 Compliance

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
11. The program does not comply with all relevant policies, laws, and regulations. *Consider* Policies; laws; regulations; standards of care	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

12 Event Management

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
12. The program has insufficient capacity and capability to identify and manage potential events and changing circumstances. *Consider* Risk management plan, process, and tools; schedule slack; funding reserve; risk mitigation plans; program continuity and contingency plans; opportunity management plan, process, and tools	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

13 Requirements

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
13. System requirements are not well understood. *Consider* Customer, user, and stakeholder requirements and needs; functional and non-functional requirements; operational requirements; system growth and expansion needs; technology maturity	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

14 Design and Architecture

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
14. The design and architecture are insufficient to meet system requirements and provide the desired operational capability. *Consider* Interfaces; dependencies; software and system architecture; operational requirements; technology maturity	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

15 System Capability

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
15. The system will not satisfactorily meet its requirements. *Consider* Functional; performance; operational; reliability; security; safety; usability; maintainability; technology maturity	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

16 System Integration

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
16. The system will not sufficiently integrate and interoperate with other systems when deployed. *Consider* Interfaces; applications; tools; hardware; data; technology maturity	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

17 Operational Support

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
17. The system will not effectively support operations. *Consider* Business and operational workflows; support of organizational and enterprise missions; operational risk mitigation; disaster recovery, contingency and business continuity plans; technology maturity	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

18 Adoption Barriers

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
18. Barriers to customer/user adoption of the system have not been managed appropriately. *Consider* User acceptance; stakeholder sponsorship; transition to operations; user support	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

19 Operational Preparedness

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
19. People will not be prepared to operate, use, and maintain the system. *Consider* Policies; procedures; training	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

20 Certification and Accreditation

Directions:

1. Evaluate the likelihood that the mission risk statement is true. Refer to the *Mission Risk Probability Criteria* for a definition of each probability value.
2. Evaluate the magnitude of the impact on key objectives if the mission risk statement were true. Refer to the *Mission Risk Impact Criteria* for a definition of each impact value.
3. Use the Mission *Risk Exposure Matrix* to determine risk exposure using the values of probability and impact.
4. Document your rationale for the probability value and, when appropriate, the impact value you selected above.

Mission Risk Statement	Probability	Impact	Risk Exposure
20. The system will not be appropriately certified and accredited for operational use. *Consider* Compliance with policies, laws, and regulations; acceptable mitigation of risk	❑ Maximum ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated	❑ Severe ❑ High ❑ Medium ❑ Low ❑ Minimal ❑ Unknown ❑ Not Evaluated

Rationale for Probability

Rationale for Impact

Part 2: Documenting the Mission Risk Profile

Directions: Record the values of impact, probability, and risk exposure for each mission risk in the *Mission Risk Profile* table on the next two pages. An example of a completed *Mission Risk Profile* spreadsheet is shown below.

Mission Risk Profile

Mission Risk	Impact	Probability	Risk Exposure
1. Program objectives (product, cost, schedule) are unrealistic or unachievable.	Severe	High	High
2. The plan for developing and deploying the system is insufficient.	Severe	Low	Low
. . .	. . .	. . .	. . .
11. The program does not comply with all relevant policies, laws, and regulations.	Low	Low	Minimal
. . .	. . .	. . .	. . .
19. People will not be prepared to operate, use, and maintain the system.	Severe	Low	Low
20. The system will not be appropriately certified and accredited for operational use.	Severe	High	High

Mission Risk Profile

Mission Risk	Impact	Probability	Risk Exposure
1. Program objectives (product, cost, schedule) are unrealistic or unachievable.			
2. The plan for developing and deploying the system is insufficient.			
3. The process being used to develop and deploy the system is insufficient.			
4. Tasks and activities are performed ineffectively and inefficiently.			
5. Activities within each team and across teams are not coordinated appropriately.			
6. Work products from suppliers, partners, or collaborators will not meet the program's quality and timeliness requirements.			
7. The program's information is not managed appropriately.			
8. The program team does not have the tools and technologies it needs to develop the system and transition it to operations.			
9. Facilities and equipment are insufficient to support the program.			
10. Enterprise, organizational, and political conditions are hindering completion of program activities.			

Mission Risk Profile (cont.)

Mission Risk	Impact	Probability	Risk Exposure
11. The program does not comply with all relevant policies, laws, and regulations.			
12. The program has insufficient capacity and capability to identify and manage potential events and changing circumstances.			
13. System requirements are not well understood.			
14. The design and architecture are insufficient to meet system requirements and provide the desired operational capability.			
15. The system will not satisfactorily meet its requirements.			
16. The system will not sufficiently integrate and interoperate with other systems when deployed.			
17. The system will not effectively support operations.			
18. Barriers to customer/user adoption of the system have not been managed appropriately.			
19. People will not be prepared to operate, use, and maintain the system.			
20. The system will not be appropriately certified and accredited for operational use.			