Project Risk Management

Reviewing Risks and Its Types

- Risk involves changes in mind, opinion, actions or place.
- Risk concerns future happenings.
  - Risk is certain (like death and taxes)--Robert Charette
    - So, we need to Manage Risks.
- Risk management are a series of steps that help a project team to understand and manage Risks.
- "A Risk is an event that may occur or not, and if occurs generally causes loss."

Reviewing Risks and Its Types

- A risk is a potential problem that might happen or not.
- Risks prevent the project form realizing the expected goals.
- Risk is the possibility of loss or injury.
  - It's better to identify it, assess its probability of occurrence, estimate its impact and establish a contingency plan (when it will occur is determined or estimate in this plan).
- Characteristics of Risks:
  - Loss
  - Uncertainty
- Positive and negative risks are commonly referred to as opportunities and threats.

Reviewing Risks and Its Types

- Types of Risks
  - Project Risks: Caused by technical aspect of work or work product and affect the project schedule or resources or cost.
  - Process Risks: Caused by formation, processes of the project or methodologies used in the project will be affected
  - *Product Risk or Technical Risks:* affect the quality or performance or even implementation possibilities.
  - *Business Risks:* affect the organization developing or procuring the software.

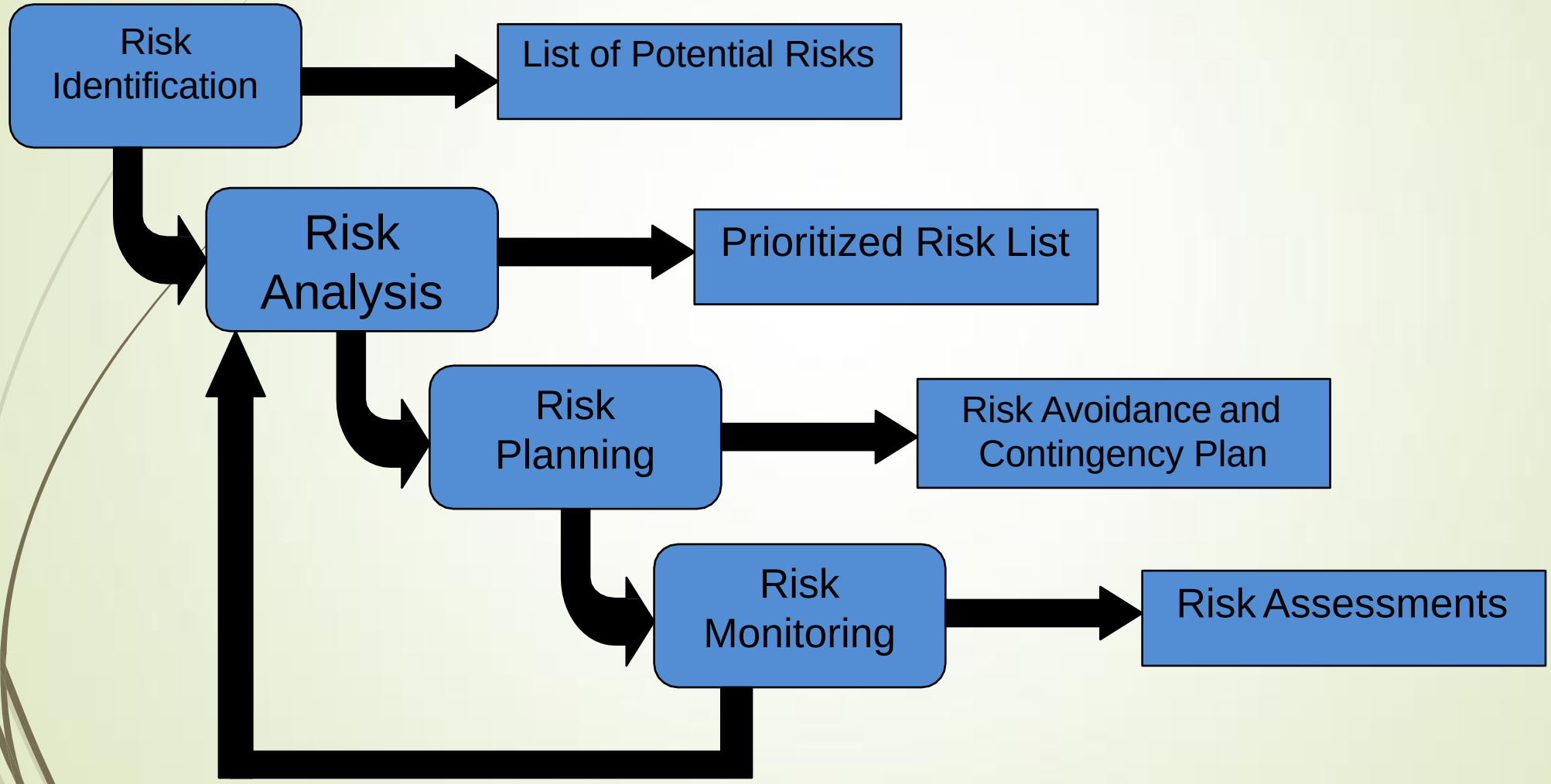
Reviewing Risks and Its Types

- *Known Risks:* easily uncover able risks.
- *Predictable Risks:* extrapolated from past project experience.
- *Unpredictable Risks:* May or may not occur and are extremely difficult to identify.

Reviewing Risks and Its Types

- Business risks
  - *Market:* business excellent product that no one wants.
  - *Strategic:* product that doesn't fit into business strategy.
  - *Sales:* product that is next to impossible to sell.
  - *Management:* losing management support due to focus / policy change
  - *Budget:* losing budgetary or personal commitment

Risk Management



PROJECT RISK MANAGEMENT

- Includes the processes of conducting risk management planning, identification, analysis, response planning, and controlling risk on a project.
- Objectives are to increase the likelihood and impact of positive events, and decrease the likelihood and impact of negative events in the project.

Project Risk Management processes

- **Plan Risk Management**—The process of defining how to conduct risk management activities for a project.
- **Identify Risks**—The process of determining which risks may affect the project and documenting their characteristics.
- **Perform Qualitative Risk Analysis**—The process of prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and impact.
- **Perform Quantitative Risk Analysis**—The process of numerically analyzing the effect of identified risks on overall project objectives.
- **Plan Risk Responses**—The process of developing options and actions to enhance opportunities and to reduce threats to project objectives.
- **Control Risks**—The process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project.

Project Risk Management processes

- Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives such as scope, schedule, cost, and quality.
- Organizations perceive risk as the effect of uncertainty on projects and organizational objectives.
- Organizations and stakeholders are willing to accept varying degrees of risk depending on their risk attitude.

Project Risk Management processes

- The risk attitudes may be influenced by a number of factors, which are broadly classified into three themes:
  - *Risk appetite*, which is the degree of uncertainty an entity is willing to take on in anticipation of a reward.
  - *Risk tolerance*, which is the degree, amount, or volume of risk that an organization or individual will withstand.
  - *Risk threshold*, which refers to measures along the level of uncertainty or the level of impact at which a stakeholder may have a specific interest. Below that risk threshold, the organization will accept the risk. Above that risk threshold, the organization will not tolerate the risk.

Plan Risk Management

- Process of defining how to conduct risk management activities for a project
- The risk management plan is vital to communicate with and obtain agreement and support from all stakeholders to ensure the risk management process is supported and performed effectively over the project life cycle.
- Careful and explicit planning enhances the probability of success for other risk management processes
- is important to provide sufficient resources and time for risk management activities and to establish an agreed upon basis for evaluating risk

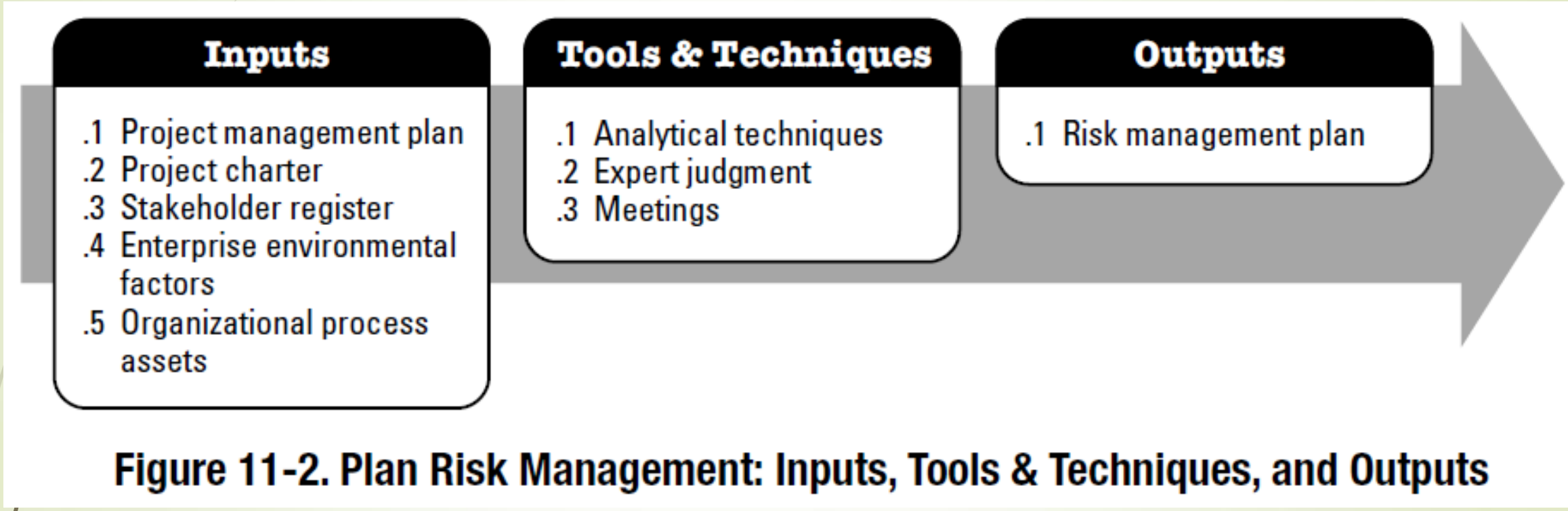


Figure 11-2. Plan Risk Management: Inputs, Tools & Techniques, and Outputs

Risk Management Plan

- **Methodology.** Defines the approaches, tools, and data sources that will be used to perform risk management on the project.
- **Roles and responsibilities.** Defines the lead, support, and risk management team members for each type of activity in the risk management plan, and clarifies their responsibilities.
- **Budgeting.** Estimates funds needed, based on assigned resources, for inclusion in the cost baseline and establishes protocols for application of contingency and management reserves.
- **Timing.** Defines when and how often the risk management processes will be performed throughout the project life cycle, establishes protocols for application of schedule contingency reserves, and establishes risk management activities for inclusion in the project schedule.

Risk Management Plan

- **Risk categories.** Provide a means for grouping potential causes of risk. A risk breakdown structure (RBS) helps the project team to look at many sources from which project risk may arise in a risk identification exercise.
- **Definitions of risk probability and impact.** The quality and credibility of the risk analysis requires that different levels of risk probability and impact be defined that are specific to the project context.

Table 11-1. Definition of Impact Scales for Four Project Objectives

Defined Conditions for Impact Scales of a Risk on Major Project Objectives (Examples are shown for negative impacts only)					
Project Objective	Relative or numerical scales are shown				
	Very low /0.05	Low /0.10	Moderate /0.20	High /0.40	Very high /0.80
Cost	Insignificant cost increase	< 10% cost increase	10 – 20% cost increase	20 – 40% cost increase	> 40% cost increase
Time	Insignificant time increase	< 5% time increase	5 – 10% time increase	10 – 20% time increase	> 20% time increase
Scope	Scope decrease barely noticeable	Minor areas of scope affected	Major areas of scope affected	Scope reduction unacceptable to sponsor	Project end item is effectively useless
Quality	Quality degradation barely noticeable	Only very demanding applications are affected	Quality reduction requires sponsor approval	Quality reduction unacceptable to sponsor	Project end item is effectively useless

This table presents examples of risk impact definitions for four different project objectives. They should be tailored in the Risk Management Planning process to the individual project and to the organization's risk thresholds. Impact definitions can be developed for opportunities in a similar way.

Risk Management Plan

- **Probability and impact matrix.** A probability and impact matrix is a grid for mapping the probability of each risk occurrence and its impact on project objectives if that risk occurs.
- R**evised stakeholders' tolerances**
- **Reporting formats**
- **Tracking**

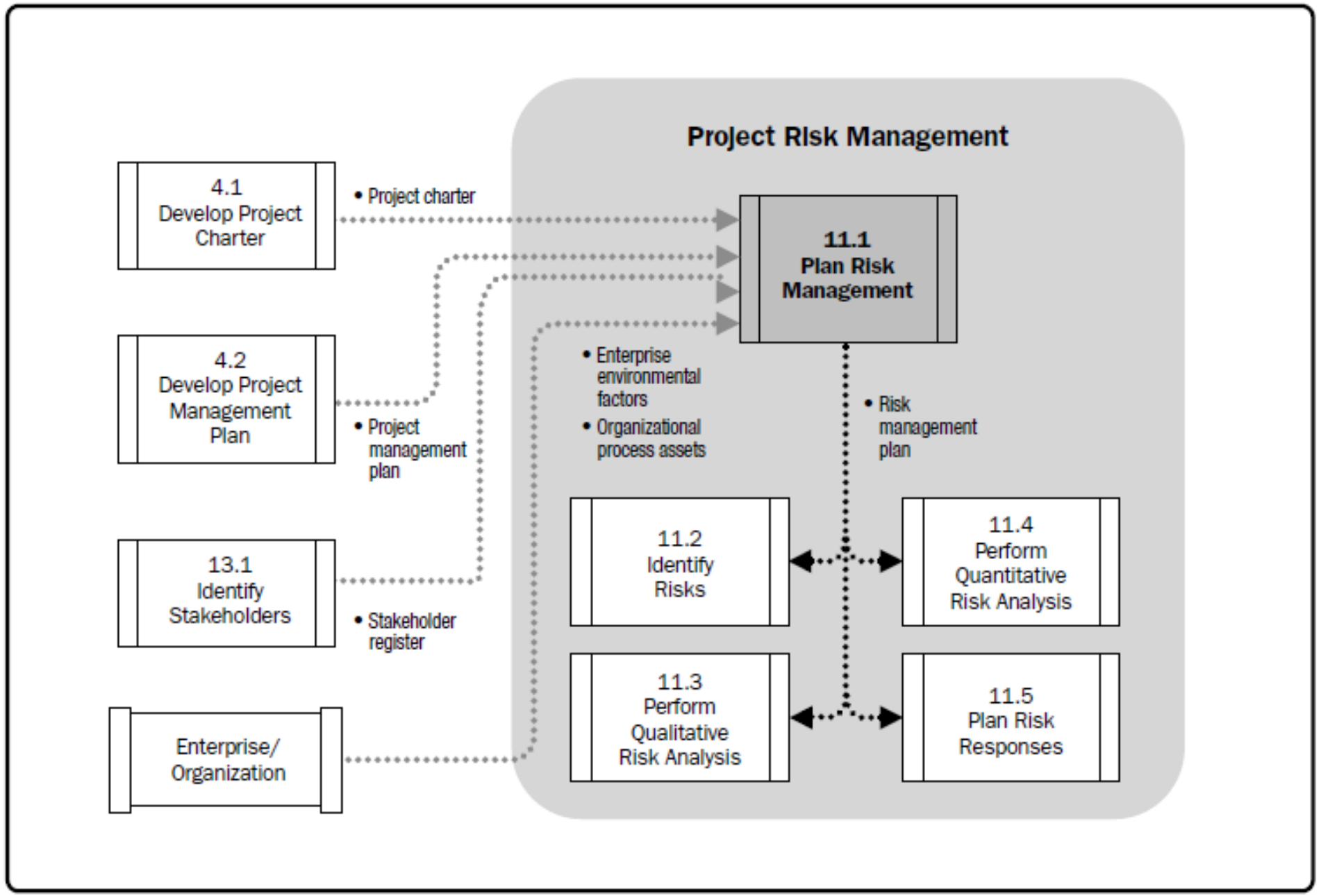


Figure 11-3. Plan Risk Management Data Flow Diagram

Identify Risks

- Process of determining which risks may affect the project and documenting their characteristics.
- Key benefit of this process is the documentation of existing risks and the knowledge and ability it provides to the project team to anticipate events.

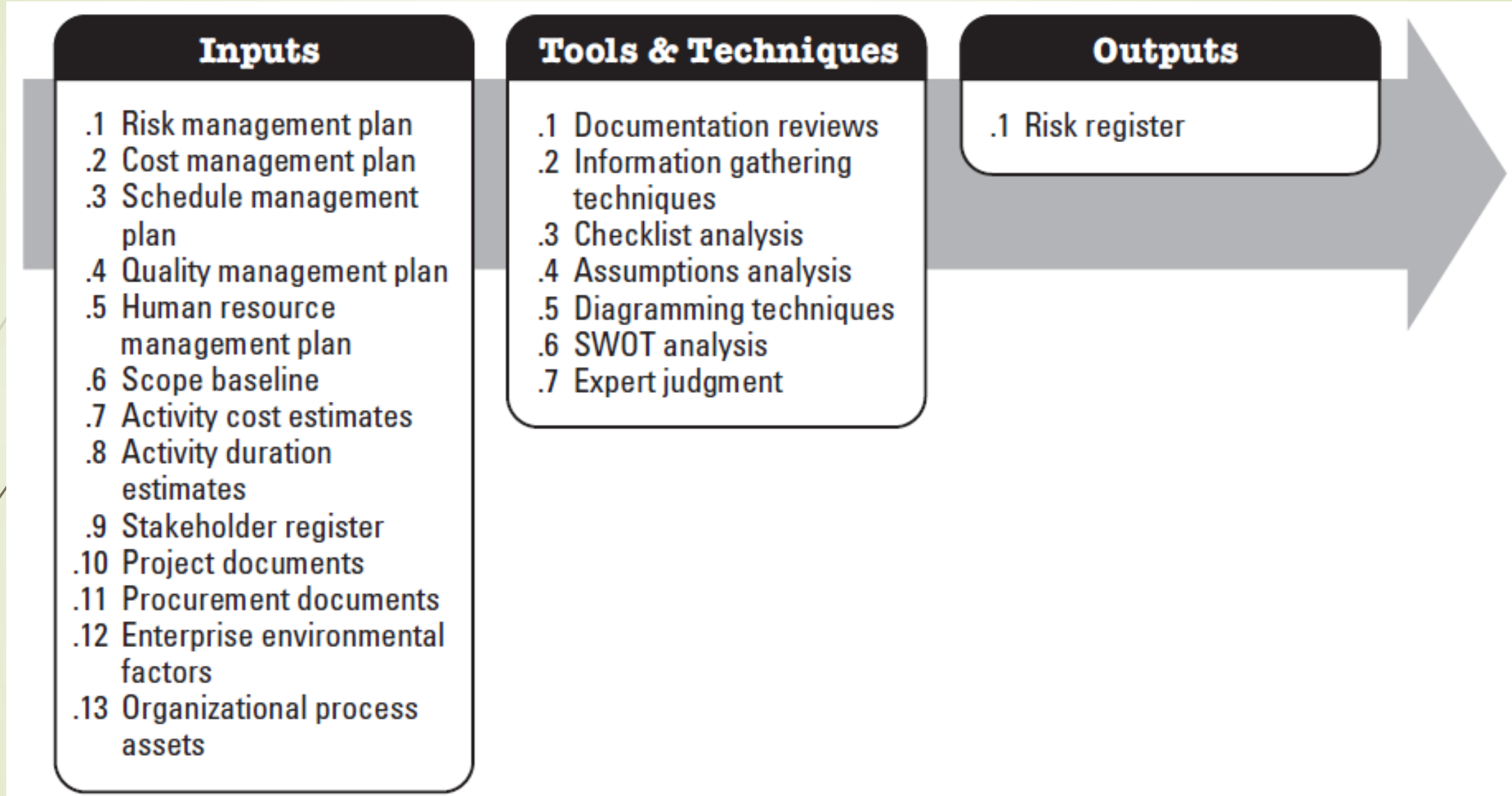


Figure 11-5. Identify Risks: Inputs, Tools & Techniques, and Outputs

Information Gathering Techniques

- **Brainstorming.** The goal of brainstorming is to obtain a comprehensive list of project risks
- **Delphi technique.** The Delphi technique is a way to reach a consensus of experts.
- **Interviewing.** Interviewing experienced project participants, stakeholders, and subject matter experts helps to identify risks.
- **Root cause analysis.** Root-cause analysis is a specific technique used to identify a problem, discover the underlying causes that lead to it, and develop preventive action.

Diagramming Techniques

- **Cause and effect diagrams.** These are also known as Ishikawa or fishbone diagrams and are useful for identifying causes of risks.
- **System or process flow charts.** These show how various elements of a system interrelate and the mechanism of causation.
- **Influence diagrams.** These are graphical representations of situations showing causal influences, time ordering of events, and other relationships among variables and outcomes.

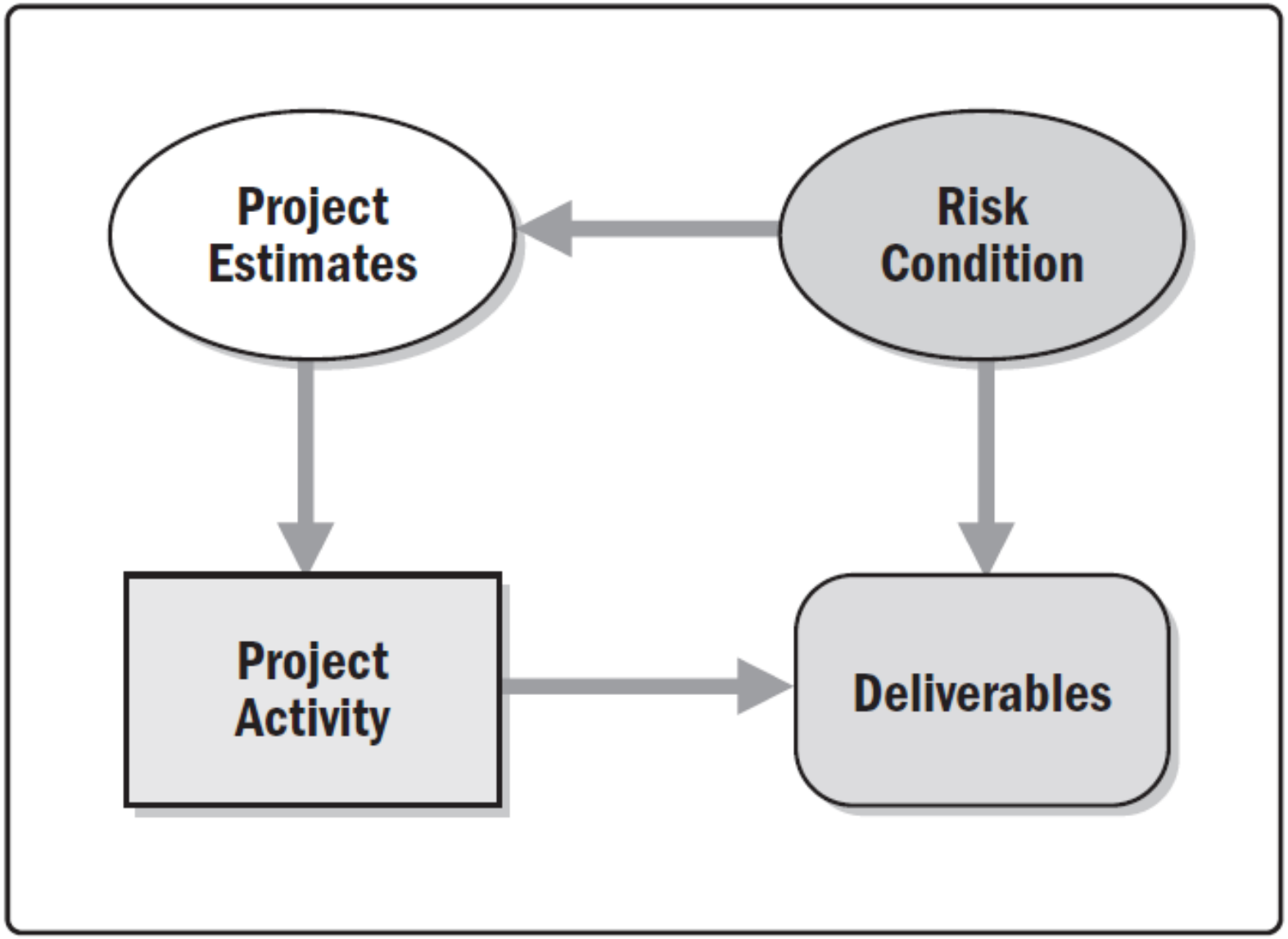


Figure 11-7. Influence Diagram

Risk Register

- The risk register is a document in which the results of risk analysis and risk response planning are recorded.
  - **List of identified risks**
  - **List of potential responses**

Perform Qualitative Risk Analysis

- process of prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and impact
- assesses the priority of identified risks using their relative probability or likelihood of occurrence, the corresponding impact on project objectives
- enables project managers to reduce the level of uncertainty and to focus on high-priority risks

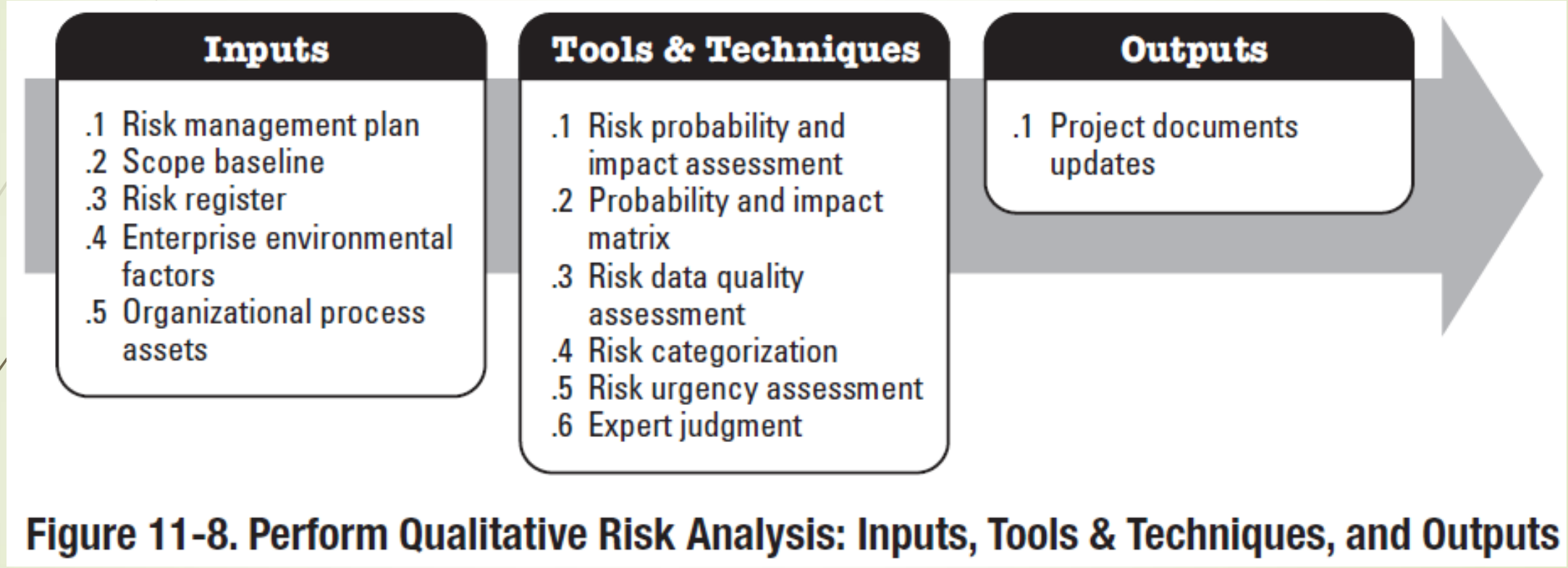


Figure 11-8. Perform Qualitative Risk Analysis: Inputs, Tools & Techniques, and Outputs

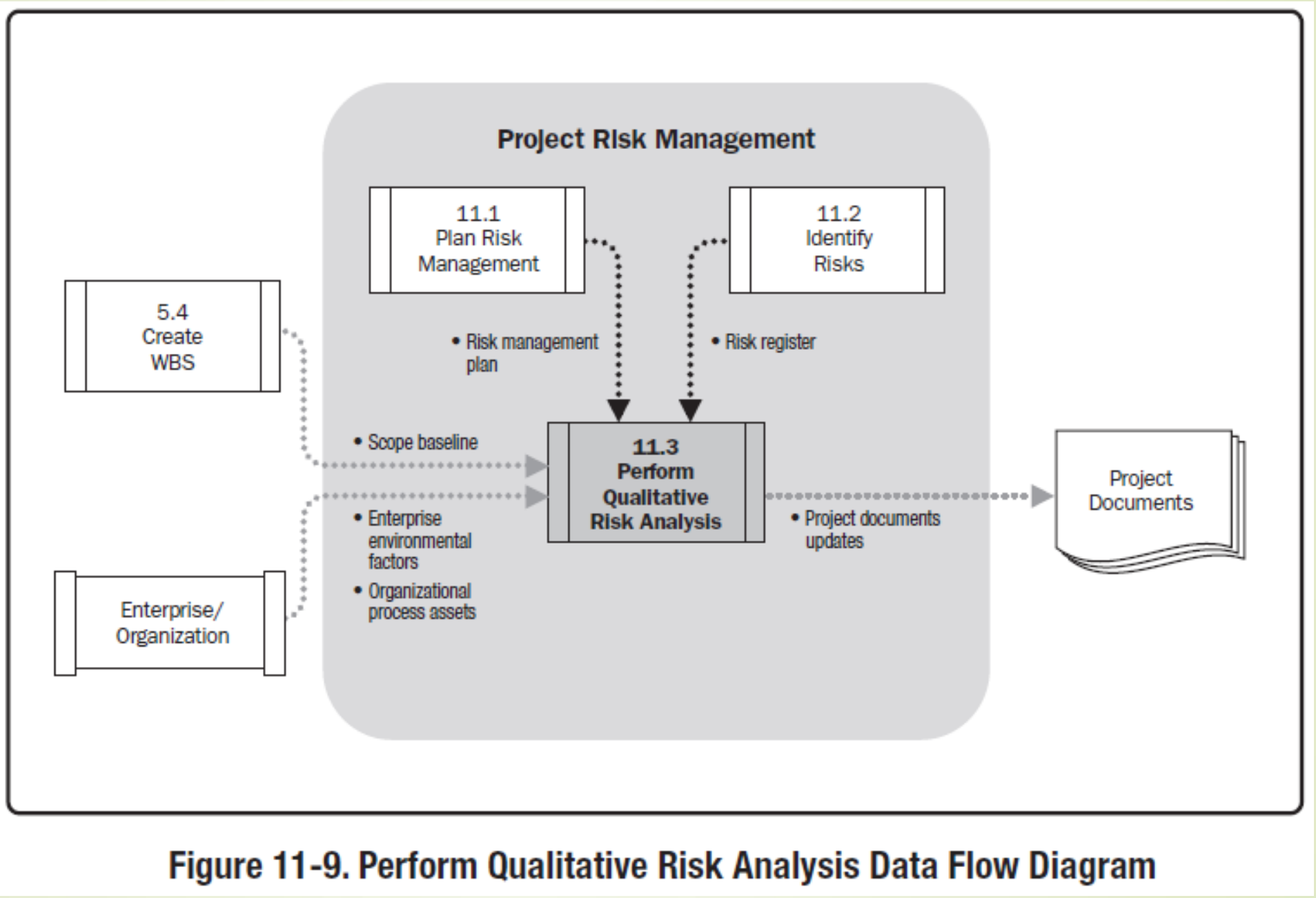


Figure 11-9. Perform Qualitative Risk Analysis Data Flow Diagram

Probability and Impact Matrix

Probability	Threats					Opportunities				
0.90	0.05	0.09	0.18	0.36	0.72	0.72	0.36	0.18	0.09	0.05
0.70	0.04	0.07	0.14	0.28	0.56	0.56	0.28	0.14	0.07	0.04
0.50	0.03	0.05	0.10	0.20	0.40	0.40	0.20	0.10	0.05	0.03
0.30	0.02	0.03	0.06	0.12	0.24	0.24	0.12	0.06	0.03	0.02
0.10	0.01	0.01	0.02	0.04	0.08	0.08	0.04	0.02	0.01	0.01
	0.05/ Very Low	0.10/ Low	0.20/ Moderate	0.40/ High	0.80/ Very High	0.80/ Very High	0.40/ High	0.20/ Moderate	0.10/ Low	0.05/ Very Low

Impact (numerical scale) on an objective (e.g., cost, time, scope or quality)

Each risk is rated on its probability of occurring and impact on an objective if it does occur. The organization's thresholds for low, moderate or high risks are shown in the matrix and determine whether the risk is scored as high, moderate or low for that objective.

Figure 11-10. Probability and Impact Matrix

Perform Quantitative Risk Analysis

- process of numerically analyzing the effect of identified risks on overall project objectives
- produces quantitative risk information to support decision making in order to reduce project uncertainty

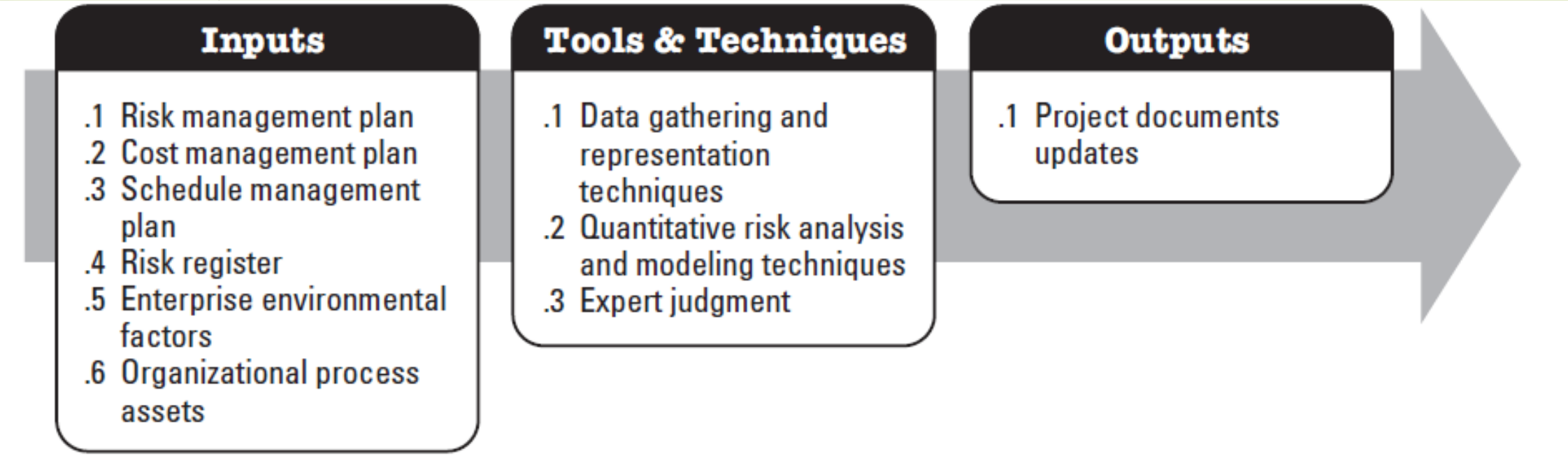


Figure 11-11. Perform Quantitative Risk Analysis: Inputs, Tools & Techniques, and Outputs

Data Gathering and Representation Techniques

- **Interviewing.** Interviewing techniques draw on experience and historical data to quantify the probability and impact of risks on project objectives.

Range of Project Cost Estimates

WBS Element	Low	Most Likely	High
Design	$4M	$6M	$10M
Build	$16M	$20M	$35M
Test	$11M	$15M	$23M
Total Project	$31M	$41M	$68M

Interviewing relevant stakeholders helps determine the three-point estimates for each WBS element for triangular, beta or other distributions. In this example, the likelihood of completing the project at or below the most likely estimate of $41 million is relatively small as shown in the simulation results in Figure 11-17 (Cost Risk Simulation Results).

Figure 11-13. Range of Project Cost Estimates Collected During the Risk Interview

- **Probability distributions.**
  - Continuous probability distributions, which are used extensively in modeling and simulation, represent the uncertainty in values such as durations of schedule activities and costs of project components.
  - Discrete distributions can be used to represent uncertain events, such as the outcome of a test or a possible scenario in a decision tree.

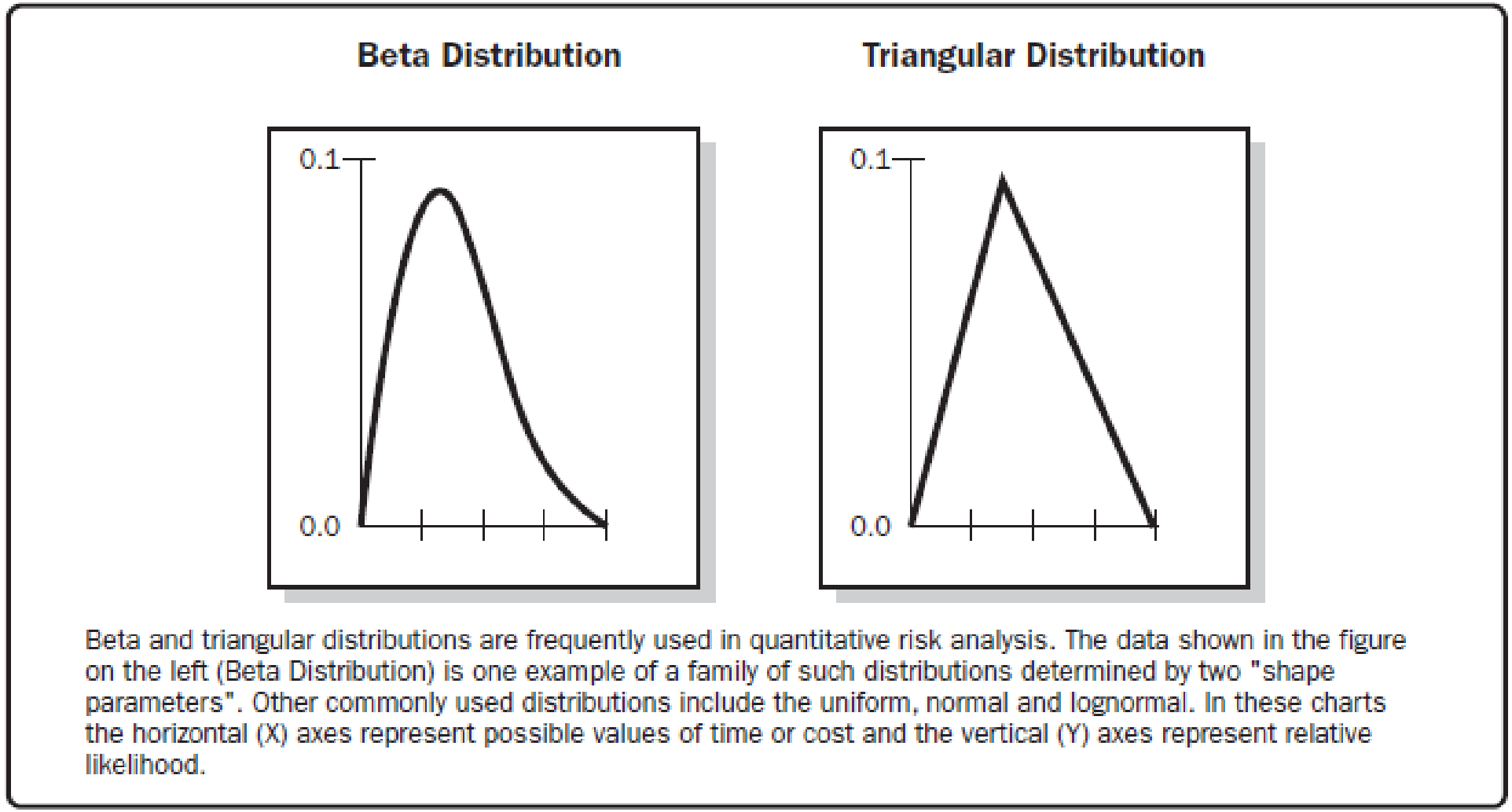


Figure 11-14. Examples of Commonly Used Probability Distributions

Quantitative Risk Analysis and Modeling Techniques

- **Sensitivity analysis.**
  - Sensitivity analysis helps to determine which risks have the most potential impact on the project.
  - It helps to understand how the variations in project's objectives correlate with variations in different uncertainties.
- One typical display of sensitivity analysis is the tornado diagram, which is useful for comparing relative importance and impact of variables that have a high degree of uncertainty to those that are more stable.

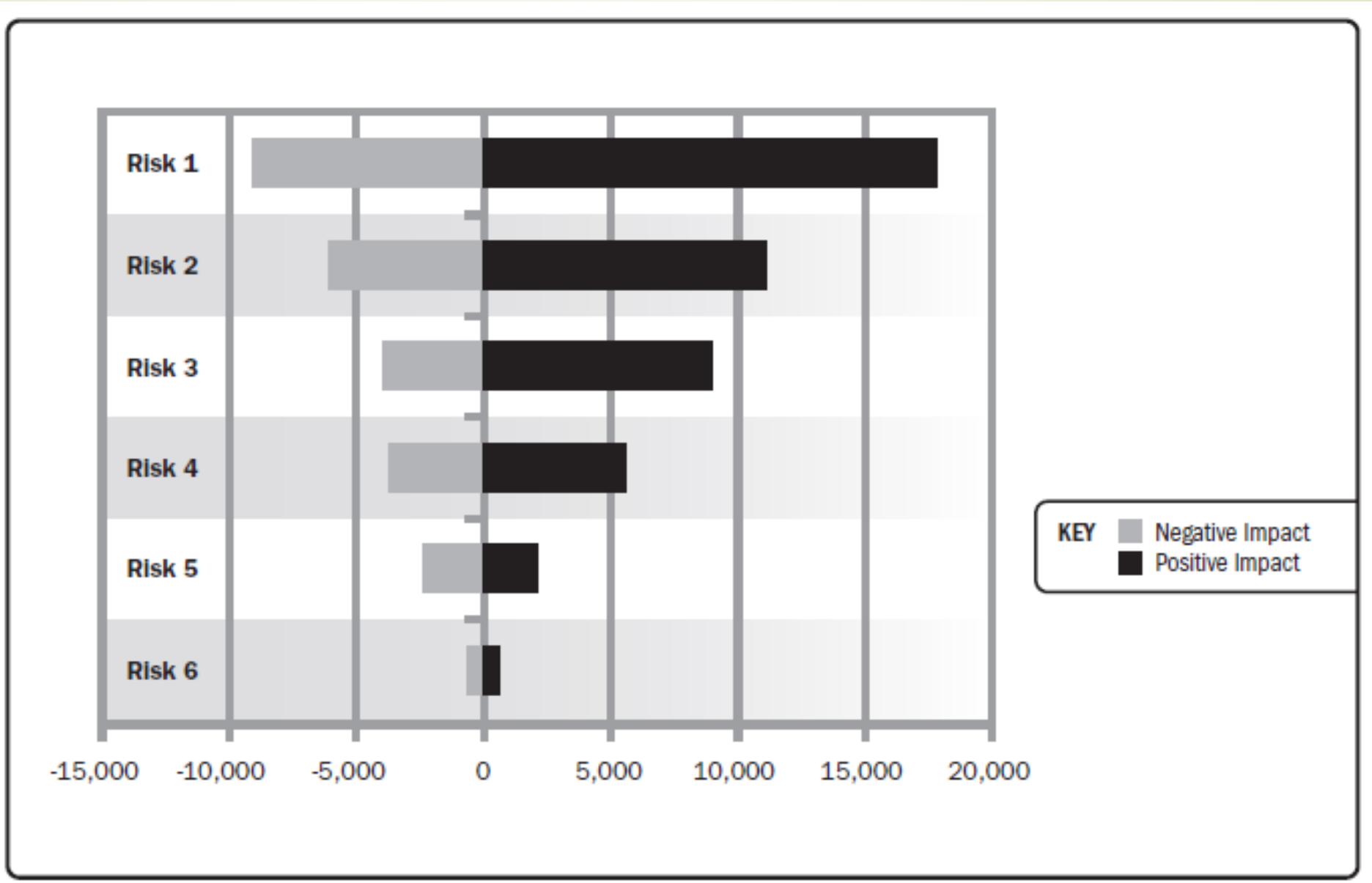


Figure 11-15. Example of Tornado Diagram

Expected monetary value analysis

- Expected monetary value (EMV) analysis is a statistical concept that calculates the average outcome when the future includes scenarios that may or may not happen (i.e., analysis under uncertainty).
- Study of decision making criteria for each decision event combination along with the associated probabilities of different profit conditions.
- Decision Tree and Risk Exposure methods

Modeling and simulation

- A project simulation uses a model that translates the specified detailed uncertainties of the project into their potential impact on project objectives.
- Simulations are typically performed using the Monte Carlo technique.
- In a simulation, the project model is computed many times (iterated), with the input values (e.g., cost estimates or activity durations) chosen at random for each iteration from the probability distributions of these variables.
- A histogram (e.g., total cost or completion date) is calculated from the iterations.
  - For a cost risk analysis, a simulation uses cost estimates.
  - For a schedule risk analysis, the schedule network diagram and duration estimates are used.

Perform Quantitative Risk Analysis: Outputs Project Documents Updates

- Probabilistic analysis of the project
- Probability of achieving cost and time objectives
- Prioritized list of quantified risks
- Trends in quantitative risk analysis results

Plan Risk Responses

- of developing options and actions to enhance opportunities and to reduce threats to project objectives
- addresses the risks by their priority, inserting resources and activities into the budget, schedule and project management plan as needed

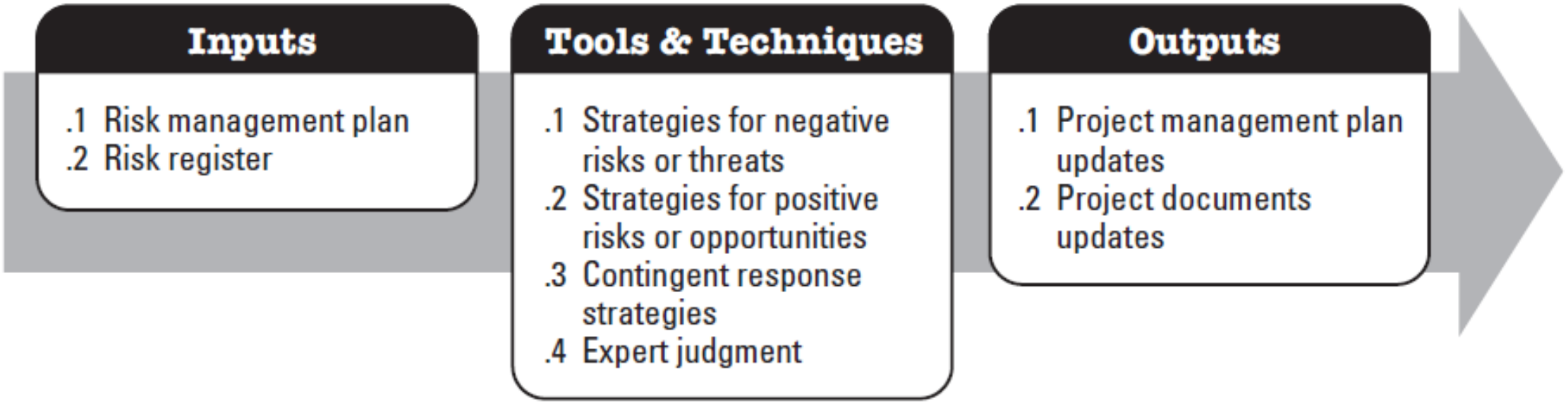


Figure 11-18. Plan Risk Responses: Inputs, Tools & Techniques, and Outputs

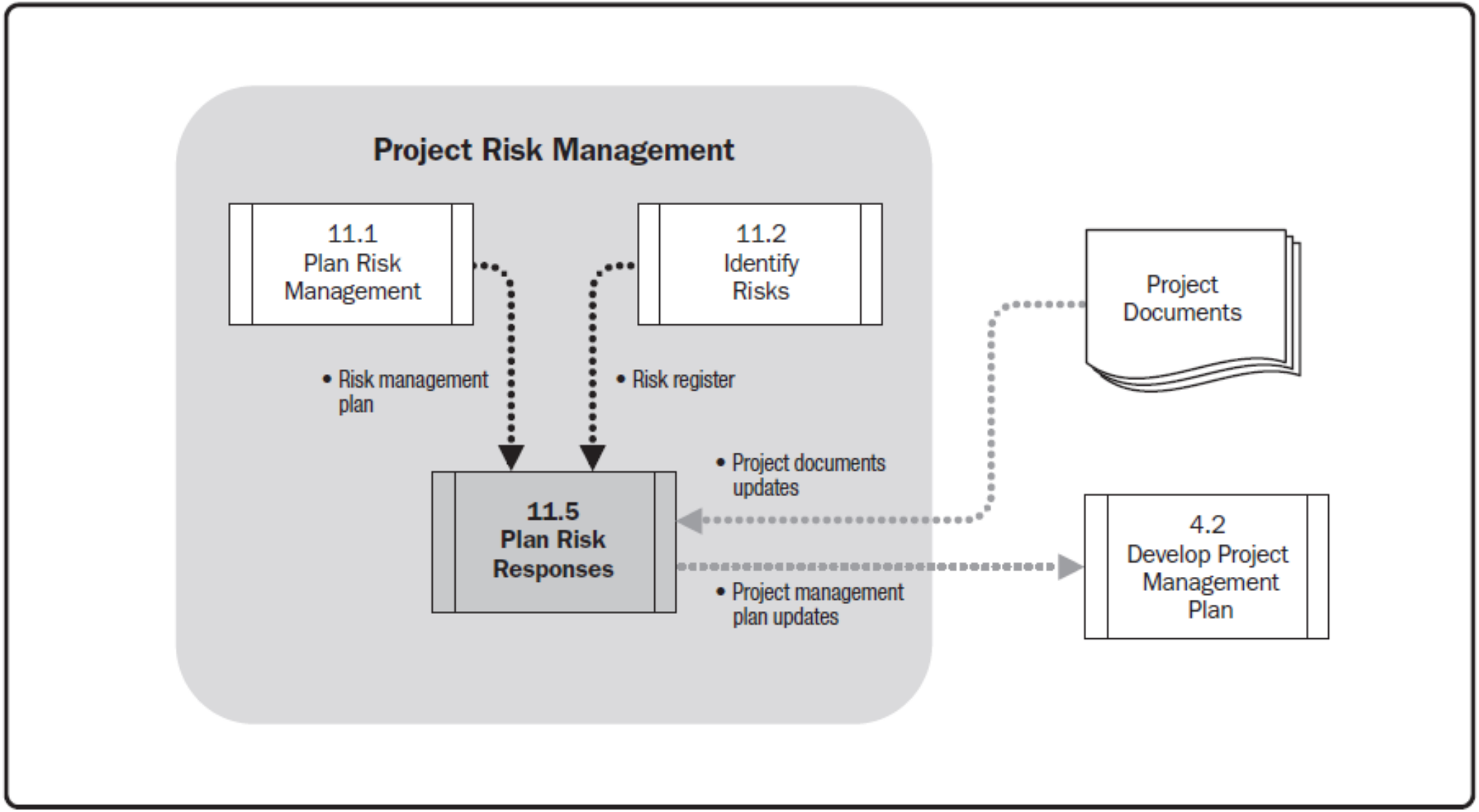


Figure 11-19. Plan Risk Responses Data Flow Diagram

Strategies for Negative Risks or Threats

- Three strategies, which typically deal with threats or risks that may have negative impacts on project objectives if they occur, are: ***avoid***, ***transfer***, **and *mitigate***.
- The fourth strategy, ***accept***, can be used for negative risks or threats as well as positive risks or opportunities.
- These strategies should be chosen to match the risk's probability and impact on the project's overall objectives.
  - Avoidance and mitigation strategies are usually good strategies for critical risks with high impact,
  - Transference and acceptance are usually good strategies for threats that are less critical and with low overall impact.

- **Avoid:** It usually involves changing the project management plan to eliminate the threat entirely.
- **Transfer.** Transferring the risk simply gives another party responsibility for its management—it does not eliminate it.
- **Mitigate.** Risk mitigation is a risk response strategy whereby the project team acts to reduce the probability of occurrence or impact of a risk.
- **Accept.** Risk acceptance is a risk response strategy whereby the project team decides to acknowledge the risk and not take any action unless the risk occurs.

Strategies for Positive Risks or Opportunities

- **Exploit.** The exploit strategy may be selected for risks with positive impacts where the organization wishes to ensure that the opportunity is realized.
- **Enhance.** The enhance strategy is used to increase the probability and/or the positive impacts of an opportunity. Identifying and maximizing key drivers of these positive-impact risks may increase the probability of their occurrence.
- **Share.** Sharing a positive risk involves allocating some or all of the ownership of the opportunity to a third party who is best able to capture the opportunity for the benefit of the project
- **Accept.** Accepting an opportunity is being willing to take advantage of the opportunity if it arises, but not actively pursuing it.

Control Risks

- process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project.
- improves efficiency of the risk approach throughout the project life cycle to continuously optimize risk responses.

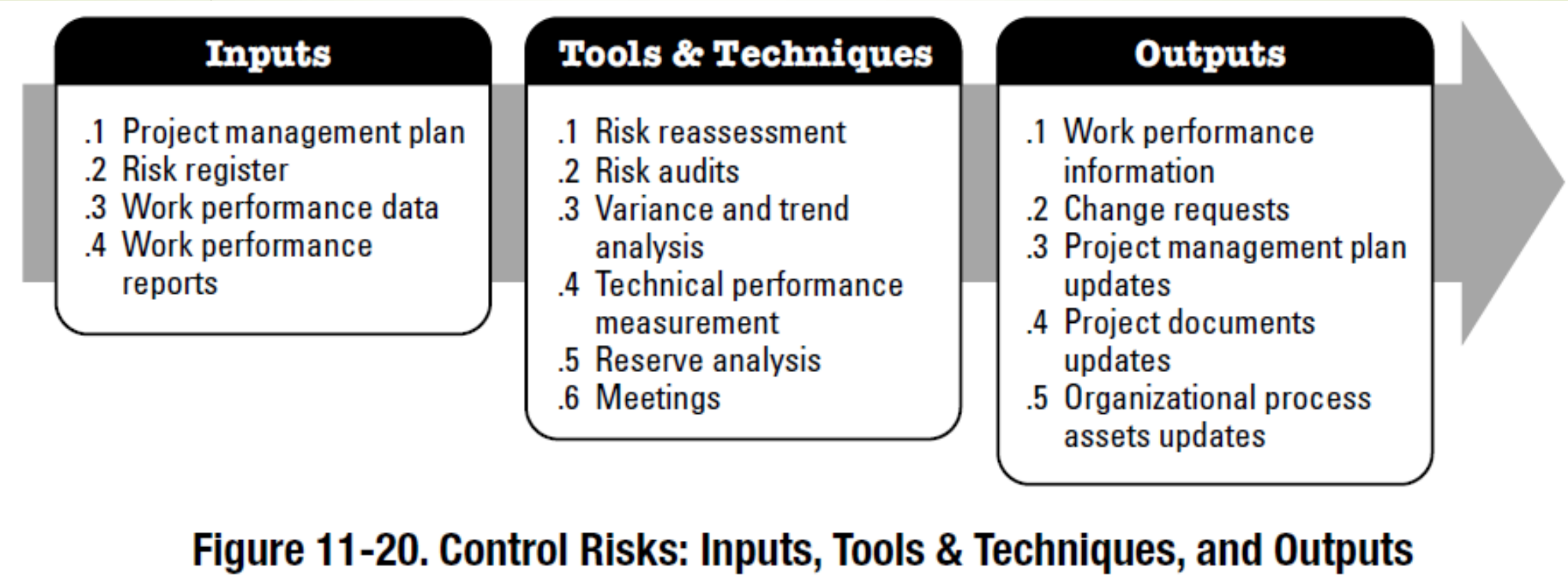


Figure 11-20. Control Risks: Inputs, Tools & Techniques, and Outputs

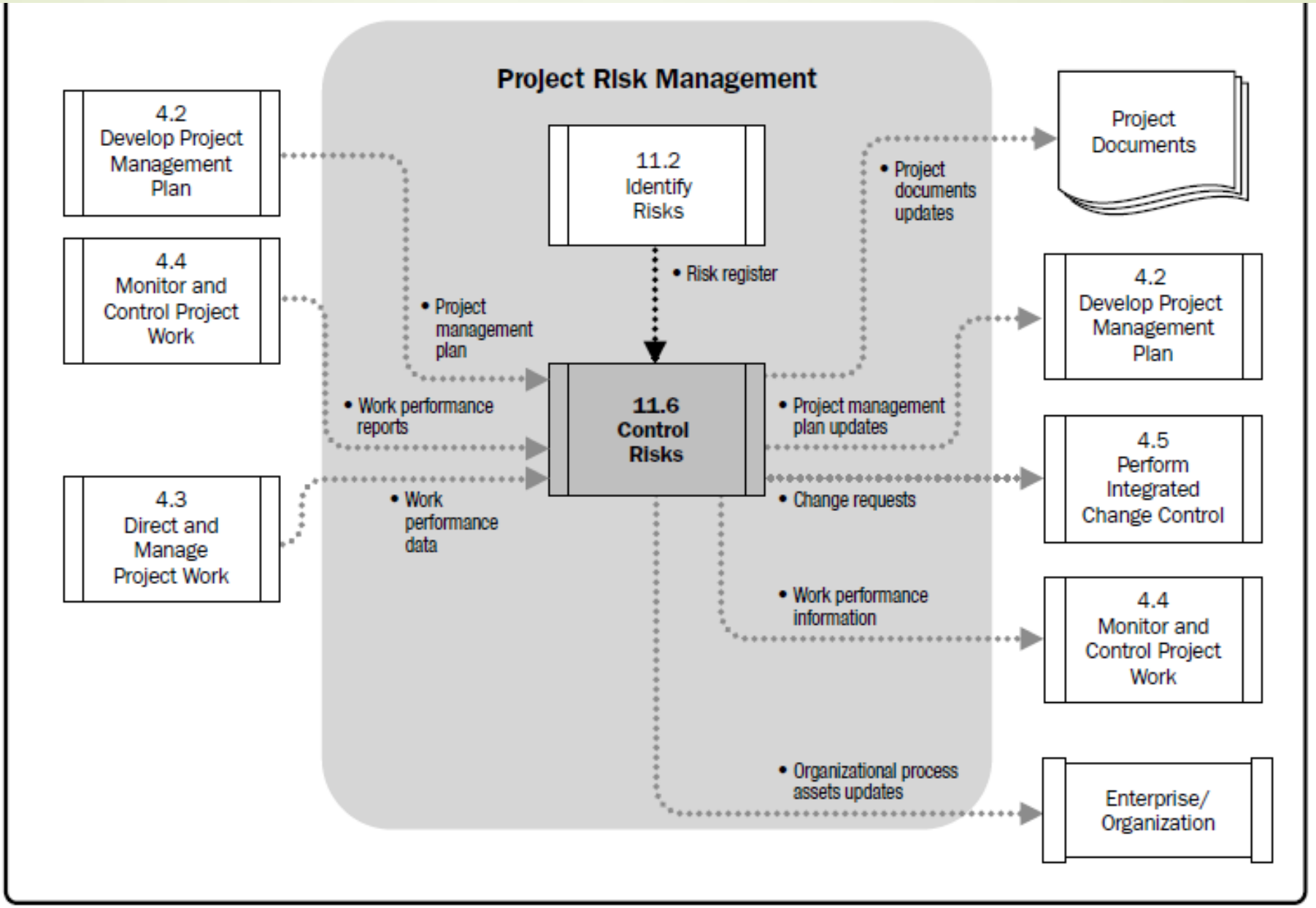


Figure 11-21. Control Risks Data Flow Diagram