ESTIMATING AND DEPICTING RISK DURING LARGE SCALE COMBAT OPERATIONS

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Risk management is an operational research area that has received increased attention over the last few decades. Civilian organizations use risk management frameworks to help supervisors make informed operational decisions. Army risk management doctrine lacks techniques needed to facilitate operations process decision-making during large scale combat operations. This thesis employed a qualitative methodology and content analysis design to compare civilian risk management frameworks and adapt techniques applicable to Army operations. Adapted techniques include framing, treatment options, and risk matrix tailoring. These adapted techniques can more accurately estimate and depict risk during large scale combat operations in a manner which facilitates commander decision-making.

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ABSTRACT

ESTIMATING AND DEPICTING RISK DURING LARGE SCALE COMBAT OPERATIONS, by MAJ Derek E. Taylor, 164 pages.

Risk management is an operational research area that has received increased attention over the last few decades. Civilian organizations use risk management frameworks to help supervisors make informed operational decisions. Army risk management doctrine lacks techniques needed to facilitate operations process decision-making during large scale combat operations. This thesis employed a qualitative methodology and content analysis design to compare civilian risk management frameworks and adapt techniques applicable to Army operations. Adapted techniques include framing, treatment options, and risk matrix tailoring. These adapted techniques can more accurately estimate and depict risk during large scale combat operations in a manner which facilitates commander decision-making.

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ACRONYMS

ADP	Army Doctrine Publication
ADRP	Army Doctrine and Reference Publication
ATP	Army Techniques Publication
CJCSM	Chairman of the Joint Chiefs of Staff Manual
COA	Course of Action
DA PAM	Department of the Army Pamphlet
DOD	Department of Defense
DRAW	Deliberate Risk Assessment Worksheet
FM	Field Manual
HQDA	Headquarters Department of the Army
IEC	International Electrotechnical Commission
IRGC	International Risk Governance Council
IRM	Institute of Risk Management
ISO	International Organization for Standardization
JP	Joint Publication
JPP	Joint Planning Process
JRAM	Joint Risk Analysis Methodology
MA	Mission Analysis
MDMP	Military Decision Making Process
OPORD	Operations Order
RM	Risk Management
RAM	Risk Assessment Matrix
WARNORD	Warning Order

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CHAPTER 1

INTRODUCTION

Background

Risk management (RM) is an operation's research area which has received increased attention over the last few decades. This thesis defines RM as "the process to identify, assess, and control risks and make decisions that balance risk cost with mission benefits."[1] While most RM publications focus on areas such as manufacturing or finance, RM equally applies to military operations.[2] Most military planners do not have RM knowledge outside published Army doctrine. As a result, planners rely on doctrinal RM techniques and tools to assess risks and make recommendations to supervisors.[3]

Casualty data after Operations Desert Shield and Desert Storm (1990-1991) drove the need for RM doctrine. In these conflicts, accidents accounted for seventy-five percent of Army losses. Only five percent resulted from fratricide, and only twenty percent from enemy action.[4] As depicted in Table 1, Desert Shield and Desert Storm accidental loss percentages far exceeded accidental loss percentages from Vietnam, Korea, and World

[1] Joint Chiefs of Staff (JCS), Joint Publication (JP) 3-0, *Joint Operations* (Washington, DC: Government Printing Office, 2017), GL-14.

[2] Jon W. Meredith, "Operational Risk and the American Way of Warfare" (monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 2011), 11.

[3] F. L. Smith, "A History of the U.S. Army in Operations Research" (master's thesis, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 1967), 2.

[4] Headquarters, Department of the Army (HQDA), Field Manual (FM) 100-14, *Risk Management* (Washington, DC: Government Printing Office, 1998), 1-2.

War II.[5] Senior leaders decided integrating RM into operations would help preserve combat power.[6] This led to the Army's first RM publication, FM 100-14 *Risk Management* (1998), which introduced the RM framework still used today.

Table 1. Battle and Non-battle Casualties

Army	World War II 1942–1945	Korea 1950–1953	Vietnam 1965–1972	Desert Shield/ Storm[1] 1990–1991
Accidents	56%	44%	54%	75%
Friendly Fire	1%	1%	1%	5%
Enemy Action	43%	55%	45%	20%

[1]These numbers include the relatively long buildup time and short period of combat action

Source: Headquarters, Department of the Army, Field Manual 100-14, *Risk Management* (Washington, DC: Government Printing Office, 1998), 1-2.
NOTE: Casualty percentages due to accidental causes rose dramatically during Operations Desert Shield and Desert Storm.

FM 100-14 defined RM as a process used to identify, assess, and control risks. The manual introduced a RM framework containing three principles and a five-step process. FM 100-14 articulated principles included: (1) integrating risk management into mission planning, preparation, and execution, (2) making risk decisions at the appropriate level in the chain of command, and (3) accepting no unnecessary risk. FM 100-14 steps included: (1) identifying hazards, (2) assessing hazards to determine risks, (3) developing

[5] HQDA, FM 100-14, 1-2.

[6] Ibid., ii.

controls and making risk decisions, (4) implementing controls, and (5) supervising and evaluating.[7] Figure 1 depicts the five-step process.

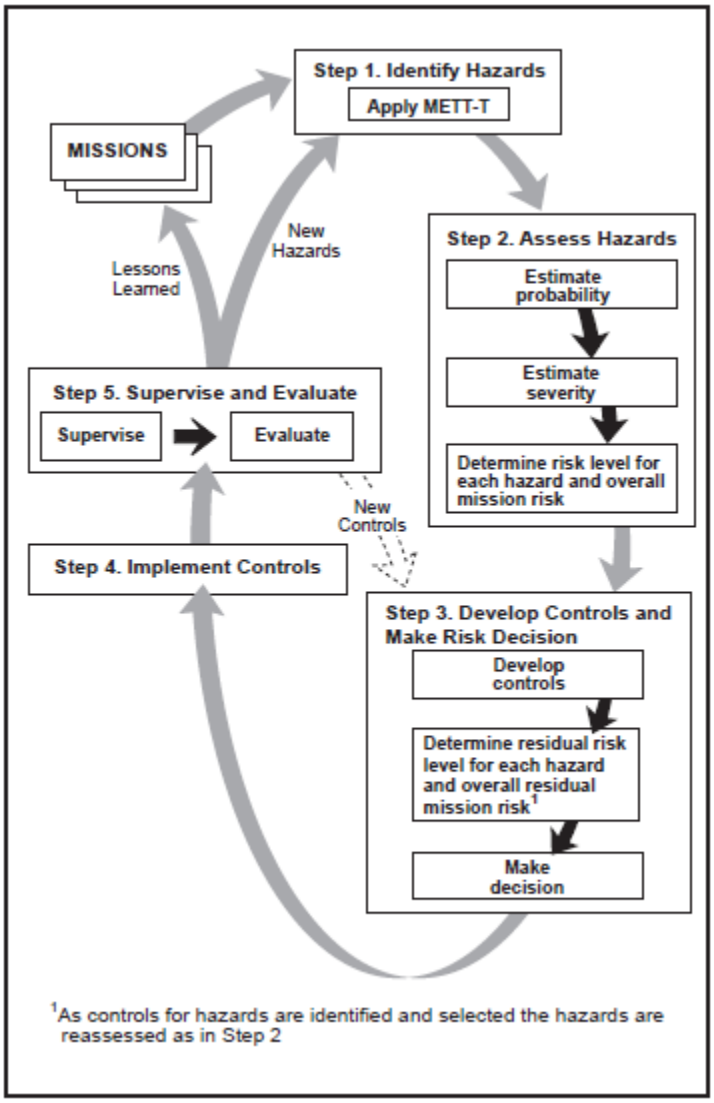

Figure 1. Army Risk Management Cycle

Source: Headquarters, Department of the Army, Field Manual 100-14, *Risk Management* (Washington, DC: Government Printing Office, 1998), 2-19.
NOTE: Army's first RM process contained five cyclical steps. RM helped commanders identify hazards and develop controls throughout mission execution. RM also provided lessons learned to future mission planning.

[7] HQDA, FM 100-14, 1-1.

FM 100-14 characterized risk by a hazard's severity and probability. Hazards, according to FM 100-14, may result from an enemy, adversary, or environmental condition.[8] More recent publications made a distinction between "hazard" and "threat" with hazard referring to environmental conditions and threat referring to enemy actions.[9] As used in this thesis, "hazard" encompasses both environmental conditions and enemy actions.

In 2001 the Air Land Sea Application Center published FM 3-100.12 *Risk Management,* a multiservice tactics, techniques, and procedures manual. This manual emphasized RM as a means to facilitate interoperability. FM 3-100.12 introduced a framework with four RM principles and a slightly modified five-step process. These principles include: (1) accepting no unnecessary risk, (2) making risk decisions at the appropriate level, (3) accepting risk when benefits outweigh costs, and (4) anticipating and managing risk by planning.[10] The five-step process replaced "hazard" with "threat" and included minor adjustments to sub-steps. Figure 2 depicts these modifications.

[8] HQDA, FM 100-14, 1-1.

[9] Headquarters, Department of the Army (HQDA), Army Doctrine Reference Publication (ADRP) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 1-2; Chairman of the Joint Chiefs of Staff (CJCS), Chairman of the Joint Chiefs of Staff Manual (CJCSM) 3105.01, *Joint Risk Analysis* (Washington, DC: Government Printing Office, 2016), B-3.

[10] Headquarters, Department of the Army (HQDA), Field Manual (FM) 3-100.12, *Risk Management: Multiservice Tactics, Techniques, and Procedures* (Washington, DC: Government Printing Office, 2001), I-2 – I-3.

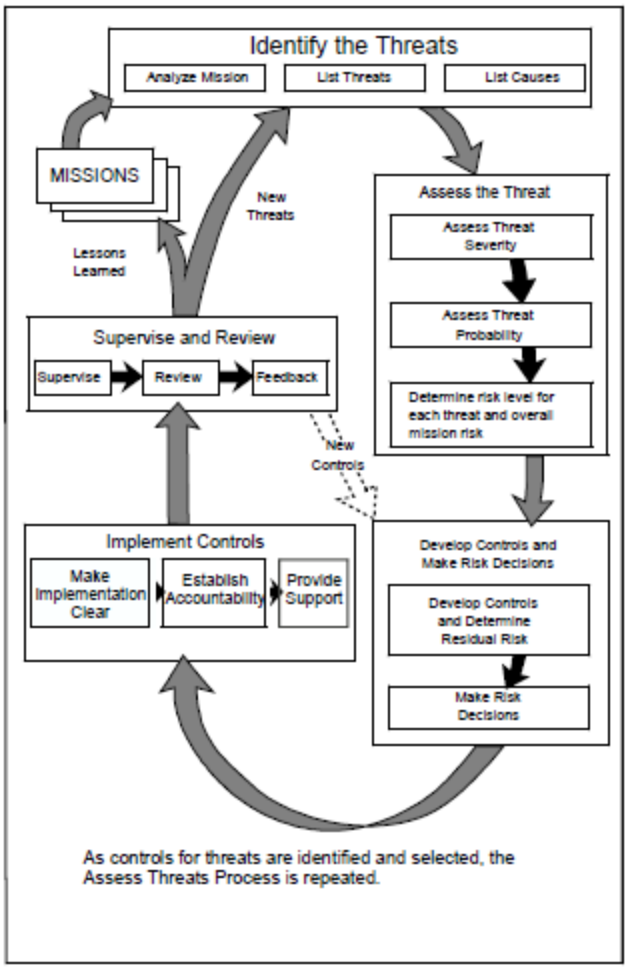

Figure 2. Revised Risk Management Cycle

Source: Headquarters, Department of the Army, Field Manual 100-14, *Risk Management* (Washington, DC: Government Printing Office, 1998), I-4.
NOTE: 2001 revisions replaced "hazard" with "threat" and made minor adjustments to process sub-steps.

In 2006, the Army updated its RM doctrine with FM 5-19 *Risk Management*. FM 5-19 broadened RM's applicability to include garrison operations and off duty activities. Additionally, "composite risk management" replaced "risk management" to reflect a holistic approach.

Currently, two publications comprise Army doctrinal RM: DA PAM 385-30 *Risk Management* (2014) and ATP 5-19 *Risk Management* (2014). DA PAM 385-30 provides administrative RM guidance and supports ATP 5-19. ATP 5-19 provides operational RM guidance. Both publications retain FM 100-14's five-step RM process and FM5-19's holistic approach. However, "composite risk management" reverted back to "risk management" to align with joint doctrine. These publications also introduced Form 2977 *Deliberate Risk Assessment Worksheet* (DRAW), which replaced Form 7566, *Composite Risk Management Worksheet*.[11]

When implementing RM, planners implement either a real-time or deliberate approach. A real-time approach takes less time, but relies on intuition and experience. A deliberate approach requires more time, but produces a more in-depth and accurate risk depiction. When time permits, planners should use a deliberate approach, collecting data and standardizing risk analysis using charts, codes and numbers.[12] This thesis framed discussions using a deliberate approach.

Purpose

The Army published its current RM doctrine in a post 9-11, counterinsurgency era. As a result, the Army's renewed large scale combat operations (LSCO) emphasis requires a RM doctrinal compatibility assessment. This thesis investigated RM doctrine

[11] Headquarters, Department of the Army (HQDA), Army Techniques Publication (ATP) 5-19, *Risk Management* (Washington, DC: Government Printing Office, 2014); Headquarters, Department of the Army (HQDA), Department of the Army Pamphlet (DA PAM) 385-30, *Risk Management* (Washington, DC: Government Printing Office, 2014).

[12] HQDA, ATP 5-19, 1-1 – 1-2.

and approaches to provide LSCO planners with adequate tools to estimate, depict, and treat operational risks. This investigation highlighted shortfalls and provided recommendations adapted from other RM frameworks.

Problem Statement

Current Army RM doctrine fails to provide sufficient operational risk estimation and depiction instructions. Furthermore, Army RM doctrine fails to provide a process which illuminates risk prioritization and treatment options. To investigate current doctrinal RM shortcomings, this research leveraged a single primary research question and four associated secondary research questions.

Research Question

How can planners better estimate and depict operational risk during large scale combat operations?

Secondary Research Questions

1. How does the Army conduct risk management?
2. Where does risk management fit into mission planning?
3. What LSCO elements must an operational risk management model address?
4. What techniques can assist in estimating and depicting risk?

Methodology

This thesis used a qualitative research methodology with a document analysis design. Research document selection began with references listed within ATP 5-19. These documents provided historical context to Army RM. ADP 3-0 contains the Army's

most recent LSCO guidance. As a result, ADP 3-0 provided valuable insight and additional references for assessing RM and LSCO.

RM concepts within ATP 5-19 served as initial codes to analyze ADP 3-0. These codes included themes related to risk, hazards, probability, consequence, success, and failure. Extracted passages provided additional doctrinal references. Analyzing these doctrinal documents revealed insufficient operational risk estimation and depiction instructions. To address the ATP 5-19 and ADP 3-0 shortcomings, non-doctrinal RM frameworks were analyzed. Chapter three describes the research methodology in more detail.

Limitations

The research in this thesis represents a thorough, but not exhaustive RM discussion. Nearly every military doctrinal publication discusses risk. Time limitations as well as publication classification prevented an exhaustive doctrinal consolidation and analysis. However, research in this thesis includes all current doctrinal publications governing RM and LSCO.

Likewise, innumerable civilian RM publications prevented an exhaustive analysis. However, chosen primary publications influenced many government and industrial RM programs worldwide. Other cited publications were chosen based on applicability and clarity in addressing the research problem. This thesis draws upon techniques found in credible non-doctrinal RM frameworks, however, information concerning their applicability and credibility in combat does not exist.

Delimitations

One can find many different risk management processes. Although these processes differ slightly from one another, they generally share conceptual steps. The U.S. Army has a five-step RM process. This thesis used the five step process as a discussion baseline. Thesis discussion considered deliberate RM. A real-time RM approach which applies to crisis response or condensed planning processes was not discussed.

Summary

Army RM doctrine resulted from high accidental casualty percentages during Operations Desert Shield and Desert Storm. Senior leaders emphasized RM as a means to conserve combat power. Currently ATP 5-19 and DA PAM 385-30 together, comprise Army RM doctrine. Their publication in 2014 predates current doctrine emphasizing LSCO. As a result, a doctrinal compatibility assessment is warranted.

Chapter one provided background information to Army RM and issues related to a renewed LSCO emphasis. Chapter two provides a literature review and addresses each secondary research question in preparation for analysis.

CHAPTER 2

LITERATURE REVIEW

Introduction

This literature review draws upon Army doctrine, civilian RM frameworks, and research from several other authors both within and outside the military. Chapter two begins with a problem statement and research question review. Each secondary research question will then be addressed in a literature review. Information discussed here establishes a foundation for chapter four analysis.

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How can planners better estimate and depict operational risk during large scale combat operations?

Secondary Research Questions

1. How does the Army conduct risk management?
2. Where does risk management fit into mission planning?
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4. What techniques can assist in estimating and depicting risk?

In answering secondary research question one, this chapter drew upon the Army's capstone RM publications, ATP 5-19 and DA PAM 385-30. ATP 5-19 provided operational RM guidance. DA PAM 385-30 focused on administrative RM.[13] Material from other joint and Army publications provided context and clarity. Understanding Army RM set the foundation for subsequent analysis.

To address secondary research question two, this chapter reviewed Joint and Army planning methodologies. Comparing methodologies, RM planning responsibilities were outlined. Joint and Army operations process and LSCO doctrine provided necessary background material.

Answering secondary research question three required reviewing historical Army RM doctrine and current LSCO doctrine. Doctrine revealed common RM considerations among several doctrinal publications.

To address secondary research question four, this chapter drew upon non-Army RM frameworks. These frameworks include techniques to better estimate, depict, and treat risk. Frameworks used include the International Organization for Standardization (ISO), International Risk Governance Council (IRGC), Institute of Risk Management, and Joint Risk Analysis Framework. Commentary from other authors whose writings reference these organizations also contributed. This section's information establishes the foundation for chapter four's analysis.

[13] HQDA, ATP 5-19, iii.

Secondary Research Question 1:
How does the Army conduct Risk Management?

Army Risk Management

The Army defines RM as "the process of identifying, assessing, and controlling risks arising from operational factors and making decisions that balance risk cost with mission benefits."[14] ATP 5-19 serves as the Army's capstone operational RM reference. It aligns with joint doctrine to facilitate joint operations.[15] The Army RM framework contains four RM principles and five steps.

The four principles include: (1) integrating RM into all phases of missions and operations, (2) making risk decisions at the appropriate level, (3) accepting no unnecessary risk, and (4) applying RM cyclically and continuously. Implementing these principles properly during operations helps maintain combat power, thus improving a commander's ability to accomplish current and future operations.[16]

When implementing RM, planners use either a real-time approach or a deliberate approach. A real-time approach takes less time, but relies on intuition and experience. A deliberate approach employs analytical methods within an established process.[17] A deliberate approach produces more in-depth, accurate risk depictions. When using a deliberate approach, planners implement five RM steps.[18]

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[14] HQDA, ATP 5-19, 1-1.

[15] Ibid., v.

[16] Ibid., 1-1.

[17] Ibid.

[18] Ibid., 1-2.

The five RM steps include: (1) identifying the hazards, (2) assessing the hazards, (3) developing controls and making risk decisions, (4) implementing controls, and (5) supervising and evaluating. Steps 1 and 2 comprise the assessment phase and steps 3 through 5 comprise the management phase.

Figure 3. Assessment Steps and Management Steps

Source: Headquarters, Department of the Army, Army Techniques Publication 5-19 *Risk Management* (Washington, DC: Government Printing Office, 2014), 1-4.
NOTE: Current Army RM doctrine reverted back to using "hazard" within step titles. Doctrine also divided steps into two phases: assessment and management.

Assessment Phase

During assessment, planners identify hazards and make initial estimates concerning their likelihood and consequence to mission accomplishment. When

identifying hazards, planners use mission and operational variables.[19] Mission variables include: mission, enemy, terrain and weather, troops and support available, time available, and civil considerations. Operational variables include: political, military, economic, social, information, infrastructure, physical environment, and time.[20] Depending on mission objectives, certain mission variables or operational variables increase operational risk.

Hazard identification methods include considering mission variable second and third order effects or connecting loss scenario elements. Loss scenarios contain three elements: source, mechanism, and outcome. A source is a mishap prerequisite. Mechanisms are how sources manifest themselves. And outcomes are undesired events resulting from mechanisms occurring due to source presence. Repeated questioning concerning why an undesired event might occur leads to hazard root cause determination.[21] Planners create a consolidated hazard list prior to assessing hazards.

When assessing hazards, planners consider likelihood and mission accomplishment consequences. Likelihood and consequence are also referred to as probability and severity, respectively.[22] Probability and severity are independent of one another. Estimating one has no direct impact on the other.[23] Planners use probability and

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[19] HQDA, ATP 5-19, 4-3.

[20] Ibid., 1-2.

[21] Ibid., 1-4.

[22] Joint Chiefs of Staff (JCS), Joint Publication (JP) 5-0, *Joint Planning* (Washington, DC: Government Printing Office, 2017), A-2.

[23] HQDA, ATP 5-19, 1-6.

severity together with a risk assessment matrix (RAM) to determine each hazard's risk level.

ATP 5-19 divides probability into five levels: Unlikely, Seldom, Occasional, Likely, and Frequent. A hazard's occurrence likelihood ranges between 0 (will not occur) and 1 (will definitely occur).[24] When possible, planners use numerical probability values. Items such as mission type, scheme of maneuver, similar occurrence frequency, and historical data can help planners more accurately estimate probability.[25]

Exposure intervals make probability more meaningful. Exposure intervals represent how often and for how long personnel and equipment encounter a hazard. Longer hazard exposure increases risk.[26]

During decision briefs, planners paint a clear picture by describing risk using mission success likelihood, objectives timelines, and force impact. Since this process depends on perspective and experience, planners must be able to explain their resultant military risk probability evaluation.[27]

Severity refers to mission-impairing factors including injury and property damage. ATP 5-19 divides severity into four categories: catastrophic, critical, moderate, or negligible.[28] Planners use historical data, intuitive analysis, and personal judgement to

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[24] HQDA, DA PAM 385-30, 6.

[25] HQDA, ATP 5-19, 1-7.

[26] Ibid., 1-8.

[27] JCS, JP 5-0, V-14.

[28] HQDA, ATP 5-19, 1-6.

determine hazardous event impact on overall mission outcome.[29] Table 2 depicts ATP 5-19 severity levels and associated sample consequences.

Table 2. ATP 5-19 Severity Levels with Example Consequences

Level	Sample consequences
I Catastrophic	• Complete mission failure or the loss of ability to accomplish a mission. • Death or permanent total disability. • Loss of major or mission-critical systems or equipment. • Major property or facility damage. • Severe environmental damage. • Unacceptable collateral damage.
II Critical	• Significantly degraded mission capability or unit readiness. • Permanent partial disability or hospitalization of at least 3 personnel. • Extensive major damage to equipment or systems. • Significant damage to property or the environment. • Significant collateral damage.
III Moderate	• Degraded mission capability or unit readiness. • Minor damage to equipment or systems, property, or the environment. • Lost days due to injury or illness.
IV Negligible	• Minimal injury or damage. • Little or no impact to mission or unit readiness. • First aid or minor medical treatment. • Little or no property or environmental damage.

Source: Headquarters, Department of the Army, Army Techniques Publication 5-19 *Risk Management* (Washington, DC: Government Printing Office, 2014), 1-9.
NOTE: Doctrinal example severity levels account for numerous risk categories. Categories include: mission accomplishment, soldier injury or death, property damage and environmental damage.

DA PAM 385-30 provides quantitative severity level definitions. These severity levels reflect an administrative focus. Each level has distinct quantifiable definitions and

[29] JCS, JP 5-0, V-14.

units tailored to categorize personnel and equipment loss or damage in a garrison or training environment.[30] Table 3 depicts these severity levels.

Table 3. DA PAM 385-30 Severity Levels

Severity	Symbol	Quantitative value — Injury or Illness[1]	Quantitative value — Dollars[1]	Definition
Catastrophic	I	1 or more death or permanent total disability	Loss equal to $2 million or more	Death, unacceptable loss or damage, mission failure, or unit readiness eliminated
Critical	II	1 or more permanent partial disability or hospitalization of at least 3 personnel	Loss equal to or greater than $500 thousand but less than $2 million	Severe injury, illness, loss, or damage; significantly degraded unit readiness or mission capability
Moderate	III	1 or more injury or illness resulting in lost time	Loss equal to or greater than $50 thousand but less than $500 thousand	Minor injury, illness, loss, or damage; degraded unit readiness or mission capability
Negligible	IV	1 or more injuries or illnesses requiring first aid or medical treatment	Loss less than $50 thousand	Minimal injury, loss, or damage; little or no impact to unit readiness or mission capability

Notes:
[1] Quantitative values are based on definitions for Class A through D accidents. See AR 385–10.

Source: Headquarters, Department of the Army, Department of the Army Pamphlet 385-30, *Risk Management* (Washington, DC: Government Printing Office, 2014), 7.
NOTE: Quantitative definitions allow planners to easily and objectively determine severity levels for different asset categories.

The RAM breaks down probability level and severity level intersections into four risk levels. These risk levels include extremely high, high, medium, and low. Frequent events with catastrophic consequences fall into extremely high risk levels. Unlikely events with negligible consequences fall into low risk levels. Each identified hazard risk level in step two is an initial assessment; planners re-assess each hazard during step three

[30] HQDA, DA PAM 385-30, 7.

after they develop controls and commanders make risk decisions.[31] Table 4 depicts the ATP 5-19 RAM with its associated severity, probability, and risk levels.

Table 4. Risk Assessment Matrix

Risk Assessment Matrix		**Probability** *(expected frequency)*				
		Frequent: Continuous, regular, or inevitable occurrences	**Likely:** Several or numerous occurrences	**Occasional:** Sporadic or intermittent occurrences	**Seldom:** Infrequent occurrences	**Unlikely:** Possible occurrences but improbable
Severity *(expected consequence)*		**A**	**B**	**C**	**D**	**E**
Catastrophic: *Mission failure, unit readiness eliminated; death, unacceptable loss or damage*	**I**	**EH**	**EH**	**H**	**H**	**M**
Critical: *Significantly degraded unit readiness or mission capability; severe injury, illness, loss or damage*	**II**	**EH**	**H**	**H**	**M**	**L**
Moderate: *Somewhat degraded unit readiness or mission capability; minor injury, illness, loss, or damage*	**III**	**H**	**M**	**M**	**L**	**L**
Negligible: *Little or no impact to unit readiness or mission capability; minimal injury, loss, or damage*	**IV**	**M**	**L**	**L**	**L**	**L**
Legend: **EH** - Extremely High Risk **H** - High Risk **M** - Medium Risk **L** - Low Risk						

Source: Headquarters, Department of the Army, Army Techniques Publication 5-19 *Risk Management* (Washington, DC: Government Printing Office, 2014), 1-7.
NOTE: The Army RAM contains four severity levels and five probability levels. Severity and probability intersections determine hazard risk levels. The Army RAM contains four risk levels.

The Management Phase

The management phase involves RM steps three through five: (3) developing controls and making risk decisions, (4) implementing controls, and (5) supervising and evaluating. A control is a method to eliminate or reduce risks. Making risk decisions

[31] HQDA, ATP 5-19, 1-9.

involves deciding which risks to accept and which to control. Risk severity and available resources impact risk decisions.[32]

During step three, planners develop controls and commanders make risk decisions. This step begins with appropriate echelon commanders determining mission risk tolerance and making initial risk treatment decisions. Risk tolerance is a "level of risk the responsible commander is willing to accept."[33] ATP 5-19 and DA PAM 385-30 advise using controls to treat every risk. However, ATP 5-19 and DA PAM 385-30 also indirectly discuss four treatment options: accepting, avoiding, transferring, or reducing risk.[34]

Reducing hazard risk requires one or more controls. A control is an "action taken to eliminate a hazard or to reduce its risk."[35] Preferably, planners control hazards at their sources.[36] When seeking to reduce a specific risk, one can lower probability value, consequence value, or both.[37] One can even increase one variable's value, correspondingly lower the other value, and still lower overall risk. Figure 4 depicts possible risk reduction paths.

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[32] HQDA, ATP 5-19, 1-1.

[33] Ibid., 1-2 – 1-10.

[34] HQDA, ATP 5-19, 1-2 – 1-16, 4-13; HQDA, DA PAM 385-30, 9.

[35] HQDA, ATP 5-19, 1-2.

[36] Ibid., 1-11.

[37] CJCS, CJCSM 3105.01, B-5.

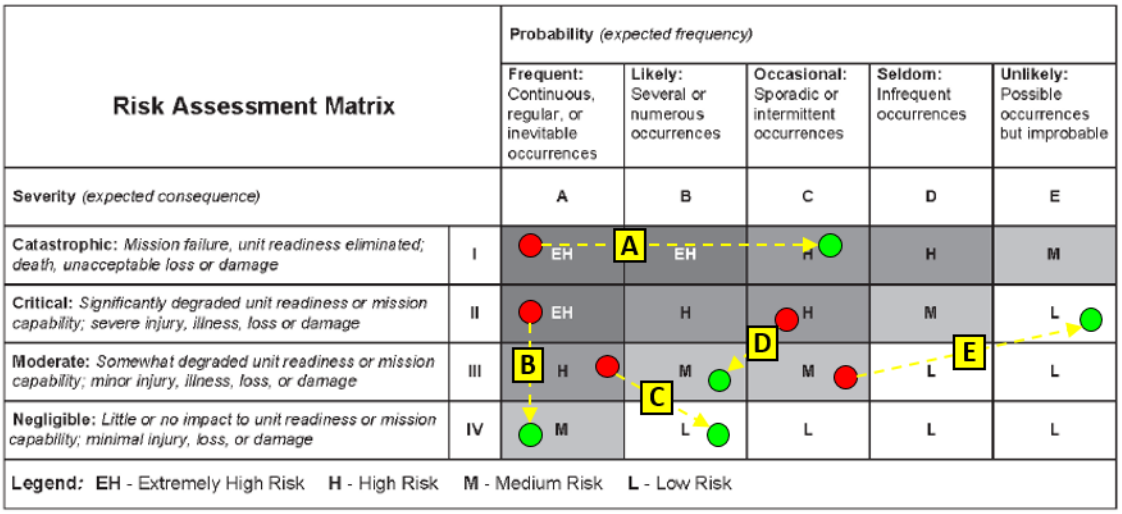

Figure 4. Risk Reduction Paths

Source: Adapted from Risk Assessment Matrix, Headquarters, Department of the Army, Army Techniques Publication 5-19 *Risk Management* (Washington, DC: Government Printing Office, 2014), 1-7.
NOTE: Path (A) reduces probability only. Path (B) reduces severity only. Path (C) reduces both probability and severity. Path (D) lowers severity, but raises probability. Path (E) lowers probability, but raises severity.

Figure 4 depicts five risk reduction paths. Understanding risk reduction options provides planners flexibility. A commander may influence risk levels by weighting probability or consequence more heavily. Furthermore, a commander may also choose not to accept lower residual risk levels if either probability or severity increase.[38]

After identifying controls, a RAM helps planners re-assess each respective risk level. Leftover risk is called "residual risk."[39] Current doctrine does not limit risk

[38] CJCS, CJCSM 3105.01, B-5.

[39] HQDA, ATP 5-19, 1-10 – 1-13.

reduction. Therefore, with proper controls, hazards with extremely high initial risk levels can have low residual risk levels.

If residual risk exceeds tolerance, planners have three options: (1) repeat step three and further develop controls to lower residual risk levels; (2) choose another treatment method, which may mean altering the plan; and (3) recommend a change to risk tolerance levels. Ultimately, commanders make decisions regarding residual risk acceptability. Figure 5 depicts this process using a risk treatment decision tree.

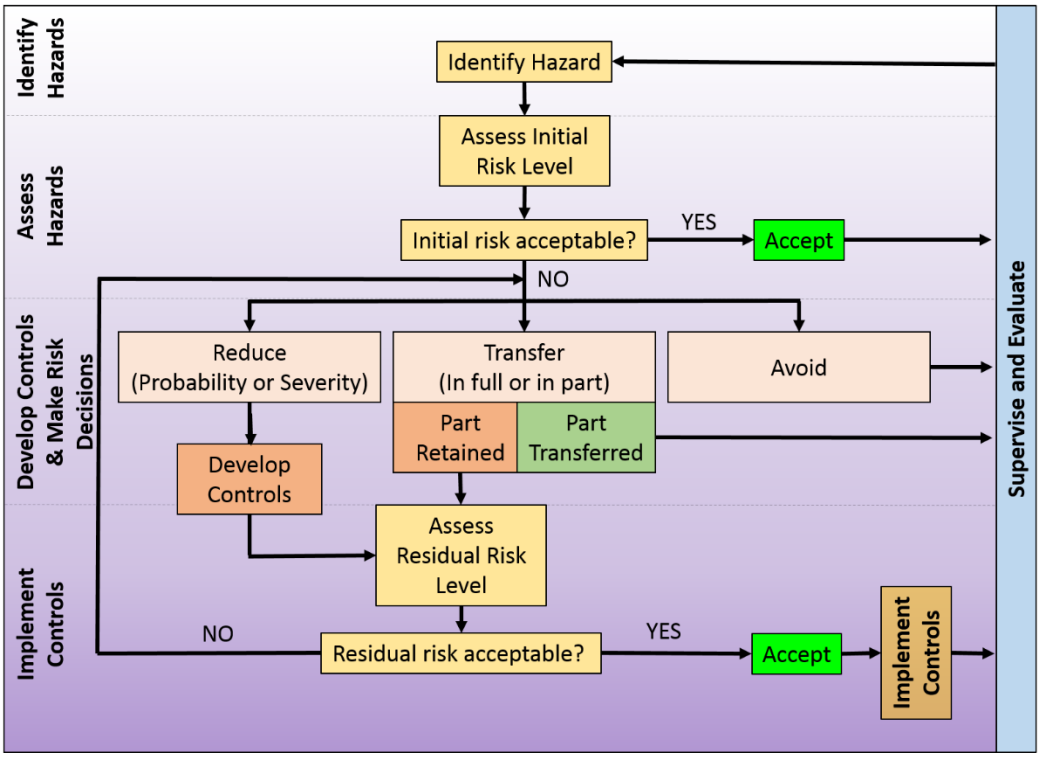

Figure 5. Risk Decision Tree

Source: Created by author. Adapted from Jan Emblemsvag, ed., "The Structure of Risk Treatment Stage," in *Risk Management for the Future: Theory and Cases* (Rijeka, Croatia: InTech, 2012), 16, accessed 17 January 2019, https://doi.org/10.5772/1809.
NOTE: Planners follow a planning and decision cycle to bring hazards within acceptable risk levels.

The five step RM process guides planners through risk treatment decisions. Ultimately, each known hazard's residual risk levels is tolerable. Planners begin by identifying a hazard and assessing its initial risk level. If acceptable, planners simply supervise and evaluate. If initial risk is deemed unacceptable, planners choose to either reduce, transfer, or avoid the hazard. For any part still retained, planners assess residual risk. If deemed acceptable, planners implement controls, then supervise and evaluate. If deemed unacceptable, planners continue to make risk decisions and implement controls until residual risk is acceptable. This process continues for each identified hazard.

After planners have identified optimal treatment methods and controls, they recommend an overall mission risk level to the commander. Residual risk levels may differ for each hazard. Nevertheless, overall risk level is at least equal to the highest residual risk level. Commanders determine overall mission risk level and may decide multiple lower level risks combined warrant a higher overall risk level.[40]

During step four, planners and Soldiers implement controls. Implementing controls normally coincides with the Army operations process preparation phase. Determining, implementing, and managing each control is crucial to ensure accurate residual risk levels. As listed in ATP 5-19, controls include overlays and graphics, drills, training, additional communications links, personal protective equipment standards, and safety briefs.[41]

[40] HQDA, ATP 5-19, 1-13 – 1-14.

[41] Ibid., 1-14.

In step five, commanders supervise and evaluate the mission. Commanders and planners ensure each control is implemented and performed to standard.[42] Post-mission subordinate feedback helps commanders and planners identify effective controls and where unforeseen hazards arose.[43] Commanders make risk decisions, develop controls, and implement additional controls as needed throughout mission execution.[44]

The Deliberate Risk Assessment Worksheet

Form 2977 *Deliberate Risk Assessment Worksheet* (DRAW) is a tool to document RM step outputs. An Army DRAW has fifteen sections. Sections one through three contain administrative items to include mission description, worksheet preparation date, and preparing individual contact information. Sections four through eleven contain information pertaining to RM steps one through four. And sections twelve through fifteen contain information pertaining to RM step five.

Planners record RM step one through four information in DRAW sections four through eleven. Section four through fifteen descriptions follow. Section four contains mission phases or subtasks warranting RM. Section five contains identified phase or subtask hazards. Using a RAM, planners record initial risk levels for each hazard in section six. Section seven contains control descriptions. Section eight contains implementation instructions and responsibility. Section nine contains residual risk levels.

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[42] HQDA, ATP 5-19, 1-15.

[43] Ibid., 1-16.

[44] JCS, JP 3-0, III-20.

Section ten contains overall residual risk level.[45] DRAWs can expand to accommodate as many hazards as needed. Figure 6 depicts sections four through ten.

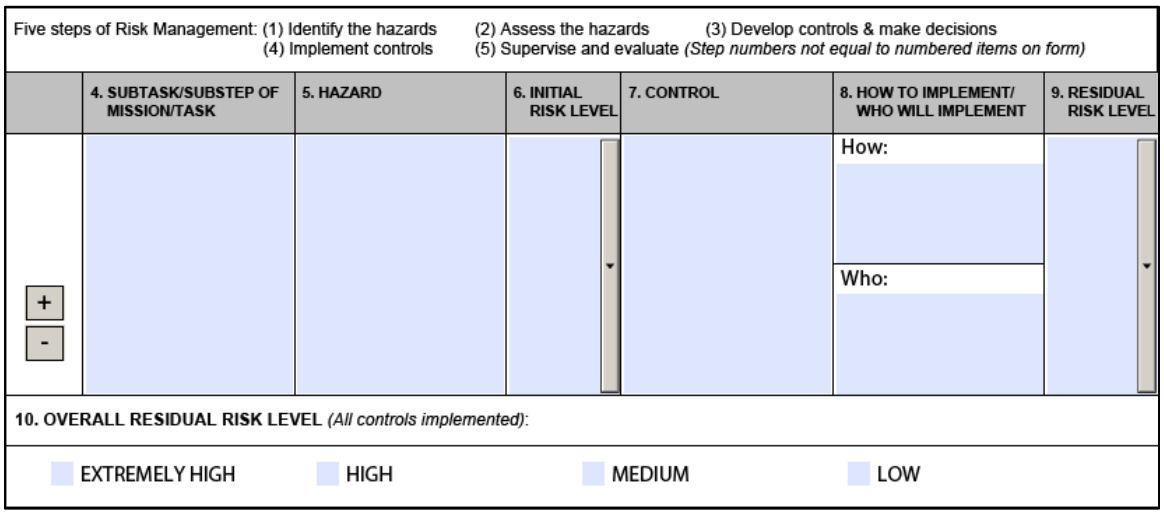

Figure 6. Form 2977 Sections 4-10

Source: Department of Defense, Form 2977, *Deliberate Risk Assessment Worksheet* (Washington, DC: Government Printing Office, 2014).
NOTE: Figure 6 depicts DRAW sections four through ten. Planners record information from RM steps one through four in these sections.

Planners determine overall risk levels based on control complexity and potential synergistic and cumulative effects. Even if each individual hazard is lower than a certain level, raising overall risk may be appropriate. For example, even if all assessed hazards range between low and moderate, a commander may select an overall high risk level. To

[45] Department of Defense (DoD), Form 2977, *Deliberate Risk Assessment Worksheet* (Washington, DC: Government Printing Office, 2014), 3.

help visualize appropriate risk levels, planners sort hazards and controls by residual risk level with highest on top.[46] Figure 7 depicts DRAW sections eleven and twelve.

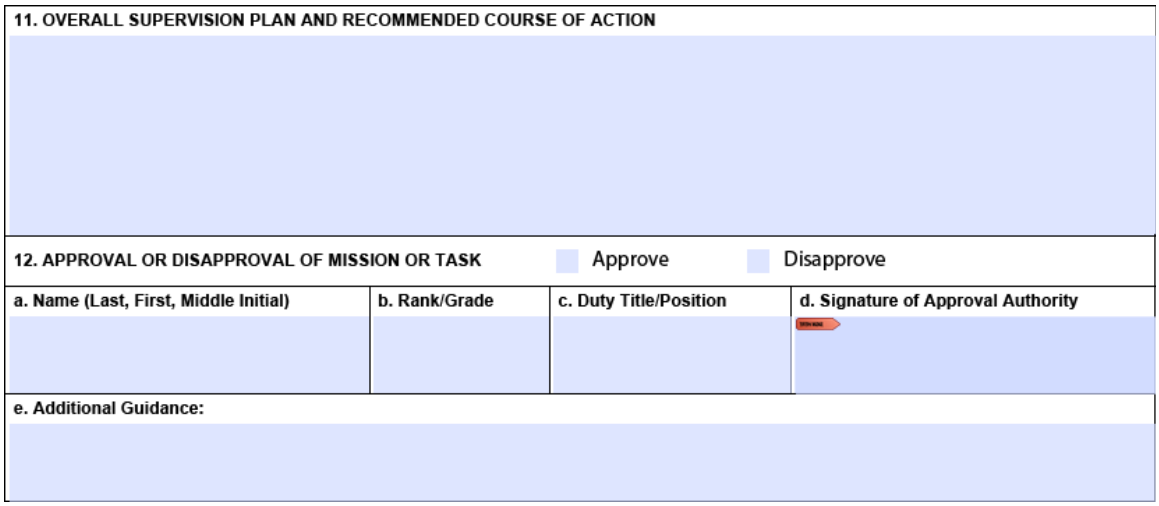

Figure 7. Form 2977 Sections 11-12

Source: Department of Defense, Form 2977, *Deliberate Risk Assessment Worksheet* (Washington, DC: Government Printing Office, 2014).
NOTE: Figure 7 depicts DRAW sections eleven and twelve. Planners summarize the RM plan in section eleven and commanders give formal approval in section twelve.

Planners use section eleven to summarize the RM plan, specify concern areas, and make commander recommendations. The risk approval authority, often a commander, approves or disapproves a DRAW based on staff recommendations.[47] Section twelve annotates formal approval. This approval gives planners and subordinate units a tangible, consolidated, and validated mission planning and execution RM reference.

[46] HQDA, ATP 5-19, 1-13 – 1-14.

[47] DoD, Form 2977, 3.

During mission preparation and execution, planners may identify additional hazards. Previously identified hazards may also change. Planners review and revise mission DRAWs regularly. A designated RM officer (usually from the protection cell) will annotate worksheet changes. Commanders make additional risk decisions when overall risk level rises.[48] Following mission execution, planners collect RM feedback which helps evaluate hazard identification accuracy and control effectiveness. Sections thirteen through fifteen document feedback information. Documented feedback serves as a future planning reference. Figure 8 depicts sections thirteen through fifteen which record RM review data and lessons learned.

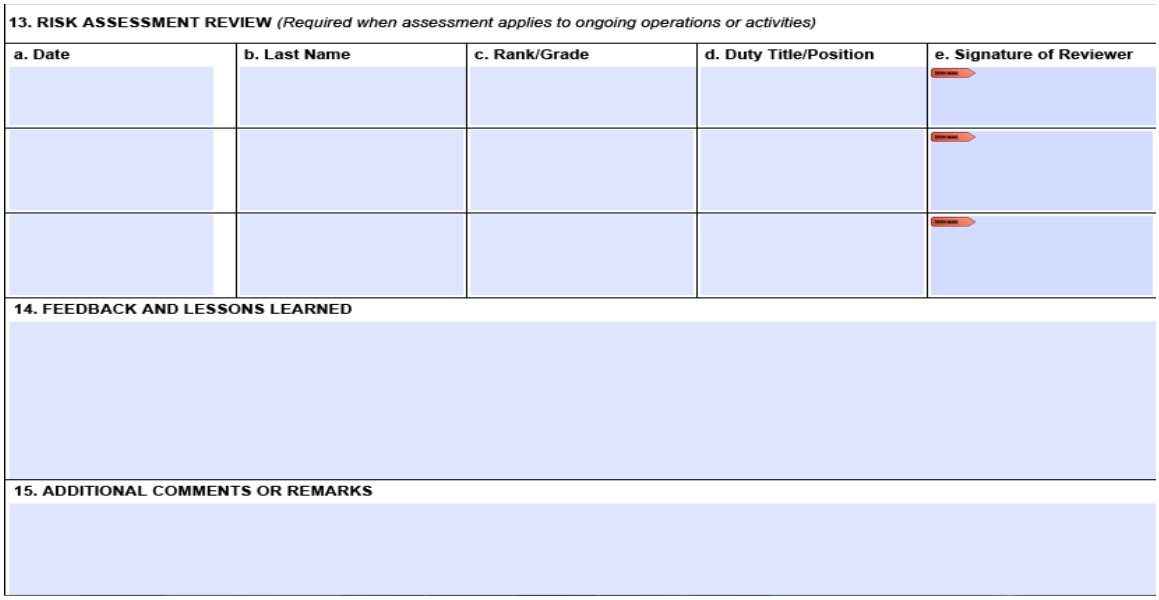

Figure 8. Form 2977 Sections 13-15

Source: Department of Defense, Form 2977, *Deliberate Risk Assessment Worksheet* (Washington, DC: Government Printing Office, 2014).
NOTE: Planners conduct periodic risk assessment reviews and record lessons learned in DRAW sections thirteen through fifteen.

[48] DoD, Form 2977, 3.

Summary

Army RM contains four principles and five cyclical steps. Adherence to these principles and steps enables planner and commander operational risk understanding. Armed with this understanding, planners and commanders make informed risk treatment decisions. The Army provides the RAM and DRAW as tools to help planners organize RM process outputs. Table 5 lists several RM tool benefits.

Table 5. RAM and DRAW Utility

RM Tool Utility
Provides flexibility and allows for intuition and personal judgement
Specifies commander approved risk tolerance
Worksheet accounts for risk controls
Rapidly assesses hazards
Defines hazard probability, consequence, and risk levels
Incorporates mission and operational variables
Allows for intuition and personal judgement
Consolidates and prioritizes identified risks
Determines risk costs and mission benefits by phase
Identifies risk areas for each involved domain
Provides control measures, management, and prediction accuracy feedback

Source: Created by author.
NOTE: Army RAM and DRAW are useful tools which facilitate RM. Table 5 depicts consolidated doctrinal RAM and DRAW utility descriptions.

Secondary Research Question 2:
How does risk management fit into mission planning?

LSCO represents combat's most extreme and complex form. Corps and higher echelons command LSCO operations and campaigns.[49] To answer the research question, this thesis addresses planning methodologies used at Corps and higher echelons.

The Army subscribes to three mission planning methodologies: Army design methodology, military decisionmaking process (MDMP), and troop leading procedures. The commander and staff integrate "RM throughout these methodologies."[50] MDMP serves as the Army's battalion and above planning methodology. MDMP is an iterative process which enables situation and mission understanding, course of action development, and operations plan or order production.[51]

Corps and higher echelons often conduct joint operations. When planning joint operations, commanders and staffs use the joint planning process (JPP).[52] JPP aligns activities and resources to achieve objectives. JPP also enables cost-benefit relationship

[49] Headquarters, Department of the Army (HQDA), Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 1-1; JCS, JP 3-0, II-4.

[50] Headquarters, Department of the Army (HQDA), Army Techniques Publication (ATP) 3-92, *Corps Operations* (Washington, DC: Government Printing Office, 2016), 2-2.

[51] Headquarters, Department of the Army (HQDA), Army Doctrine Reference Publication (ADRP) 5-0, *The Operations Process* (Washington, DC: Government Printing Office, 2012), 2-4 – 2-11.

[52] Headquarters, Department of the Army (HQDA). Army Doctrine Publication (ADP) 5-0, *The Operations Process* (Washington, DC: Government Printing Office, 2012), V-1.

and risk examination to determine preferable courses of action (COA).[53] This section establishes RM's relationship to JPP and MDMP. Because JPP and MDMP steps nearly mirror one another, these methodologies are discussed together.

This section leads to a consolidated RM output list applicable to either planning methodology. Where joint and Army term definitions differ, this thesis defaults to Army terminology. This thesis follows a deliberate RM approach and does not discuss RM as it relates to crisis response or when formal planning processes are condensed. Figure 9 depicts RM and planning methodology integration.

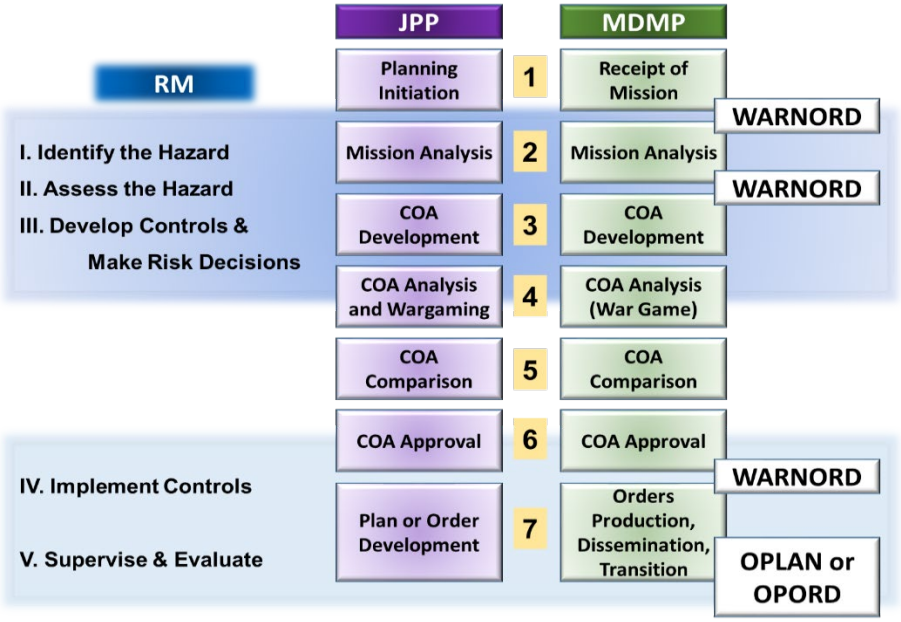

Figure 9. Military Planning and RM Processes

Source: Created by author using Joint Chiefs of Staff, Joint Publication 5-0, *Joint Planning* (Washington, DC: Government Printing Office, 2017), V-2; Headquarters, Department of the Army, Army Techniques Publication 5-19, *Risk Management* (Washington, DC: Government Printing Office, 2014), 4-1.
NOTE: Each RM step corresponds to a planning methodology step.

[53] JCS, JP 3-0, II-5.

Step 1: Planning Initiation and Receipt of Mission

JPP step one and MDMP step one differ more than each other step. In MDMP, a commander and staff receive an order prior to mission planning. Joint operations often involve planning with limited strategic leader and policy guidance.[54] This section separately describes RM as it applies JPP and MDMP.

JPP Step 1: Planning Initiation

Planning initiation involves a detailed operational environment analysis. It incorporates operational art and operational design elements to identify ways to shape battlefield environments.[55] During planning initiation, commanders use operational design to answer the following questions:[56]

(1) What are the objectives and desired military end state? (Ends)

(2) What sequence of actions is most likely to achieve those objectives and military end state? (Ways)

(3) What resources are required to accomplish that sequence of actions? (Means)

(4) What is the likely chance of failure or unacceptable results in performing that sequence of actions? (Risk)

Two foundational risk resources available to aid joint planners during step one include the Chairman's Risk Assessment and combatant commanders' strategic

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[54] JCS, JP 5-0, V-4.

[55] Ibid.

[56] Ibid., II-4.

estimates.[57] The Chairman of the Joint Chiefs of Staff updates the Chairman's Risk Assessment annually. This assessment includes risks to national interests, risks to military, and resource requirements to address those risks. Furthermore, it facilitates meeting targeted policy objectives by aligning strategic ends, ways, and means. This risk assessment represents combatant commanders' views.[58]

Combatant commanders' strategic estimates include regional national interests, national interest vulnerabilities, and capabilities to protect those interests. Combatant commanders work closely with senior DOD leaders to reach shared strategic and military risk understanding. Together they determine acceptable risks and establish risk controls to minimize accepted risk effects.[59]

During JPP step one, commanders provide planners their initial commander's intent. A commander's intent includes a purpose statement, end state, and associated risk statement. A risk statement defines where and when commanders willingly accept risk.[60] Joint planners must understand accepted risks and higher commander directed risk controls prior to initiating planning.

MDMP Step 1: Receipt of Mission

MDMP step one is receipt of mission. With regard to RM, planners in this step identify hazards and acknowledge higher headquarters' accepted risks. When identifying

[57] CJCS, CJCSM 3105.01, A-2; JCS, JP 5-0, III-14.

[58] CJCS, CJCSM 3105.01, A-2 – A-3.

[59] JCS, JP 5-0, III-14.

[60] Ibid., IV-19.

risks, planners consider mission variables, operational variables, risk tolerance, higher headquarters' directed controls, and adjacent unit controls. If organic assets cannot mitigate risks posed from mission and operational variables, commanders request additional assets. Commanders must know higher commanders' risk tolerances and risk level decision authorities. Each warning order (WARNORD) and operations order (OPORD) should contain this information. Additionally, each WARNORD and OPORD should specify controls implemented by higher headquarters.[61]

Upon receipt of mission, commanders and staffs assess how controls impact or detract from the primary mission and begin control coordination along unit boundaries.[62] MDMP outputs, which help commanders and staffs begin RM, include updating running estimates, issuing commander's initial guidance, and establishing time allocations. Step one concludes with WARNORD one publication.[63]

Each staff section maintains a running estimate.[64] Running estimates identify and prioritize issues, risks, and deficiencies. Estimates also include mitigation recommendations and sourcing requirements.[65] RM is often perceived as solely a safety officer responsibility. However, Army doctrine integrates RM into all Army processes

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[61] HQDA, ATP 5-19, 4-2 – 4-3.

[62] Ibid.,

[63] Ibid., 3-3.

[64] Headquarters, Department of the Army (HQDA), Field Manual (FM) 6-0, *Commander and Staff Organization and Operations* (Washington, DC: Government Printing Office, 2014), 8-1.

[65] Ibid., 8-2.

and activities.[66] RM goes beyond safety and includes risks which affect mission outcomes. While "conduct risk management" is a protection warfighting function task, proper integration and synchronization throughout the Army operations process requires all staff sections incorporate RM into running estimates and provide risk mitigation control recommendations.[67] A designated officer, normally within the protection cell, consolidates staff risk assessments. A consolidated assessment helps commanders and staffs integrate risk management throughout mission planning and execution.[68]

Army doctrine lists three integrating processes: RM, targeting, and intelligence preparation of the battlefield (IPB). RM, targeting, and IPB synchronize staff functions throughout the Army operations process.[69] Protection officers or operations officers ensure staff sections integrate RM throughout the Army operations process.[70] Figure 10 illustrates how RM, targeting, and IPB nest within the Army operations process.

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[66] HQDA, FM 100-14, iii.

[67] Headquarters, Department of the Army (HQDA). Army Doctrine Publication (ADP) 3-37, *Protection* (Washington, DC: Government Printing Office, 2018), 2-1; HQDA, ADRP 5-0, 1-12.

[68] HQDA, ATP 3-92, 1-26.

[69] HQDA, ADRP 5-0, 1-11.

[70] HQDA, ADRP 5-0, 1-12; HQDA, ATP 5-19, 4-8.

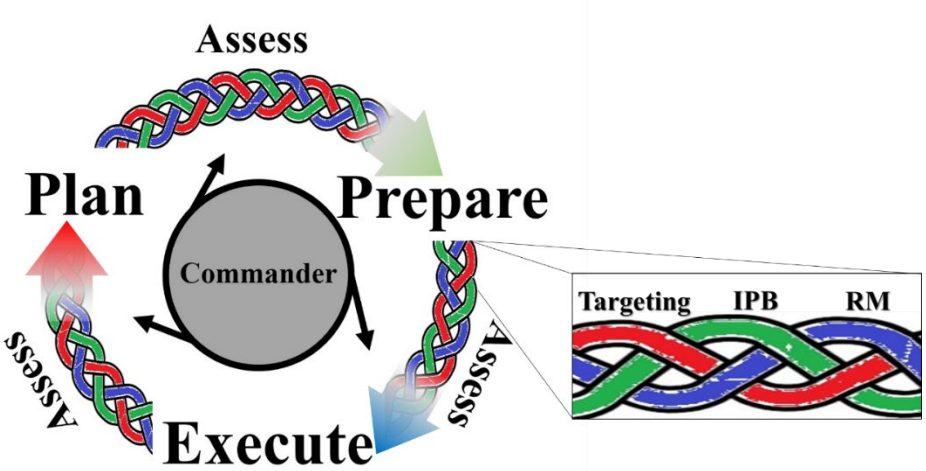

Figure 10. Operations Process with Integrating Processes

Source: Created by author. Adapted from Headquarters, Department of the Army, Army Doctrine Reference Publication 5-0, *The Operations Process* (Washington, DC: Government Printing Office, 2012), 1-2, 1-11.
NOTE: The Army operations process contains three integrating processes: targeting, IPB, and RM. Each integrating process enables mission planning, preparation, and execution.

Key step one outputs include commander initial guidance and time allocations.[71] Initial guidance and time allocations determine whether planning employs a deliberate or real-time RM approach. "A deliberate approach is more analytical, but takes more time; a real-time approach is more intuitive and tends to take less time".[72] When time permits, planners use a deliberate approach. A deliberate approach involves gathering data, analyzing hazard probability and consequences, then depicting risks.[73]

[71] HQDA, FM 6-0, 9-3.

[72] HQDA, ATP 5-19, 1-2.

[73] Ibid., 1-1.

With regard to RM, WARNORD #1 includes, at a minimum, commander's overall risk tolerance, each risk level's decision authority, higher command implemented controls, commander's initial guidance, and time allocations[74]. WARNORD #1 RM items provide planners information necessary to begin mission analysis.

Step 2: Mission Analysis

JPP and MDMP step two is mission analysis. Commanders and staffs conduct mission analysis to gain an operational environment and mission requirement understanding.[75] RM begins during JPP and MDMP planning step two. RM is a deliberate mission analysis sub-step and continues throughout mission planning and execution.[76] During mission analysis, commanders and staffs use operational and mission variables to assess conditions and events which may impact mission accomplishment. Commanders and staffs assign risk levels to potentially impactful conditions and events.[77] Assessment continues throughout planning as new conditions and events arise.[78]

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[74] HQDA, ATP 5-19, 4-2 – 4-3; HQDA, FM 6-0, 9-3.

[75] HQDA, FM 6-0, 9-6.

[76] Ibid., 9-9.

[77] HQDA, ATP 5-19, 4-3.

[78] Ibid., 1-6.

IPB also serves as an opportunity to identify high and low risk areas within each operational domain and environment.[79] Proper operational and mission variable assessments identify potential risk areas.[80] Enemies generally prefer COAs offering the greatest advantage with minimized risk. However, enemies may accept greater risk when pursuing a desired end state.[81] To help planners identify vulnerabilities and analyze risks to units and assets, ATP 3-60 *Targeting*, Appendix C suggests using a target value analysis tool.

ATP 3-60's target value analysis tool helps planners identify vulnerabilities. Enemies are more likely to target vulnerabilities.[82] Known as CARVER, this tool evaluates unit and asset criticality, accessibility, recuperability, vulnerability, effect, and recognizability. Evaluated units and assets are ranked to help planners appropriately allocate security and protection assets.[83] Commanders use evaluation results to develop operation phase protection priorities. Integrating protection capabilities helps

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[79] Joint Chiefs of Staff (JCS), Joint Publication (JP) 2-01.3, *Joint Intelligence Preparation of the Operational Environment* (Washington, DC: Government Printing Office, 2017), III-12.

[80] Headquarters, Department of the Army (HQDA), Army Techniques Publication (ATP) 2-01.3, *Intelligence Preparation of the Battlefield* (Washington, DC: Government Printing Office, 2014), 9-1 – 9-12.

[81] Ibid., 6-6.

[82] JCS, JP 2-01.3, C-1.

[83] Headquarters, Department of the Army (HQDA), Army Techniques Publication (ATP) 3-60, *Targeting* (Washington, DC: Government Printing Office, 2015), C-1.

commanders make informed risk decisions concerning identified and prioritized vulnerabilities.[84]

Risk assessment notes are an IPB output which aids control identification.[85] To capture risk assessment notes, planners use a DRAW. Each staff section maintains and updates a DRAW with their running estimates.[86] A consolidated staff DRAW enables commander mission analysis risk decisionmaking.[87] During mission analysis, staff sections assign identified hazards an initial risk level. Staff sections also make risk mitigation recommendations, however, control feasibility and acceptability is not known until COA development and COA analysis.[88] Therefore, preliminary risk assessment worksheets do not estimate residual risk levels. Table 6 depicts a consolidated preliminary risk assessment example.

[84] HQDA, ADP 3-37, iv – 1-2.

[85] HQDA, ATP 5-19, 4-5.

[86] HQDA, ATP 5-19, vi.

[87] Ibid., 4-8.

[88] Ibid., 4-13.

Table 6. Sample Consolidated Preliminary Risk Assessment Worksheet

Staff estimates	*Hazards identified*	*Initial assessment level*	*Proposed controls*
Movement and maneuver estimate Mobility and countermobility	High water levels and swift current make fording the Usee River extremely dangerous.	High risk: Water levels are not expected to drop for the next 48 hours.	Consider making bridge security a key enabler and evaluating sites for deploying three armored vehicle-launched bridges during phase I of the operation.
Intelligence estimate Synchronization plan	Host nation 125th infantry brigade lacks electronics intelligence collection capability	High risk: Intelligence collection of enemy forces in 125th Infantry Brigade's sector is extremely limited. Confidence in knowledge of enemy force size, capability, and intention is low.	Consider designating 305th Military Intelligence Battalion under operational control of, or in primary support of, 125th Infantry Brigade until phase III of the operation.
Fires estimate	TBP (to be prepared)	TBP	TBP
Sustainment estimate	TBP	TBP	TBP
Protection estimate	TBP	TBP	TBP

Source: Headquarters, Department of the Army, Army Techniques Publication 5-19, *Risk Management* (Washington, DC: Government Printing Office, 2014), 4-9.
NOTE: Each staff section provides RM estimates. RM estimates include identified hazards, initial assessment levels based on probability and severity, and proposed controls to mitigate potential hazard effects.

Concluding JPP and MDMP step two, staffs provide commanders a mission analysis brief, which includes identified hazards, proposed controls, and how those controls might affect mission objectives.[89] Identified hazards and proposed controls play an important role during COA analysis.

Mission analysis ends with WARNORD #2 publication. WARNORD #2 includes detailed risk guidance, higher headquarters directed controls, initial consolidated DRAW with overall risk level, and commander risk tolerance. Because exact COAs have not been developed and hazard controls not finalized, WARNORD #2's overall risk level reflects commander risk tolerance.[90]

[89] HQDA, ATP 5-19, 4-10.

[90] Ibid., 3-4, 4-2.

Step 3: Course of Action Development

JPP and MDMP step three is COA development. During COA development, staffs create options to accomplish mission objectives. COA development risk outputs include updated staff estimates, updated risk assessment, concept narrative, and COA evaluation criteria. Staff estimates capture common and unique COA risks. Each COA must meet the following five validity criteria: feasible, suitable, distinguishable, complete, and acceptable. Acceptable COAs balance risk costs with potential advantages. Risk costs may include force ratios, time, tactical positioning, and opportunity.[91]

Concept sketches include narratives which address significant risk considerations. Narratives also recommend treatment methods and residual risk levels. Residual risk may warrant inclusion as an evaluation criterion.[92]

Arraying forces is critical to COA development. Arraying forces establishes relative relationships between friendly and enemy units.[93] Historical planning ratios assist friendly unit to anticipated adversarial unit alignment. Historically, planning ratios provide a fifty percent success probability.[94] Using planning ratios does not guarantee success, but serves as a starting point upon which planners add combat power or enablers to improve success probability. Doctrinally, historical planning ratios are the only

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[91] JCS, JP 5-0, V-20 – V-28.

[92] JCS, JP 5-0, V-30 – V-36.

[93] David R. Hogg, "Correlation of Forces: The Quest for a Standardized Model," (monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 1993), 4.

[94] HQDA, FM 6-0, 9-19.

analytical tool to help planners array forces and weigh mission success probability. Table 7 depicts doctrinal historical planning ratios.

Table 7. Historical Minimum Planning Ratios

Friendly Mission	*Position*	*Friendly : Enemy*
Delay		1:6
Defend	Prepared or fortified	1:3
Defend	Hasty	1:2.5
Attack	Prepared or fortified	3:1
Attack	Hasty	2.5:1
Counterattack	Flank	1:1

Source: Headquarters, Department of the Army, Field Manual 6-0, *Commander and Staff Organization and Operations* (Washington, DC: Government Printing Office, 2014), 9-20.
NOTE: Historical planning ratios provide planners an arraying forces guideline. Depending on the friendly mission and battle position type, planners estimate a fifty percent success rate using friendly to enemy ratios.

After initial arraying, planners determine specific unit types and adjust force quantities and other variables to increase or decrease relative combat power. Should ratios fall below minimum planning recommendations, planners either request additional resources, accept risk, or change task sequencing.[95] ADP 3-90 *Offense and Defense* advises tailoring reconnaissance, surveillance, security, tempo, distributed operations, and reserve force size, based on risk. Commanders should never risk mission failure to enhance force protection. Experience, reasoning, situational awareness, and unit familiarity help commanders make prudent risk decisions.[96] Figure 11 depicts risk based reduction factors.

[95] HQDA, FM 6-0, 9-20.

[96] HQDA, ADP 3-37, 1-2, 1-7, 2-15.

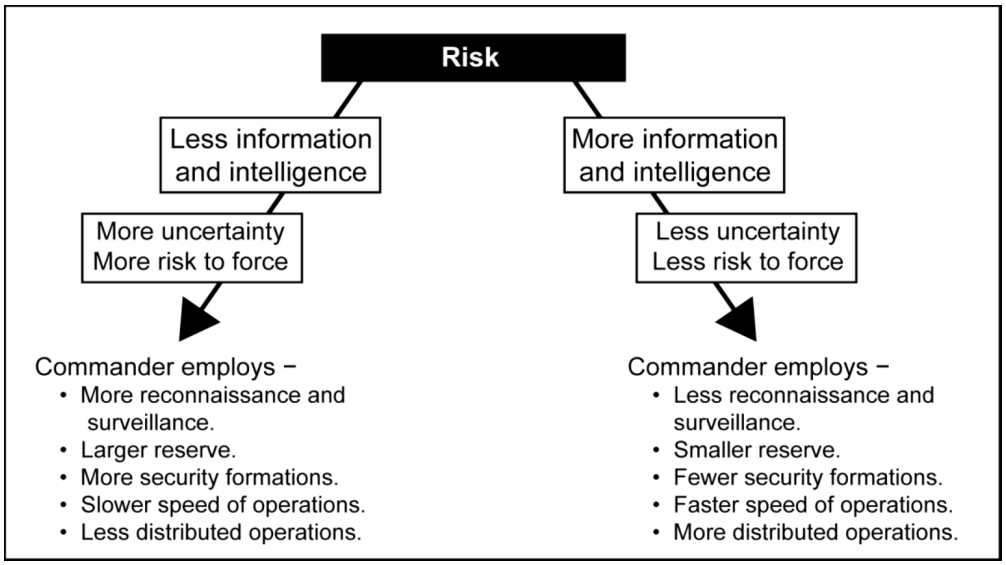

Figure 11. Risk Reduction Factors

Source: Headquarters, Department of the Army, Army Doctrine Publication 3-90, *Offense and Defense* (Washington, DC: Government Printing Office, 2018), 1-7.
NOTE: Commanders tailor unit size, speed, security, and distribution based on risk and information available.

One common non-doctrinal tool to help array forces is a correlation of forces (COF) calculator. A COF objectively compares opposing force combat power ratios to estimate engagement outcomes.[97] Subjective variables such as terrain, weather, recent successes, leadership, morale, and equipment may impact ratios needed to improve success probability.[98] Some tacticians make a distinction between "correlation of forces" (COF) and "correlation of forces and means" (COFM) where COF refers strictly to

[97] Dale Spurlin and Matthew Green, "Demystifying the Correlation of Forces Calculator," *Infantry* (January-March 2017), 14-15, accessed 14 February 2019, http://www.benning.army.mil/infantry/magazine/issues/2017/JAN-MAR/pdf/7)Spurlin_CoFCalculator.pdf.

[98] Hogg, "Correlation of Forces," 6; HQDA, FM 6-0, 9-20.

objective combat force ratios and COFM accounts for subjective variables.[99] With this distinction COF better corresponds with COA development and COFM with COA Analysis.

Assigning headquarters to arrayed forces and including risk in the COA statement, briefing, and modifications concludes COA development. COA statements should address overall risk. Specific risks may warrant COA decision brief discussion. Staffs use running estimates and a compiled risk assessment to address specific commander questions. Commander modified COAs require staff risk reassessment.[100]

Step 4: Course of Action Analysis

Following COA development planners conduct COA analysis, or wargaming. Army doctrine considers COA analysis and wargaming synonyms while joint doctrine considers wargaming a means to analyze COAs. During COA analysis, planners examine advantages and disadvantages. Wargaming analyzes COA critical events to help operation visualization and force comparison. Done correctly, wargaming provides planners further COA advantage and disadvantage insights. To help evaluate these advantages and disadvantages, planners use commander approved evaluation criteria. While not necessary for wargaming, modeling and simulation tools can aid friendly and enemy action adjudications.[101] One such tool is the COFM calculator.

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[99] Hogg, "Correlation of Forces," 6.

[100] HQDA, ATP 5-19, 4-13.

[101] JCS, JP 5-0, V-31 – V-35.

A COFM calculator is an analytical tool used to estimate engagement outcomes. COFM calculators consider both objective relationships between opposing forces and subjective variables.[102] Subjective variable identification occurred during mission analysis using operational and mission variables. Planners record resulting risks in preliminary risk assessments. Prior to wargame commencement, intelligence operations officers discuss wargaming parameters and subjective variables. Most planners will not have access to a COFM calculator which numerically incorporates subjective variables. If no COFM calculator is available, adjudicators use experience and sound judgement to adjust engagement outcomes.[103] Doctrine acknowledges mathematical and analytical tool utility, but advises sound judgement and experience weigh higher than calculated outcomes.[104]

COFM calculators have drawbacks. Modern combat materiel specialization and diversity, combined with innumerable battlefield variables, cause drastic COF variations.[105] Additionally, COFM calculators do not accurately compare functionally dissimilar systems and units.[106] Furthermore, because no calculator accounts for every

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[102] Hogg, "Correlation of Forces," 6.

[103] Ibid., 37.

[104] HQDA, ATP 5-19, 1-14.

[105] James K. Womack, "Soviet Correlation of Forces and Means: Quantifying Modern Operations" (master's thesis, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 1990), 36.

[106] Womack, "Soviet Correlation of Forces and Means," 34; Spurlin and Green, "Demystifying the Correlation of Forces Calculator," 16.

subjective variable, including only a few does not necessarily provide more accurate results.[107]

Planners should not use mathematical and analytical tools to precisely predict engagement outcomes. Nor should planners use these tools to facilitate "winning" the war "game." Mathematical and analytical tools strictly facilitate estimates within COA analysis.[108] Estimates allow planners to accomplish four things. First, estimates synchronize friendly plans across each warfighting function for each COA. Second, they identify strengths and weaknesses, new decision points, and risks.[109] Third, they determine commander's critical information requirements, potential branches, and sequels.[110] Forth, they estimate battle losses, casualties, and how one engagement outcome might impact future engagements.[111]

Understanding how one engagement outcome might impact future engagements is critical to future operations planning. Decisions made to mitigate short term risks may affect future risk exposure. Likewise, mitigating potential future risks may increase short term risk exposure.[112] After considering engagement outcomes, planners consider transitions.

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[107] Hogg, "Correlation of Forces," 38.

[108] Ibid., 6.

[109] HQDA, ATP 2-01.3, 2-4.

[110] JCS, JP 5-0, V-33.

[111] Spurlin and Green, "Demystifying the Correlation of Forces Calculator," 16.

[112] CJCS, CJCSM 3105.01, B-6.

Transitioning from one operation type to another is a formation's greatest risk period. Phasing and transitions refer to operation arrangement and control over time, distance, and terrain.[113] Transitions incur risk because they require changing guidance, orientation, or focus. Introducing new variables gives rise to new risks.[114] Transitions occur when commanders assess a need to change from one decisive action element to another.[115] COA analysis identifies which COA best accomplishes mission objectives while best positioning forces for future operations.[116]

Planners consider transitions when evaluating COAs. A COA which unfavorably positions units for future transition may be a higher risk mission despite achieving overwhelming short term success. All offensive tasks which do not achieve complete victory reach a culminating point when combat power balance shifts.[117] Operational reach and risk cannot be separated.[118] Planners deliberately plan for transitions, branches, and sequels.[119] Information gained from COA analysis allows planners to update the

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[113] HQDA, FM 3-0, 6-17.

[114] Meredith, "Operational Risk and the American Way of Warfare," 8.

[115] Headquarters, Department of the Army (HQDA), Army Doctrine Publication (ADP) 3-90, *Offense and Defense* (Washington, DC: Government Printing Office, 2018), 3-18.

[116] JCS, JP 5-0, V-33.

[117] HQDA, ADP 3-90, 3-18.

[118] Meredith, "Operational Risk and the American Way of Warfare," 7.

[119] JCS, JP 3-0, V-13.

DRAW with revised controls and residual risk levels. Following DRAW updates, planners begin COA comparison.[120]

Step 5: Course of Action Comparison

COA comparison facilitates commander decision-making. During COA comparison, staffs compare each COA using predetermined and approved evaluation criteria.[121] Joint Publication 5-0 *Joint Planning,* Appendix G, provides planners several analytical methods to conduct COA comparison.[122] Planners should remember COA comparison's subjective nature and should not strictly rely on numerical results. Comparison serves as a means to inform commanders why one COA is preferred over others. Planners explain preferences based on evaluation criteria and risk.[123]

During COA comparison, planners identify and discuss risks associated with COA assumptions. Planners consider repercussions should any assumption prove false.[124] COA comparison enables the following: future operation force positioning, subordinate unit latitude, and flexibility to respond to unexpected threats and

[120] JCS, JP 5-0, V-36.

[121] Ibid., V-42 – V-43.

[122] Ibid., G-1.

[123] Ibid., V-45.

[124] Ibid., C-6.

opportunities.[125] COA comparison key risk outputs include revised staff estimates and refined critical commander information requirements.[126]

Step 6: Course of Action Approval

After comparing COAs, staffs seek COA approval. Commanders receive a wargaming results brief and choose or modify a preferred COA.[127] Commanders may want more information prior to committing to a COA. Providing planners additional time and resources may compensate for increased mission risk.[128] Nevertheless, effective commanders do not postpone a COA decision to pursue a perfect solution. Commanders balance satisfactory COAs with acceptable risk as timely as possible.[129] Key COA approval risk outputs include staff estimate updates based on COA modifications and a refined commander's intent. A refined intent includes each operational phase's acceptable risk level.[130] COA approval concludes with WARNORD three publication.

Step 7: Orders Production, Dissemination, and Transition

JPP and MDMP conclude with step seven, orders production, dissemination, and transition. Step seven involves taking the approved COA, refining it based on

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[125] Ibid., V-45.

[126] JCS, JP 5-0, V-42.

[127] Ibid., V-45 – V-46.

[128] HQDA, ADP 3-90, 1-7.

[129] HQDA, ATP 3-92, 3-37.

[130] JCS, JP 3-0, III-19.

commander's guidance, and publishing the final plan or OPORD. Final OPORDs include overall mission risk levels and risk guidance.[131]

Published orders indicate an Army operations process phase transition. Planners and commanders transition from plan and prepare to execute and assess. Execute and assess corresponds to the final RM step. Planners and commanders implement feedback systems to ensure effective control implementation while supervising and evaluating. Complacency, lackadaisical standard enforcement, poor control implementation, or unanticipated hazards may require commander intervention and a return to RM step three, develop controls and make risk decisions.[132] When constrained for time, commanders may dictate planners use a real-time RM approach to rapidly assess and treat risk.

Battlefield events may present opportunities. Effective mission execution involves seizing initiative through action and accepting prudent risk to exploit opportunities. Battlefield conditions change frequently. As a commander gains understanding, he or she may redirect risk mitigation resources to strengthen the decisive operation.[133] Following a mission, planners use feedback systems to determine risk forecast accuracy and risk controls effectiveness.[134] Feedback facilitates more objective assessments during future mission planning.

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[131] HQDA, ATP 5-19, 4-4.

[132] Ibid., 1-15.

[133] HQDA, ADRP 5-0, 4-1 – 4-2.

[134] HQDA, ATP 5-19, 1-16.

Summary

Nearly every joint and Army doctrinal publication contains information related to RM. Chapter two RM information thus far presented explain RM's role within the Army operations process and, more specifically, within mission planning. Figure 12 overlays RM with JPP and MDMP and adds each planning step's key RM outputs.

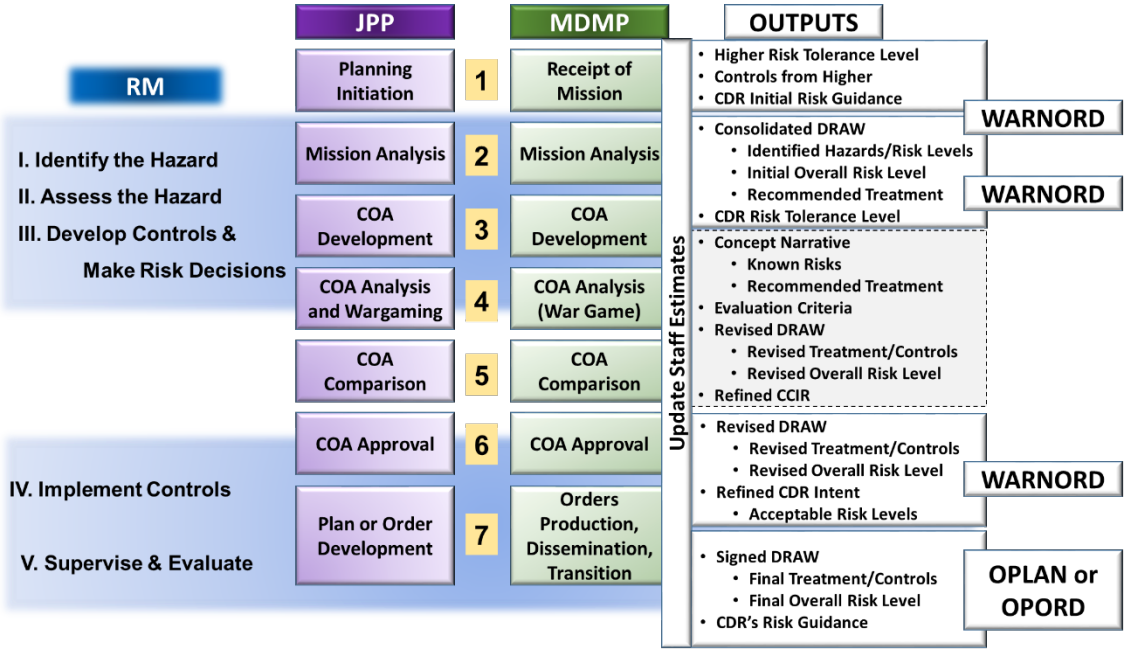

Figure 12. Military Planning & RM Processes with RM Outputs

Source: Created by author using Joint Chiefs of Staff, Joint Publication 5-0, *Joint Planning* (Washington, DC: Government Printing Office, 2017), V-2; Headquarters, Department of the Army, Army Techniques Publication 5-19, *Risk Management* (Washington, DC: Government Printing Office, 2014), 4-1.
NOTE: Each planning step results in RM outputs. RM outputs feed subsequent planning steps. Planners include RM plans in published orders.

Updated running staff estimates and a DRAW are consistent mission planning step requirements. Running staff estimates include prioritized issues, risks, and deficiencies with recommended mitigations. A DRAW quantifies and consolidates

identified risks using a RAM to determine overall risk level. DRAW and RAM provide planners a means to estimate and depict risk.

Doctrine asks RM to enable mission planning and execution. As an integrating function within the operations process, RM feeds all planning aspects. Doctrinal RM discussion broadens ATP 5-19 RM context. Consolidating common doctrinal RM themes revealed four broad RM requirements as depicted in Table 8. These RM requirements served as evaluation criteria in chapter four analysis.

Table 8. Doctrinal Risk Management Requirements

Risk Management Requirements	
Requirement Category	**Evaluation Criteria**
Tailorable	Provides flexibility and allows for intuition and personal judgement
	Determines risk tolerance
	Process guides control development
Standardized	Rapidly assesses hazards
	Numerically estimates hazard probability and consequence
	Accounts for risk exposure
	Incorporates mission and operational variables
	Consolidates and prioritizes identified risks
Consistent	Determines the same risk levels, given the same initial data
	Users can explain the process and reasoning behind results
Insightful	Provides accurate mission success probability
	Determines risk costs and mission benefits by phase
	Identifies risk areas for each involved domain
	Provides insight to potential branch plans and sequels
	Provides control measures, management, and prediction accuracy feedback
	Provides insight to possible treatment options

Source: Created by author.
NOTE: Current LSCO doctrine lists several reasons why planners should use RM and what RM should contribute to the operations process. RM reasons and expected contributions are listed as Table 8 evaluation criteria. Evaluation criteria were grouped, resulting in RM requirement categories. These RM requirement categories facilitated chapter four thematic and framework comparisons.

Doctrine lists RM as an Army operations process supporting tool. Doctrine reiterates RM's importance through inclusion as an operational art element, a command and control task, and a mission command principle.[135] RM is a command function and key planning consideration.[136] RM doctrine provides an institutional standard to facilitate decision making and prudent risk acceptance.[137] Notwithstanding, commanders and planners may institute or tailor RM to their mission.[138] However, prior to RM tailoring, commanders and planners must understand how RM fits within the Army operations process. Failure to incorporate RM into planning equates to removing targeting or IPB from the operations process.

Understanding doctrinal RM requirements enhances RM incorporation into planning. However, simply understanding RM steps and requirements does not provide sufficient RM context. Context is critical to ensure planners identify and assess appropriate hazards. LSCO hazards differ from training hazards. To identify and assess appropriate LSCO hazards requires investigating LSCO risk driving elements.

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[135] HQDA, ADRP 3-0, 2-4; JCS, JP 3-0, III-2; Headquarters, Department of the Army (HQDA), Army Doctrine Reference Publication (ADRP) 6-0, *Mission Command* (Washington, DC: Government Printing Office, 2014), 2-1.

[136] JCS, JP 3-0, III-19.

[137] HQDA, ATP 5-19, v.

[138] JCS, JP 3-0, III-19.

Secondary Question 3:
What LSCO elements must an operational risk management model address?

Risk Considerations

LSCO is inherently a joint venture. As a contribution to this joint venture, the Army conducts unified land operations through decisive action. When deployed abroad, decisive action is the "continuous, simultaneous combination of offensive, defensive, and stability tasks."[139] During LSCO, commanders primarily focus their efforts on offensive and defensive operations. ADP 3-90 *Offense and Defense*, lists several offensive and defensive planning considerations arranged by warfighting function.[140] Plans which address these items will have a higher success probability. Table 9 summarizes the ADP 3-90 planning considerations.

[139] Headquarters, Department of the Army (HQDA). Army Doctrine Publication (ADP) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), iv.

[140] HQDA, ADP 3-90, 3-1 – 4-27.

Table 9. Offensive and Defensive Planning Considerations

ADP 3-90 Planning Considerations	
Offense	**Defense**
Mission Command	
Operations process	Operations process
Team development between commanders	Team development between commanders
Degraded communications	Degraded communications
Movement and Maneuver	
Armored and Stryker Forces	Exploit terrain advantages
Dismounted Infantry Forces	Maintain security
Rotary-Wing Aviation and Unmanned Aircraft	Disrupt the enemy attack at every opportunity
Combat Formations	Mass combat power effects
Soldiers' Load	Armored and Stryker Forces
Assured Mobility	Dismounted Infantry Forces
Mobility	Rotary-Wing Aviation and Unmanned Aircraft
Countermobility	Ensure mutual support
Obscuration	Mobility
	Countermobility
	Enemy airborne and air assault attacks
	Obscuration
Inteligence	
IPB	IPB
Fires	
Targeting	Targeting
Army Indirect Fires and Joint Fires	Army Indirect Fires and Joint Fires
Air and missile defense	Air and missile defense
Sustainment	
Logistics	Logistics
Health service support	Health service support
Personnel services	Personnel services
Protection	
Survivability	Survivability
Detention Activities	CBRN Defense
	Risk Management
	Physical Security and Antiterrorism
	Population and resource control
Transitions	

Source: Created by author using Headquarters, Department of the Army, Army Doctrine Publication 3-90, *Offense and Defense* (Washington, DC: Government Printing Office, 2017).
NOTE: ADP 3-90 lists offensive and defensive planning considerations by warfighting function. Planning considerations help planners identify potential risk categories and drivers.

While colloquial LSCO discussion focuses on offense and defense, ignoring stability operations altogether may incur unnecessary risk. Stability tasks conducted early

in an operation support follow-on phases and strategic success.[141] "All operations morally and legally require forces to conduct minimal-essential stability tasks."[142] Commanders determine how to best conduct each minimal-essential stability task based upon resources available and risks they are willing to accept.[143] ADRP 3-07 *Stability*, lists four broad stability considerations applicable to LSCO.[144] Table 10 lists these stability considerations.

Table 10. Stability Planning Considerations

ADRP 3-07 Planning Considerations
Recognize complexity
Balance resources, capabilities, and activities
Recognize planning horizons
Avoid planning pitfalls

Source: Created by author. Adapted from Headquarters, Department of the Army, Army Doctrine Reference Publication 3-07, *Stability* (Washington, DC: Government Printing Office, 2012).
NOTE: ADRP 3-07 lists four general stability planning considerations. Stability planning considerations remind planners to broaden their planning aperture.

[141] Headquarters, Department of the Army (HQDA), Army Doctrine Reference Publication (ADRP) 3-07, *Stability* (Washington, DC: Government Printing Office, 2012), 3-1.

[142] Ibid., 2-5.

[143] Ibid., 2-6.

[144] Ibid., 4-1.

Accepting risk is a mission command principle and a consideration critical to planning. FM 3-0, Appendix B contains additional risk considerations oriented on staff actions and leadership. Table 11 lists these staff and leadership risk considerations.

Table 11. FM 3-0 Risk Considerations

FM 3-0 Risk Considerations
Combat power
Command and support relationships
Sufficient guidance
Comander location
Relationships with unified action partners and local authorities
Product classification
Understanding terrain
Parallel planning
Staff interaction with commander
Staff rehearsals
Feedback mechanisms
Mutual support between special staff, scheme of maneuver, and information narrative
Simulations and gaming techniques to refine operations
Synchronization across domains
Operational Security (OPSEC)
Military deception

Source: Created by author. Adapted from Headquarters, Department of the Army, Field Manual 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), Appendix B.
NOTE: FM 3-0 lists numerous questions planners should ask while executing the operations process. Table 11 consolidates these questions by risk consideration topic.

Commanders and staff planners must also consider available information. Better situational awareness and factual historical data leads to more accurate risk estimations.[145] Subordinate feedback helps commanders analyze previous forecast

[145] HQDA, DA PAM 385-30, 6; HQDA, ATP 5-19, 1-7, 4-10.

completeness and accuracy. Feedback processes lead to more effective controls and identifying previously unanticipated risks.[146] When lacking information and unable to perform information collection activities, commanders and planners compensate using experience and initiative.[147]

Summary

Most doctrinal LSCO risk considerations focus on warfighting functions, leadership, and information. These three areas constitute the elements of combat power. Successful decisive action requires continuous combat power generation and application.[148] Combat power in this context goes beyond individual soldier safety and encompasses organizational strength. RM should address items which potentially inhibit leadership, information collection, or warfighting function tasks.

Secondary Research Question 4: What techniques can assist in estimating and depicting risk?

RM plays an important role outside the Army and military. From financial investments to manufacturing, RM helps organizations improve performance and make informed decisions.[149] This section summarizes four alternative RM frameworks. The four frameworks include the International Organization for Standardization (ISO),

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[146] HQDA, ATP 5-19, 1-16.

[147] HQDA, DA PAM 385-30, 6; HQDA, ADP 3-90, 3-1.

[148] HQDA, ADRP 3-0, 5-1.

[149] International Organization for Standardization (ISO), "ISO 31000: Risk Management," 2019, accessed 04 March 2019, https://www.iso.org/iso-31000-risk-management.html.

International Risk Governance Council (IRGC), Institute of Risk Management (IRM), and Joint Risk Analysis Methodology (JRAM).

International Organization for Standardization

ISO 31000:2018 *Risk Management – Guidelines* outlines ISO RM standards. While oriented toward business risks, it contains principles, a framework, and a RM process applicable and customizable to any organization.[150] ISO RM principles center on value creation and protection. These principles include: integrated, structured and comprehensive, customized, inclusive, dynamic, best available information, human and cultural factors, and continual improvement. Following these principles enables effective and efficient RM.[151]

The ISO RM framework assists organizations with integrating RM into all activities. Effective RM depends on RM integration into organizational governance. To support this integration, framework tenets center on leadership and commitment. ISO RM tenets include integration, design, implementation, evaluation, and improvement.[152]

ISO RM follows a systematic and iterative process. It applies across the management and decision-making spectrum, from strategic to project level. Figure 13 depicts the ISO RM process.

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[150] International Organization for Standardization (ISO), ISO 31000:2018, *Risk Management: Guidelines*, 2nd ed. (Geneva, Switzerland: ISO, 2018), 1.

[151] Ibid., 2-3.

[152] Ibid., 4.

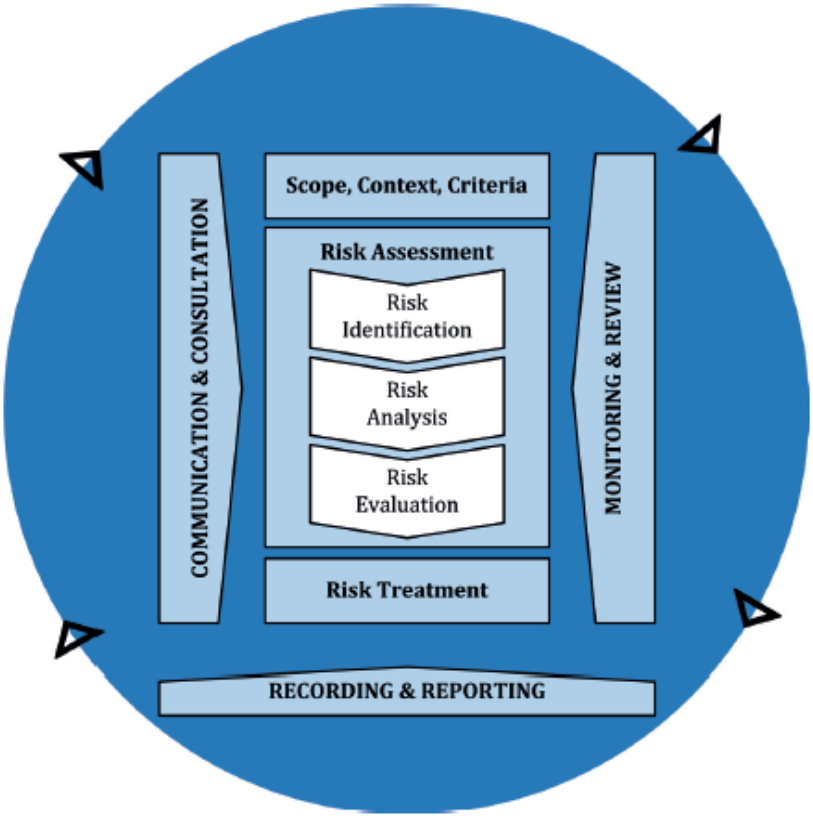

Figure 13. ISO Risk Management Process

Source: International Organization for Standardization (ISO), ISO 31000:2018, *Risk Management: Guidelines*, 2nd ed. (Geneva, Switzerland: ISO, 2018), 9.
NOTE: ISO RM follows a six step iterative process.

This process begins with communication and consultation. After all relevant stakeholders understand associated risks, decision-making methods, and action requirements, risk practitioners customize the process. Customization occurs in the scope, context, and criteria phase. Customization enables effective assessments and appropriate treatment techniques.[153]

[153] ISO, ISO 31000:2018, 10.

Risk assessment contains three sub-steps. Sub-steps include: risk identification, analysis, and evaluation. During risk identification, practitioners find, recognize, and describe risks which may prevent objective achievement. Risk analysis involves comprehending each risk's nature and characteristics. This includes considering an event's likelihood, consequence, complexity, and volatility. It also includes considering time-related factors and current control effectiveness. During risk evaluation, practitioners compare analysis results to the established risk criteria. This comparison helps determine future actions. Actions include doing nothing, treating the risk, conducting further analysis, maintaining controls, or reconsidering objectives.[154]

When risks warrant treatment, practitioners use an iterative process to select the appropriate option, implement that option, assess its effectiveness, evaluate the residual risk, and make further treatment decisions. ISO RM lists the following treatment options: avoid, take the risk to pursue and opportunity, remove the risk source, change either the likelihood or consequence, share the risk, and retain the risk. The stakeholders should understand the options and have a part in the treatment discussions prior to implementation.[155]

Once a treatment option is determined, a treatment plan is required. Treatment plans outline plan reasoning and designate implementation responsibilities. A treatment plan includes proposed actions, required resources, performance measures, reporting

[154] ISO, ISO 31000:2018, 11-12.

[155] Ibid., 13.

requirements, and timeline.[156] After implementation, treatments require monitoring and reviewing.

Planners integrate monitoring and reviewing into each RM process phase. Monitoring enforces plan quality and effectiveness while also enabling accurate recording and reporting. Recording and reporting provides decision-makers information needed to improve RM activities and future decisions.[157]

The International Electrotechnical Commission (IEC) 31010: 2009 *Risk Management – Risk Assessment Techniques*, supplements the ISO 31000. It describes several risk assessment options available to planners. These options range from strictly qualitative, such as brainstorming and using checklists, to strictly quantitative, such as Monte-Carlo and Bayesian analysis.[158] When possible, defining consequence and probability in quantitative terms leads to more accurate hazard categorization. Small to mid-size organizations often find quantitative RM data collection too intensive. However, qualitative RM usually meets their needs.[159] One recommended technique for small to mid-size organizations is the consequence-probability matrix. The consequence-probability matrix determines risk levels by combining qualitative and semi-quantitative consequence and probability ratings. Organizations often use the matrix method to screen

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[156] ISO, ISO 31000:2018, 14.

[157] Ibid.

[158] International Electrotechnical Commission (IEC), IEC/FDIS 31010:2009, *Risk Management: Risk Assessment Techniques* (Geneva, Switzerland: IEC, 2009), 23-26.

[159] Jan Emblemsvåg, ed., *Risk Management for the Future: Theory and Cases,* (Rijeka, Croatia: InTech, 2012), 470, accessed 17 January 2019, https://doi.org/10.5772/1809.

many risks at once and the format facilitates tailoring based "on the context in which it is used."[160]

Consequence-probability matrices contain customized scales that cover the possible consequence and probability ranges. Practitioners define these terms as unambiguous as possible to provide matrix clarity and simplicity.[161] The consequence and probability definitions impact the risk levels.

Risk matrices may be symmetric or weighted. Weighted matrices indicate how organizations perceive and tolerate risk. An organization may use risk levels as a broad determinate to treat or not treat a risk.[162]

Risk matrices have several advantages and disadvantages. Advantages include ease and speed. Matrices are relatively easy to use compared to other assessment tools. They also help rapidly rank risks by risk level. These advantages, especially for smaller organizations, often outweigh the disadvantages.[163]

Disadvantages include applicability, ambiguity, subjectivity, aggregation, and comparison. Matrix applicability is limited to the circumstances for which it was designed. A single matrix may not apply to all circumstances within an organization. Defining unambiguous scales may prove difficult. Raters presented with ambiguous terms may rate the same hazards with different risk levels. This subjectivity leads to less

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[160] IEC, IEC/FDIS 31010:2009, 82.

[161] Ibid., 83.

[162] Ibid., 83-85.

[163] Ibid., 85.

reliability. Risks presented in a matrix cannot be aggregated. Because many risk areas are not directly related, defining overall risk levels by lower risk level quantities will mislead decision-makers. Furthermore, detailed analysis led to more identified risks, often with lower risk levels. Aggregating these may underestimate the overall risk level. This concept ties into the comparison disadvantage. Risk levels in one risk area cannot be directly compared to similar risk levels in another area. Practitioners must consider hazards in different risk areas separately.[164]

International Risk Governance Council

IRGC provides evidence-based risk governance recommendations to diverse organizations.[165] The IRGC risk governance framework contains four elements and three cross-cutting aspects. Elements include: (1) pre-assessment, (2) appraisal, (3) characterization and evaluation, and (4) management. Cross-cutting aspects include: (1) communication, (2) stakeholder engagement, and (3) context. Figure 14 depicts this framework.

[164] IEC, IEC/FDIS 31010:2009, 86.

[165] International Risk Governance Center (EPFL IRGC), *Introduction to the IRGC Risk Governance Framework,* rev. ed. (Lausanne, Switzerland: EPFL IRGC, 2017), preface, accessed 08 February 2019. https://dx.doi.org/10.5075/epfl-irgc-233739.

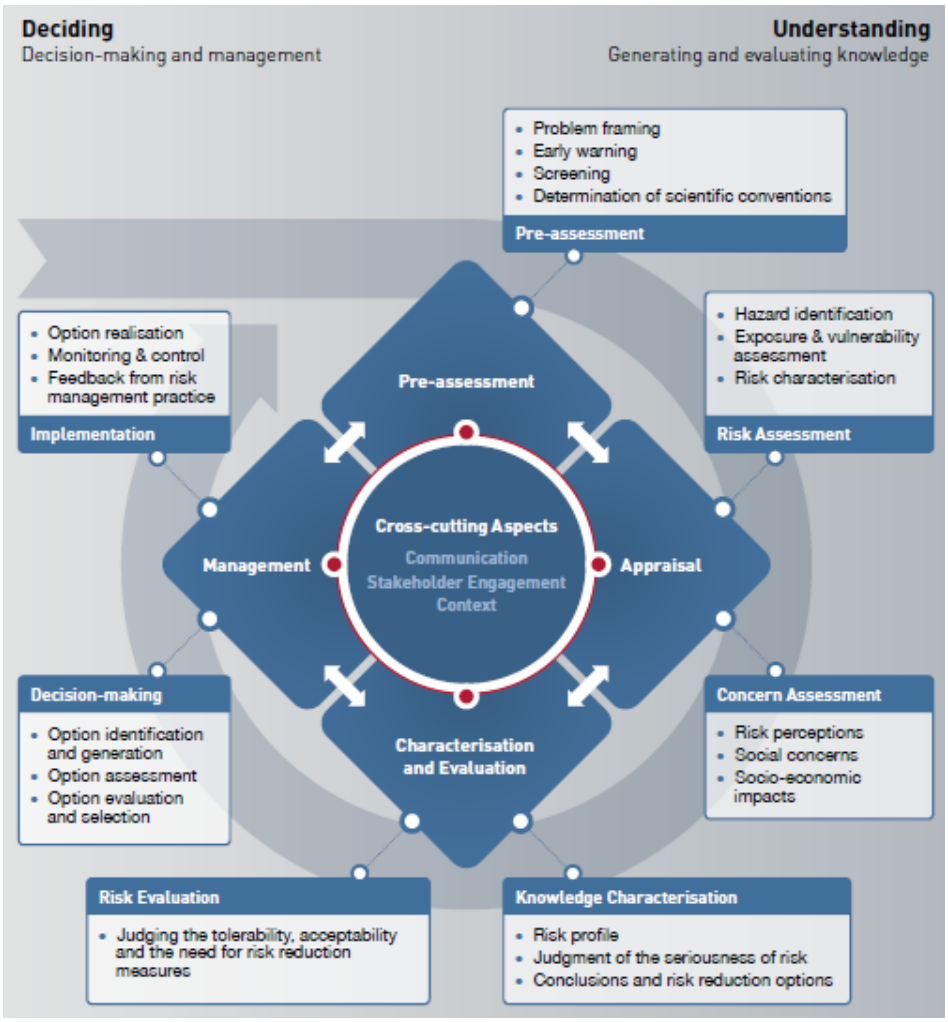

Figure 14. IRGC Risk Governance Framework

Source: International Risk Governance Center (EPFL IRGC), *Introduction to the IRGC Risk Governance Framework,* rev. ed. (Lausanne, Switzerland: EPFL IRGC, 2017), 10. NOTE: IRGC risk governance involves four iterative elements, or steps, and three cross-cutting aspects. Risk governance begins with Pre-assessment and concludes with management.

During pre-assessments practitioners define risk issues, clarify differing risk perspectives, and form risk assessment and management baselines. Practitioners consider several items when conducting pre-assessments. Pre-assessment items include:[166]

1. Identifying which risks and opportunities will be addressed
2. Understanding stakeholder views and interactions
3. Determining risk dimensions and evaluation boundaries
4. Recognizing risk indicators
5. Establishing which tools and methods will best assess the risks
6. Reviewing applicable legal systems
7. Recognizing the organization's capability to deal with risk

Risk sources, drivers, and governance issues frame RM. Risk sources include any item with potential to cause risk. Risk sources fall into three categories: (1) natural events, (2) human behavior, and (3) interactions between multiple sources.[167]

Risk drivers are items or circumstances which amplify or attenuate risk. Risk drivers include: (1) emerging risk knowledge, (2) system complexity, (3) social and cultural dynamics, (4) development, (5) natural resources and the environment, (6) competing interests, and (7) variability in risk susceptibility.[168]

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[166] EPFL IRGC, *Introduction to the IRGC Risk Governance Framework*, 11-12.

[167] International Risk Governance Council (IRGC), *Emerging Risks: Sources, Drivers and Governance Issues,* Concept Note, rev. ed. (Geneva, Switzerland: ITGC, 2010), 6-9, accessed 01 May 2019, https://dx.doi.org/10.5075/epfl-irgc-228190.

[168] Ibid.

Risk governance issues include organizational aptitude or capacity to deal with risk. Areas affecting risk governance include: (1) risk complexity, (2) uncertainty, (3) adaptability, (4) organizational structure and authorities, (5) pre-conceived agendas or biases, and (6) conflict resolution.[169]

The next element is appraisal. Appraisal involves risk assessment and concern assessment. Risk assessment involves (1) identifying and ranking risks; (2) quantifying potential hazard likelihood, severity, and persistence; (3) investigating organizational risk absorbing capacity; and (4) investigating possible scenarios which may exploit vulnerabilities. Insufficient data and misapplied methods may lead to less reliable risk assessments.[170]

When identifying and ranking risks, the IRGC utilizes a hazard type taxonomy. Hazard types include: physical agents, chemical agents, biological agents, natural disasters, social-communicative issues, and complex hazards. Complex hazards have more than one hazard type.[171]

Concern assessments consider stakeholder risk opinions and concerns. Understanding people's perceptions, past experiences, and values contributes to understanding why and how people make risk decisions. The IRGC strongly advises

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[169] IRGC, *Emerging Risks,* 6-9.

[170] EPFL IRGC, *Introduction to the IRGC Risk Governance Framework*, 14-15.

[171] International Risk Governance Council (IRGC), *Risk Governance: Toward an Integrative Approach,* White Paper (September 2005; repr., Geneva, Switzerland: IRGC, January 2006), 20, accessed 03 February 2019, https://www.irgc.org/wp-content/uploads/2012/04/IRGC_WP_No_1_Risk_Governance__reprinted_version_3.pdf.

assessors conduct risk and concern assessments using scientific methodologies. Big data, predictive analysis, or social media sources feed these methodologies.[172]

The next element involves characterization and evaluation. First, each risk is characterized based on information availability and reliability.[173] Risks with different complexity and uncertainty require different management strategies.[174] Conventional risk assessments apply when hazard likelihood and consequence are relatively certain. When uncertainty increases, practitioners rely on experience.[175]

Understanding risk character provides insight into management approaches. Management approaches vary based on whether planners address risk impacts or sources. Risk character may also change over time. Changes in risk character will impact control effectiveness and require changes to management approaches.[176] Table 12 depicts four risk character categories and management strategies for each.

[172] EPFL IRGC, *Introduction to the IRGC Risk Governance Framework*, 13-15.

[173] IRGC, *Risk Governance*, 30.

[174] EPFL IRGC, *Introduction to the IRGC Risk Governance Framework*, 24.

[175] IRGC, *Risk Governance*, 123.

[176] EPFL IRGC, *Introduction to the IRGC Risk Governance Framework*, 17.

Table 12. IRGC Risk Management Strategies

Risk Character	Strategy Target	
	Risk Impact	Risk Source
Simple	**Routine-based** regulations, policies	
Complex	**Robustness-focused** built strength, contain	**Risk-informed** apply treatment option
Uncertain	**Resilience-focused** prepare for surprise	**Precaution-based** be prudent, flexible
Ambiguous	**Discourse-based** build tolerance, confidence, trust	

Source: Created by author. Adapted from International Risk Governance Center (EPFL IRGC), *Introduction to the IRGC Risk Governance Framework,* rev. ed. (Lausanne, Switzerland: EPFL IRGC, 2017), 25.
NOTE: Planners evaluate risk character and determine whether to target risk impact or source. Together, risk character and target strategy inform a RM approach.

Evaluating risk requires judgement as to its acceptability to decision-makers and stakeholders. Risk evaluation categories include acceptable, tolerable, and intolerable. Acceptable risks do not require risk reduction. Tolerable risks require reduction. Intolerable risks must be avoided. Ethical considerations, social values, and constraints factor into risk evaluation and may alter preconceived category boundaries.[177] Determining these boundaries is difficult.[178] Figure 15 depicts the IRGC risk evaluation concept.

[177] EPFL IRGC, *Introduction to the IRGC Risk Governance Framework*, 20.

[178] IRGC, *Risk Governance*, 37.

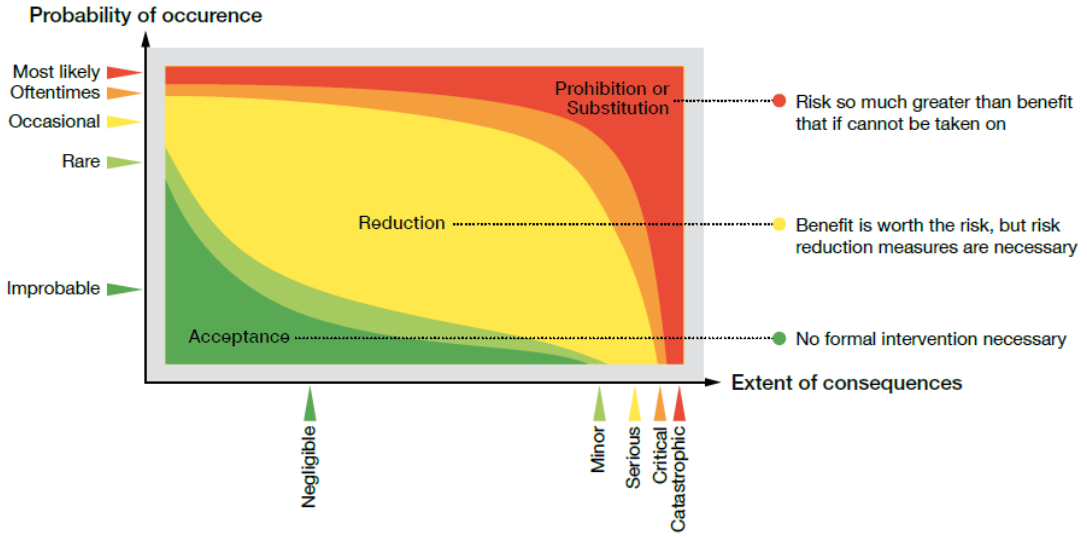

Figure 15. IRGC Risk Evaluation

Source: International Risk Governance Center (EPFL IRGC), *Introduction to the IRGC Risk Governance Framework,* rev. ed. (Lausanne, Switzerland: EPFL IRGC, 2017), 20. NOTE: Figure 15 depicts three general risk evaluation categories: acceptable (green), tolerable (yellow), and intolerable (red). Probability and consequence levels are determined by risk category boundaries and intersections.

The final element is management. Management involves designing and implementing tolerable risk treatments. Risk treatments include avoid, reduce, transfer, and retain. When making treatment decisions, assessors consider relevant actors involved, reduction impacts, other organization cooperation, effectiveness measures, and management options. Management options are methods to controls risk. Management options may include technological, regulatory, institutional, and educational methods.[179]

Good RM depends on established processes and systematic decision-making. These processes should include pre-established management options and pre-defined

[179] EPFL IRGC, *Introduction to the IRGC Risk Governance Framework*, 23.

control criteria. Example criteria include effectiveness, efficiency, sustainability, political and legal implementation policies, ethical and public acceptance, side effect minimization, and fairness. Decision-makers must implement measures to ensure successful management. Areas which lead to less successful controls include indecision, knee-jerk reactions, unsustainability, or lacking responsibility and accountability.[180]

Once decision-makers determine treatments and management options, they implement a monitoring and review plan. Existing controls or treatments may require alterations should conditions change. Flexible management options and an integrated feedback system enable decision-makers to make timely, informed, adjustments.[181]

The cross-cutting aspects include communication, stakeholder engagement, and context. When faced with challenging risks, communication creates long term trust. Stakeholder engagement depends on risk characteristics. Determining management options for uncertain and ambiguous risks, requires increased stakeholder participation. Risk decisions must consider social, institutional, political, and economic context. The risk culture external to the organization may impact risk tolerance and trust. Additionally, an organization must understand its capacity to fulfill its RM roles within changing cultural dynamics.[182]

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[180] EPFL IRGC, *Introduction to the IRGC Risk Governance Framework*, 24-25; IRGC, *Risk Governance*, 42.

[181] EPFL IRGC, *Introduction to the IRGC Risk Governance Framework*, 25-26.

[182] Ibid., 32.

Institute of Risk Management

The IRM advocates organizations embed RM into each management level. Accomplishing objectives within each management level requires taking strategic, tactical, and operational risks. Successful managements fully integrate RM into each work function. Defined professional standards and behavioral competencies facilitate RM integration.[183]

The IRM framework revolves around four professional standards and six behavioral competencies. Professional standards describe employee knowledge and skills needed for success. Behavioral competencies describe desired employee qualities and behaviors. Table 13 depicts these standards and competencies.[184]

Table 13. IRM Risk Management Framework

Risk Management Framework	
Professional Standards	**Behavioral Competencies**
Insight and Context	Courage and Confidence
Strategy and Performance	Influence and Impact
Risk Management Process	Integrity, Ethics, and Values
Organizational Capability	Innovation and Catalyst
	Building Capacity
	Collaboration and Partnering

Source: Created by Author. Adapted from Institute for Risk Management (IRM), *Professional Standards in Risk Management* (London: IRM, 2019).
NOTE: Professional standards and behavioral competencies contribute to a RM framework.

[183] Institute for Risk Management (IRM), *Professional Standards in Risk Management* (London: IRM, 2019), 5-20, accessed 19 April 2019, https://www.theirm.org/media/1406416/IRM-PSRM-Brochure_WEB.pdf.

[184] Ibid.

IRM recognizes risk has both positive and negative consequences. Safety oriented organizations tend only to manage negative consequences. Negative consequences arise from external and internal drivers.[185]

Example external drivers include natural, political, or legal events. External drivers are often difficult to forecast, have lower occurrence probability, and have higher consequences than internal drivers. Internal drivers may include people, premises, processes, and products. Internal drivers can usually be forecasted and their probabilities determined.[186] Identifying these drivers facilitates organizational RM. Figure 16 depicts example risk driver relationships.[187]

[185] IRM, *Professional Standards in Risk Management*, 2-3.

[186] Emma Bayer and Gabriel Öberg Bustad, "Introducing Risk Management Process to a Manufacturing Industry" (master's thesis, KTH Royal Institute of Technology, Stockholm, Sweden, 2013), 15.

[187] IRM, *A Risk Management Standard*, 2-3.

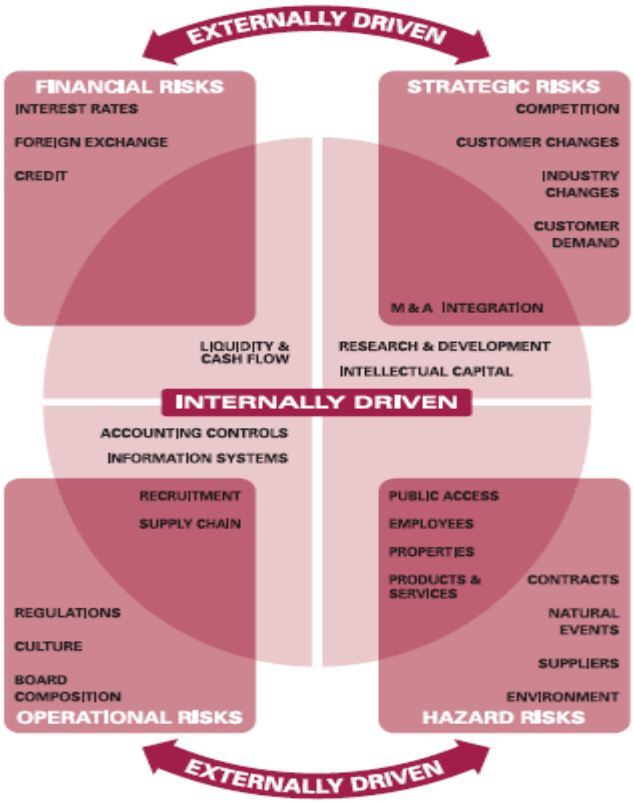

Figure 16. Key Risk Driver Examples

Source: Institute for Risk Management (IRM), *A Risk Management Standard* (London: IRM, 2002), 3.
NOTE: RM involves categorizing risks and identifying risk drivers. Each quadrant above represents one risk category (white font). Within each category are internal and external risk drivers (black font).

IRM RM contains seven steps. Step one involves ensuring all parties understand the organization's strategic objectives. Step two is risk assessment. Risk assessment includes risk analysis and risk evaluation. Risk analysis encompasses identifying, describing and estimating the risks. During analysis planners identify risks and opportunities related to achieving strategic objectives. Identification techniques may include brainstorming, questionnaires, studies, and RM workshops. Next, planners

categorize significant organizational activities and define possible resulting risks. Generally, planners begin with a risk category, evaluate possible incident types, and then identify specific risks and their potential impact. Identified risks require clear descriptions. Descriptions involve specifying scope, nature, and quantification. Also included are relevant stakeholders, risk tolerances, treatments and controls, improvement options, and policy developments.[188]

Estimating risk involves quantitative, semi-quantitative, or qualitative methods. Methods may include dependency models, event tree analysis, statistical inference, SWOT, BPEST, or PESTLE. SWOT analysis investigates strengths, weaknesses, opportunities, and threats. BPEST analysis looks into business, political, economic, social, and technological aspects. PESTLE involves political, economic, social, technical, legal, and environmental conditions. These models apply to both threat and opportunity risk. Some models are more appropriate to one or the other.

Models useful in analyzing opportunity risk include market surveys, prospecting, research and development, and impact analysis. Models for threat risk include threat analysis, fault tree analysis, and FMEA. FMEA stands for failure mode and effect analysis. The model used should match investigated risk categories.[189]

Defining consequence, threat probability, and opportunity probability improves risk estimations. Risk analysis techniques help prioritize the risks. The prioritized risks

[188] IRM, *A Risk Management Standard*, 4-6.

[189] Ibid., 14.

are then evaluated against pre-established criteria. Evaluating risks helps determine which risks receive treatment.[190]

The next step is risk reporting. The assessment results will contain information pertinent to different organizational levels. Communicating the method used to identify risks, implemented controls, and the monitoring and review plan to internal organizational levels and external stakeholders fosters shared understanding and trust.[191]

Following risk reporting comes risk treatment. Risk treatment options may include mitigation, avoidance, transfer, or financing. Option recommendations must be prioritized by potential benefit to the organization. Each treatment option has an associated cost. The treatment option implementation cost must be less than the expected loss if no control is implemented.[192]

Step seven is monitoring and reviewing the RM process. As operations continue, changes in the organization or environment may necessitate assessment and treatment plan modifications. Reviewing each treatment plan for accuracy and efficacy feeds future assessments.[193] Figure 17 depicts the IRM RM process.

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[190] IRM, *A Risk Management Standard*, 6-8.

[191] Ibid., 9-10.

[192] Ibid., 10.

[193] Ibid., 11.

Figure 17. IRM Risk Management Process

Source: Institute for Risk Management (IRM), *A Risk Management Standard* (London: IRM, 2002), 4.
NOTE: IRM RM begins by identifying an organization's strategic objective and concludes with monitoring implemented risk decisions.

Hopkin, in his IRM publication *Fundamentals of Risk Management*, expands upon several RM frameworks concepts. Items pertinent to this thesis include risk subdivisions, risk appetite, and risk treatment.

Hopkin states there are no right or wrong risk subdivisions. An organization must find the system best suited to its needs.[194] However, after identifying risk within each

[194] Paul Hopkin, *Fundamentals of Risk Management: Understanding, Evaluating and Implementing Effective Risk Management* (London: Kogan Page, 2010), 13, accessed

subdivision, a temporal risk analysis will provide insight to short, medium, and long-term risk consequences. Understanding these consequences may impact risk decisions.[195]

When responding to hazards, Hopkin lists four treatment options. These options include tolerate, treat, transfer, and terminate.[196] Determining which risks to tolerate largely depends on the organization's risk appetite and capacity to deal with hazards. Risk appetite can be risk averse or risk aggressive. Figure 18 contains two matrices which illustrate these concepts.[197]

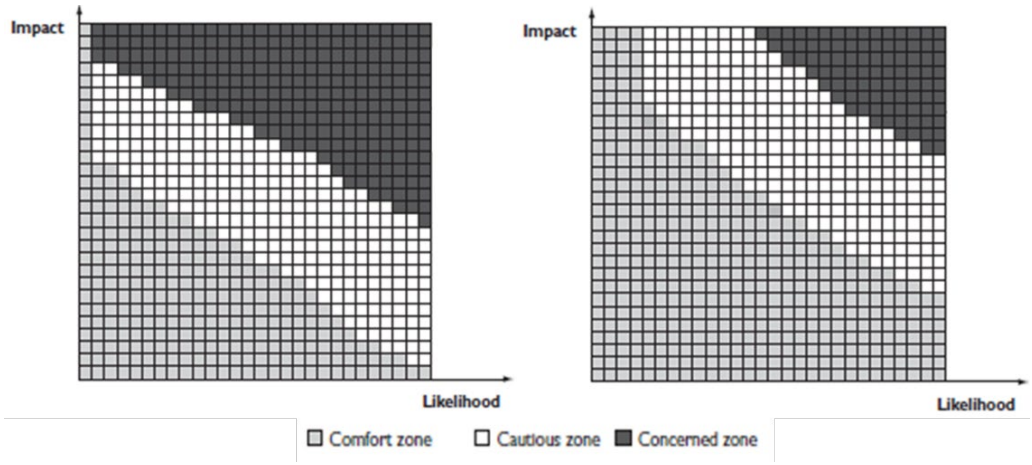

Figure 18. Risk Appetite Matrices

Source: Paul Hopkin, *Fundamentals of Risk Management: Understanding, Evaluating and Implementing Effective Risk Management* (London: Kogan Page, 2010), 128.
NOTE: Figure 18 depicts a risk averse matrix (left), as indicated with a larger concerned zone, and a risk aggressive matrix (right), as indicated with a smaller concerned zone.

March 6, 2019, http://www.hostgator.co.in/files/writeable/uploads/hostgator12628/file/fundamentalsofriskmanagement.pdf.

[195] Hopkin, *Fundamentals of Risk Management*, 28.

[196] Ibid., 49.

[197] Ibid., 128.

Figure 18 depicts a risk averse matrix (left) and a risk aggressive matrix (right). Organizations tailor risk matrices based upon risk appetite. Shaded regions represent how organizations view plotted hazards. Organizations tend to avoid hazards plotted within a concerned zone. A larger concerned zone indicates a risk averse organization. A smaller concerned zone indicates a risk aggressive organization. Risk appetite is important when considering risk capacity.[198]

Risk capacity is how much risk an organization can afford to take. An organization's risk appetite should fall below its risk capacity.[199] Likewise, the risk exposure should also fall below an organization's risk capacity.[200] An optimal risk appetite, exposure, and capacity relationship resembles Figure 19.

[198] Hopkin, *Fundamentals of Risk Management*, 128.

[199] Ibid., 146.

[200] Ibid., 237.

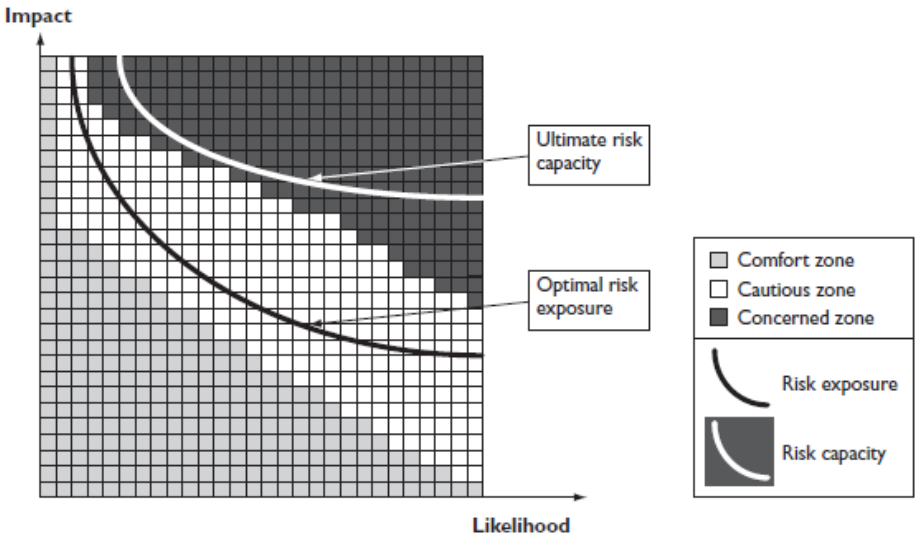

Figure 19. Risk Appetite, Exposure, and Capacity (Optimal)

Source: Paul Hopkin, *Fundamentals of Risk Management: Understanding, Evaluating and Implementing Effective Risk Management* (London: Kogan Page, 2010), 237.
NOTE: This figure depicts an optimal RM approach as indicated by aversion to risks approaching capacity and routine exposure falling closer to the comfort zone.

In Figure 19, risk capacity lies just above the concerned zone boundary. This means an organization has capacity to deal with risks just inside the concerned zone. Optimal risk exposure lies well below capacity. This means an organization wants hazards below its capacity. Organizations with this risk model can sustain operations and likely recover from a few unanticipated risks. Figure 20 depicts a contrasting, vulnerable, organization.

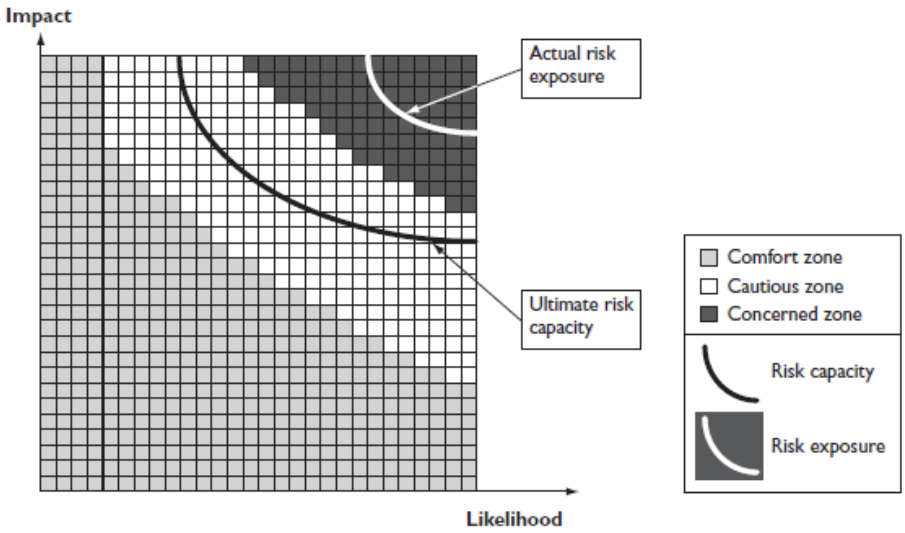

Figure 20. Risk Appetite, Exposure, and Capacity (Vulnerable)

Source: Paul Hopkin, *Fundamentals of Risk Management: Understanding, Evaluating and Implementing Effective Risk Management* (London: Kogan Page, 2010), 238.
NOTE: This figure depicts a vulnerable organization as indicated by risk capacity falling below the concerned zone and routine exposure falling well within the concerned zone.

Figure 20 depicts an organization whose risk appetite lies well above its risk handling capacity. In addition, risk exposure lies well within the concerned zone. This is not sustainable and makes an organization vulnerable.[201]

When faced with hazards, organizations may decide to tolerate, treat, transfer, or terminate them. When a hazard has a low likelihood and impact, an organization can usually tolerate it. When the impact remains low, but the likelihood increases, an organization should treat the likelihood or impact to lower the overall risk level. When the likelihood remains low, but the impact is high, an organization should transfer all or

[201] Hopkin, *Fundamentals of Risk Management*, 248.

part of the risk to a third party. Finally, activities generating hazards with high likelihood and high probability should be terminated. Figure 21 depicts these treatment options.[202]

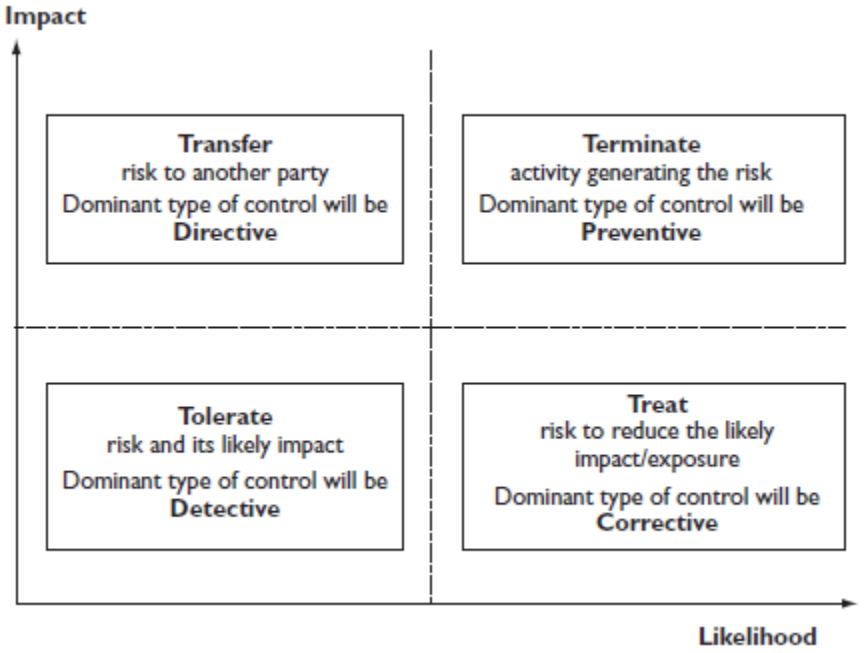

Figure 21. Hazard Treatment Options

Source: Paul Hopkin, *Fundamentals of Risk Management: Understanding, Evaluating and Implementing Effective Risk Management* (London: Kogan Page, 2010), 246.
NOTE: Dividing risk matrices into quadrants provides hazard treatment option insight.

Often, hazards do not fall neatly into these four quadrants. To rectify this issue, risk zones are overlaid with treatment quadrants. All hazards plotted within the cautious zone require individual risk treatment consideration. A cautious zone lower boundary

[202] Hopkin, *Fundamentals of Risk Management*, 245-246.

becomes a judgement line and an upper boundary becomes a critical line. Figure 22 depicts this concept.

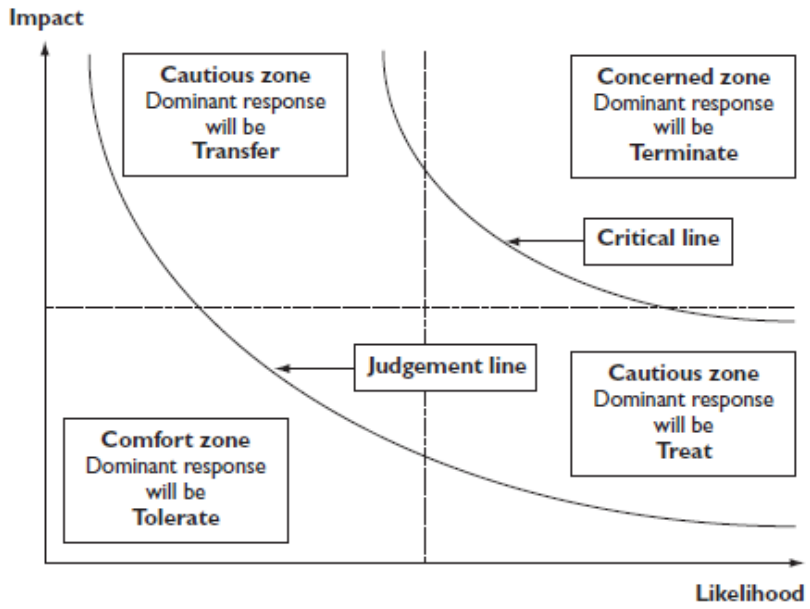

Figure 22. Hazard Risk Zones

Source: Paul Hopkin, *Fundamentals of Risk Management: Understanding, Evaluating and Implementing Effective Risk Management* (London: Kogan Page, 2010), 246.
NOTE: Hazards plotted between risk judgement and critical risk lines require treatment decisions. Hazards plotted outside these lines are treated based upon quadrant recommendation.

Risk decision-makers determine cautious zone boundaries and treatment methods for all hazards plotted within this zone. An organization's risk capacity and exposure help decision-makers determine ideal treatment options. Planners do not need treatment decisions for hazards outside the cautious zone. Hazards outside the cautious zone are either terminated or tolerated.

Bayer, in her RM application to manufacturing, expanded upon similar IRM matrices by analyzing plotted hazard groups. Bayer's meta-analysis provided insight into broader manufacturing supply chains issues.[203] Supply chain categories considered include: supply, demand, company, and environment. Figure 23 depicts supply chain hazards plotted by category.

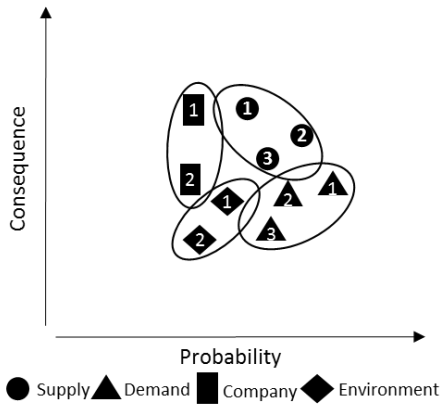

Figure 23. Supply Chain Hazard Meta-analysis

Source: Created by author. Adapted from Emma Bayer and Gabriel Öberg Bustad, "Introducing Risk Management Process to a Manufacturing Industry" (master's thesis, KTH Royal Institute of Technology, Stockholm, Sweden, 2013), 16.
NOTE: This figure depicts hazards from four supply chain risk categories. Analyzing multiple hazards at once can provide insight into which categories incur more risk.

Figure 23 contain hazards plotted from four manufacturing categories. Depicting all hazards simultaneously and distinguishing them by category facilitates meta-analysis. Analyzing Figure 23 reveals supply hazards as highest risk and environmental hazards as

[203] Bayer and Bustad, "Introducing Risk Management Process to a Manufacturing Industry," 16.

lowest. Company leadership can use such information to maximize resource allocation effectiveness.

The Joint Risk Analysis Methodology

The Chairman of the Joint Chiefs produces an annual risk assessment for the President, Secretary, and Congress. With combatant commander and joint chief input, this risk assessment addresses strategic risk and military risk. Strategic risk addresses national security. Military risk addresses military objectives and resources. Military risk includes two risk types and four subsets. The two risk types include risk to mission and risk to force. Risk to mission subsets include operational risk and future challenges risk. Risk to force subsets include force management risk and institutional risk.[204]

Chairman of the Joint Chiefs of Staff Manual (CJCSM) 3105.01 *Joint Risk Analysis* contains guidance for the Chairman's risk assessment and establishes a joint risk analysis methodology (JRAM). It represents the first "authoritative Joint Staff risk reference" and supports the Joint Strategic Planning System. CJCSM 3105.01 applies to all services and addresses military strategic risk.[205] Figure 24 depicts the JRAM framework.

[204] CJCS, CJCSM 3105.01, C-3 – C-9.

[205] Ibid., 1, A-2.

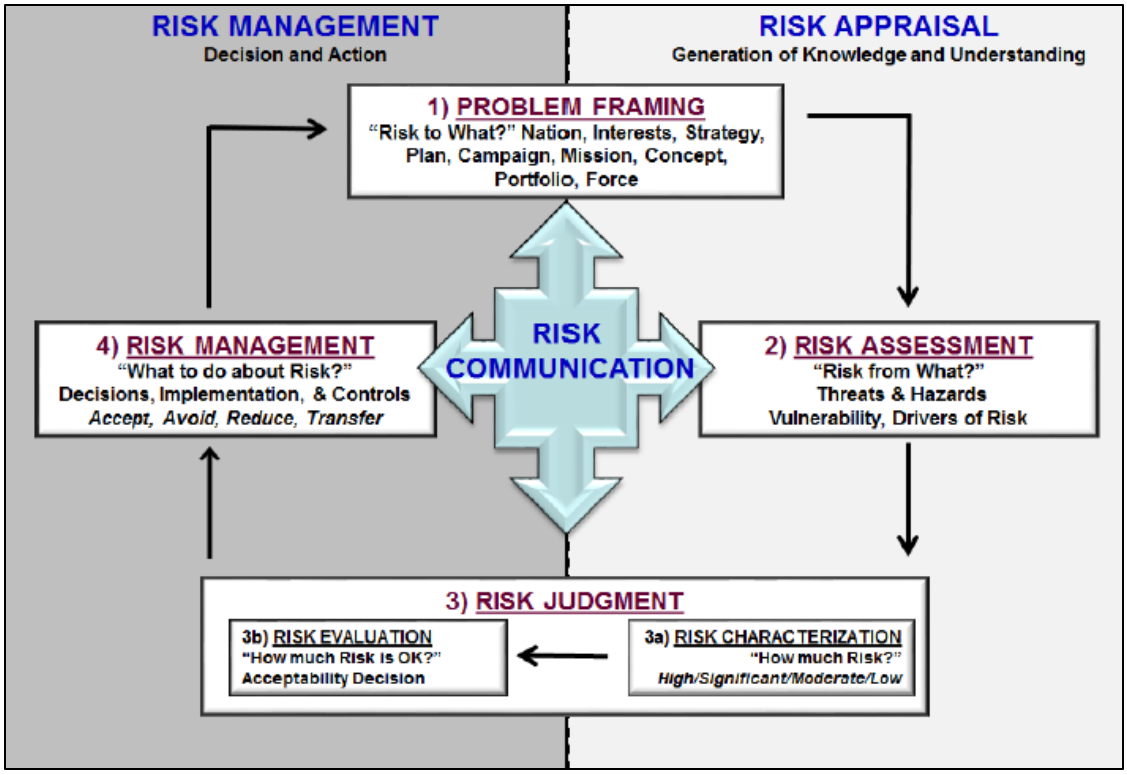

Figure 24. JRAM Framework

Source: Chairman of the Joint Chiefs of Staff, Chairman of the Joint Chiefs of Staff Manual 3105.01, *Joint Risk Analysis* (Washington, DC: Government Printing Office, 2016), B-2.
NOTE: RM begins with problem framing and concludes with management.

The JRAM framework contains three components and four steps. Framework components include: risk appraisal, risk management, and communication. Framework steps include: problem framing, risk assessment, risk judgment, and risk management. This framework emphasizes using terminology both civilian policy makers and military leaders understand.[206]

[206] CJCS, CJCSM 3105.01, A-1 – B-1.

Problem framing answers the question "risk to what?" It also defines assessment step standards and terms. Assessment step standards may include risk criteria or scale. Terms requiring definitions include probability and consequence levels.[207]

The risk assessment step links expected harmful events with an appropriate probability and likely consequence. Identifying risk sources and drivers is critical to risk assessments. Sources include threats and hazards. Drivers include factors which "increase or decrease the probability, frequency, or consequence of risks arising from various sources."[208] Example risk drivers include limited resources, vulnerability, resilience, criticality, accessibility, recognition, and severity. After identified sources receive appropriate probability and likely consequence levels, they require characterization and evaluation. Characterization and evaluation take place during risk judgement.[209]

During risk judgment, decision-makers determine acceptable risk levels. Planners then characterize and evaluate each risk source. Risk characterization establishes each risk source's risk level by plotting consequence and probability. Evaluation involves assigning treatment options to each source.[210]

CJCSM 3501.01 divides consequence into four levels, each with definitions tailorable to specific scenarios or risk types.[211] CJCSM 3501.01 provides example

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[207] CJCS, CJCSM 3105.01, B-2.

[208] Ibid., B-3.

[209] Ibid., B-3 – B-4.

[210] Ibid., B-5.

[211] Ibid., B-3.

generic, strategic, and military risk consequence levels. Table 14 consolidates these levels with potential definitions.

Table 14. Tailored Consequence Levels

CJCSM 3105.01 *Joint Risk Analysis* Tailored Consequence Levels		
Generic	**Strategic**	**Military**
Extreme	Existential – permanent destruction relative to interests	Mission failure. Objectives unachievable, no sourcing solutions exist for critical requirements
Major	Catastrophic – high order, long-term damage to interests	Objectives partially achieved/shortfalls for critical requirements
Moderate	Major – considerable, mid-term damage to interests	Objectives partially achieved/world-wide sourcing solutions for most requirements
Minor	Limited – confined, short-term damage to interests	Mission success, Objective achievable, joint force fully sustained, requirements sourced

Source: Created by author.
NOTE: Consequence definitions should be tailored for each risk category. CJCSM 3105.01 defines four consequence levels for strategic risks and military risks.

CJCSM 3105.01 also divides probability into four levels: highly unlikely, improbable, probable, and very likely. Finally, it divides consequence and probability intersections into four risk levels: low, moderate, significant, and high. The overall risk level is expressed as a function of probability and consequence using the following formula:[212]

$$R=f(P,C)$$

[212] CJCS, CJCSM 3105.01, B-4.

This formula implies graduated risk levels formed by a relationship between two independent variables: probability (P) and consequence (C). Decision-makers may weigh consequence or probability more heavily. Weighting may impact defined risk levels or an individual risk's acceptability.[213] Figure 25 depicts a graduated risk contour graph.

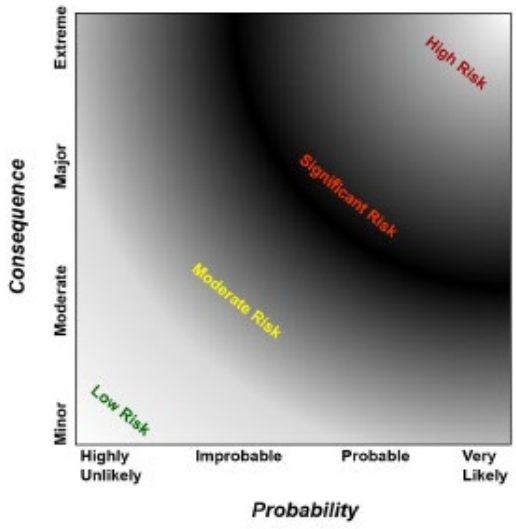

Figure 25. Generic Risk Contour Graph

Source: Chairman of the Joint Chiefs of Staff, Chairman of the Joint Chiefs of Staff Manual 3105.01, *Joint Risk Analysis* (Washington, DC: Government Printing Office, 2016), B-5.
NOTE: Boundaries between risk levels are less defined. Planners

Figure 25 does not have clearly delineated risk level boundaries. Planners often qualitatively assess hazards. Quantifying consequence and probability definitions adds

[213] CJCS, CJCSM 3105.01, B-4 – B-5.

clarity to plotting hazards.[214] Graduated risk levels force planners to closely examine risks to determine appropriate risk levels.

Step four is management. Unacceptable risks require treatment options. CJCSM 3501.01 explicitly lists four treatment options: accept, avoid, reduce, and transfer. Planners consider each treatment option's long term implications. Mitigating short term risk may increase future exposure. Likewise, mitigating future risk may increase short term exposure.[215]

RM has three major challenges. These challenges include complexity, uncertainty, and ambiguity. Data availability, variable quantities assessed, and assessors' knowledge depth all affect risk analysis accuracy. Senior leaders often have experience which enhances issue perspectives and appropriate decision-making.[216]

Summary

Each framework above represents a distinct risk conceptualization method. While each framework contained aspects similar to Army RM, each also contained considerations beyond those within Army doctrine. These considerations provide the foundation for chapter four's analysis. They also provide context for the risk estimation and depiction recommendations found in chapter five.

As a whole, chapter two answered the four secondary research questions. Chapter three justifies the qualitative methodology and document analysis design used in chapter

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[214] CJCS, CJCSM 3105.01, B-4.

[215] Ibid., B-5 – B-6.

[216] Ibid., B-6 – B-7.

four. Chapter five draws upon chapter two's discussions to answer the primary research question and recommend techniques to enhance risk estimation and depiction during LSCO.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction

This thesis used a qualitative research methodology and document analysis design. Chapter three begins with a problem statement and research question review. This chapter then justifies the research methodology, design, and specific procedures used to answer the primary research question.

Problem Statement

Current Army RM doctrine fails to provide sufficient operational risk estimation and depiction instructions. Furthermore, Army RM doctrine fails to provide a process which illuminates risk prioritization and treatment options. To investigate current doctrinal RM shortcomings, this research leveraged a single primary research question and four associated secondary research questions.

Research Question

How can planners better estimate and depict operational risk during large scale combat operations?

Secondary Research Questions

1. How does the Army conduct risk management?
2. Where does risk management fit into mission planning?
3. What LSCO elements must an operational risk management model address?
4. What techniques can assist in estimating and depicting risk?

Methodology

Research can be described as either a quantitative or qualitative methodology. Quantitative research employs statistical tools to compare and analyze objectively collected data. To collect this data, researchers use surveys or conduct experiments which provide replicable numerical results. Quantitative research begins with a hypothesis and a standard research model to test it.[217]

Alternatively, qualitative research seeks causal relationships using subjective assessments and less structured data collection techniques. Researchers seek common themes to explain a phenomena. Qualitative analysis begins with a research purpose and questions which guide the research.[218]

A qualitative methodology best suited this research. Answering the primary research question required either discovering new tools or techniques, or adapting existing ones. Neither a survey nor an experiment could appropriately accomplish these tasks. Therefore, the qualitative methodology more appropriately fit the research goals.

Design

This thesis used a document analysis design. Documents facilitate research by providing background information, additional research questions, supplementary research

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[217] Martin B. Davies, *Doing a Successful Research Project: Using Qualitative or Quantitative Methods* (New York: Palgrave Macmillan, 2007), 51; Joy Frechtling Westat, *The 2010 User-Friendly Handbook for Project Evaluation*, 2010 Revision to NSF 02-057 (Arlington, VA: National Science Foundation, 2010), 52, accessed 08 April 2019, https://www.purdue.edu/research/docs/pdf/2010NSFuser-friendlyhandbookfor projectevaluation.pdf.

[218] Westat, *The 2010 User-Friendly Handbook for Project Evaluation*, 53.

data, a means to track changes over time, and a means to verify information from other data sources.[219] A document analysis is an analytic procedure to find, select, appraise, and synthesize data within documents.[220]

To find documents, researchers use either public or private records. Records include physical or digital documents, interviews, media, or entertainment sources.[221] Researchers select appropriate research documents and appraise each one using codes. Coding involves finding common themes related to a research subject and assigning descriptive words or short phrase to each relevant passage. Researchers normally begin appraising with pre-established codes. As research progresses, researchers may add or combine codes. Coded passages become research data. Codes help organize data prior to synthesizing. Synthesizing involves finding convergence and corroboration among sources and uncovering themes which address the research question.[222]

Document analysis advantages include: availability, efficiency, cost effectiveness, and stability. Research for this thesis drew primarily from the public domain. Public domain document availability made data collection efficient. This research did not require travel or specialized supplies, making it cost effective. Archived documents made

[219] Glenn A. Bowen, "Document Analysis as a Qualitative Research Method," *Qualitative Research Journal* 9, no. 2 (2009): 29-30, accessed 08 April 2019, https://doi.org/10.3316/QRJ0902027.

[220] Bowen, "Document Analysis as a Qualitative Research Method." 28.

[221] Westat, *The 2010 User-Friendly Handbook for Project Evaluation*, 69.

[222] Bowen, "Document Analysis as a Qualitative Research Method." 28.

this research stable. If needed, future researchers can easily access documents used in this research.[223]

Research

Army doctrinal RM publications predate current LSCO doctrine. Furthermore, RM doctrine largely emphasizes accidental risk. This led the researcher to inquire whether RM doctrine sufficiently supports current LSCO doctrine. Research document selection began with references listed within ATP 5-19. ATP 5-19 references provided historical context to Army RM. ADP 3-0 contains the Army's most recent LSCO guidance and served as a starting point for evaluating RM within LSCO.

RM concepts within ATP 5-19 served as initial codes to analyze ADP 3-0. Codes included themes related to risk, hazards, probability, consequence, success, and failure. Coded passages often cited additional doctrinal references. Analyzing additional doctrinal references revealed insufficient operational risk estimation and depiction instructions. To address the insufficient instructions, research turned to non-doctrinal RM methodologies.

Chapter two contains a literature review which addresses the secondary research questions. ATP 5-19 answered secondary research question one. ATP 5-19 in conjunction with several other doctrinal publications answered secondary research question two. Topic areas within coded doctrinal passages revealed LSCO RM requirements, answering secondary research question three. Answering secondary research question four required sources outside military doctrine.

[223] Bowen, "Document Analysis as a Qualitative Research Method." 31.

To answer secondary research question four and, ultimately, the primary research question, this thesis turned to other RM frameworks. Primary frameworks used include: International Risk Governance Council (IRGC), International Organization for Standardization (ISO), Institute of Risk Management (IRM), and Joint Risk Analysis Methodology (JRAM). Several military publications and policies, as well as many civilian RM publications and articles, reference these frameworks.

Initial coding categorized passages using Army RM process steps. Coding provided several insights into differences and similarities among RM frameworks. As research progressed, additional themes emerged. These additional themes included risk treatment options and risk treatment techniques. New themes were then applied to Army RM doctrine. Data revealed similarities between risk treatment options and techniques among non-Army frameworks. Research also revealed the Army RM framework lacked clarity and depth with regard to these themes.

With this disparity identified, research focused incorporating non-Army risk treatment options and techniques into the Army RM framework. Due to risk treatment technique quantity, this thesis focused on risk matrices. Risk matrix techniques directly relate to and expand upon the Army RAM and DRAW. Chapter four analyzes framework themes against doctrinal RM requirements and expands upon risk matrix concepts.

Limitations

Research in this thesis represents a thorough, but not exhaustive RM discussion. Nearly every military doctrinal publication discusses risk. Research here includes only recent doctrinal publications governing RM and LSCO.

Likewise, innumerable civilian RM publications prevented an exhaustive analysis. However, primary publications chosen from the RM foundation used by many government and civilian organizations worldwide. Other publications used were chosen based on their applicability and clarity in addressing the research problem. While the civilian sector established credibility for non-doctrinal frameworks used, their accuracy and applicability was tested in the civilian sector and not in combat.

Delimitations

Many different risk management frameworks exist. Time available and publication classification prevented an exhaustive doctrinal consolidation and analysis. Although these frameworks differ slightly from one another, they share concepts and use similar tools. The Army RM framework serves as a baseline for all thesis discussion. Discussion addresses RM using a deliberate approach.

This thesis does not instruct commanders or staffs how to quantify or weight any specific risks. It does provide concepts and tools to aid commanders and staffs develop a method to quantify and weight risks. This thesis also contains recommendations to help commanders and staffs better manage multiple risk areas.

Thesis content focuses on estimating and depicting risk during LSCO. It does not contain an exhaustive operational risk list. Furthermore, it does not contain discussion on differences in risks or risk treatments as they relate to other conflict types on the conflict continuum.

While many concepts in this thesis also apply to individual safety, this paper does not include individual safety in its discussion. The U.S. Army Combat Readiness Center

(https://safety.army.mil/) contains additional information and tools for individual safety and risk reduction measures during combat operations.

Summary

A document analysis design within a qualitative methodology best suited researching doctrinal RM's applicability to LSCO and investigating risk estimation and depiction techniques. Various themes emerged from chapter two's literature review. Chapter four analyzed these themes using chapter three's justified research methodology and design. Analysis results led to chapter five's conclusion and recommendations.

CHAPTER 4

FINDINGS AND ANALYSIS

Introduction

Using a qualitative methodology and document analysis design, this chapter thematically analyzes information presented in chapter two. This chapter begins with a problem statement and research question review. Thematic findings and analysis follows.

Findings include a doctrinal RM requirement review, framework theme comparison, theme to requirement evaluation, and requirement to framework evaluation. Analysis focused on determining which risk estimation and depiction techniques can improve Army LSCO RM.

Problem Statement

Current Army RM doctrine fails to provide sufficient operational risk estimation and depiction instructions. Furthermore, Army RM doctrine fails to provide a process which illuminates risk prioritization and treatment options. To investigate current doctrinal RM shortcomings, this research leveraged a single primary research question and four associated secondary research questions.

Research Question

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Secondary Research Questions

1. How does the Army conduct risk management?
2. Where does risk management fit into mission planning?

3. What LSCO elements must an operational risk management model address?
4. What techniques can assist in estimating and depicting risk?

Findings

This section begins with a doctrinal RM requirement review. Next, RM themes across each framework are compared. Frameworks compared include: Army RM, International Organization for Standardization (ISO), International Risk Governance Council (IRGC), Institute of Risk Management (IRM), and Joint Risk Analysis Methodology (JRAM). Shared themes include: steps, sources and drivers, treatment options, matrices, cross-cutting aspects, principles, and character.

Theme comparison addresses similarities, differences, qualities and shortfalls. Following theme comparison, findings investigated how well each theme met RM requirement categories. RM requirements include: tailorable, standardized, consistent, and insightful. Finally, each framework is compared against RM requirements to determine which risk estimation and depiction techniques can improve Army RM. Tables 15 and 16 depict evaluation templates used.

Table 15. Theme to RM Requirement Evaluation

Theme to Requirement Evaluation							
Requirement Category	RM Steps	Categories, Drivers, Sources	Treatment Options	Matrices	Principles	Cross-cutting Aspects	Character
Tailorable							
Standardized							
Consistent							
Insightful							

Source: Created by author.
NOTE: Each framework theme is evaluated against RM requirement categories. Results will illustrate which themes best meet each requirement category.

Table 16. Requirement to Framework Evaluation

Requirement Category to Framework Evaluation				
RM Framework	Tailorable	Standardized	Consistent	Insightful
Army				
ISO				
IRGC				
IRM				
JRAM				

Source: Created by author.
NOTE: Each framework is compared to RM requirement categories. Results will illustrate which framework best meets each requirement category.

Doctrinal Risk Management Requirements

Research answering secondary research question two highlighted several LSCO doctrinal RM requirements. Grouping doctrinal requirements together revealed four requirement categories: tailorable, standardized, consistent, and insightful. Army RM should enable the operations process as an integrating function. Proper integration requires a RM framework which sufficiently meets requirements within each requirement category. Table 17 lists, as evaluation criteria, RM requirements.

Table 17. RM Tool Utility Compared to RM Requirements

Risk Management Requirements	
Requirement Category	**Evaluation Criteria**
Tailorable	Provides flexibility and allows for intuition and personal judgement
	Determines risk tolerance
	Process guides control development
Standardized	Rapidly assesses hazards
	Numerically estimates hazard probability and consequence
	Accounts for risk exposure
	Incorporates mission and operational variables
	Consolidates and prioritizes identified risks
Consistent	Determines the same risk levels, given the same initial data
	Users can explain the process and reasoning behind results
Insightful	Provides accurate mission success probability
	Determines risk costs and mission benefits by phase
	Identifies risk areas for each involved domain
	Provides insight to potential branch plans and sequels
	Provides control measures, management, and prediction accuracy feedback
	Provides insight to possible treatment options

Source: Created by author.
NOTE: RM evaluation criteria were grouped, resulting in four RM requirement categories. These RM requirement categories facilitated thematic and framework comparisons.

Risk Management Theme Comparison

This section compares framework themes to one another. Discussion is broken down by theme and addresses similarities, differences, qualities and shortfalls. Key take-a-ways from comparative discussion fed follow-on analysis.

Framework Steps

Framework steps varied between four and seven. Despite step differences, all frameworks shared similar step and sub-step themes. Step and sub-step theme similarities include hazard identification, analysis assessment, evaluation, decisions, management, treatment, and communication. Table 18 lists each framework's steps.

Table 18. Risk Management Steps Comparison

RM Steps				
ATP 5-19 & DA PAM 385-30	ISO	IRGC	IRM	JRAM
	Communication and consultation			
	Scope, Context, Criteria	Pre-assessment	Strategic objectives	Problem framing
Identify the hazards				
Assess the hazards	Assessment	Appraisal	Assessment	Assessment
			Reporting (threats and opportunities)	
Develop controls and make risk decisions		Characterization and evaluation	Decision	Judgment
Implement controls	Treatment		Treatment	
Supervise and evaluate	Monitoring and Review	Management	Residual reporting	Management
	Recording and Reporting		Monitoring	

Source: Created by author.
NOTE: Each framework used steps to guide RM. Steps from each framework are arranged by similar actions for comparison.

Notable step and sub-step theme differences include framing, opportunities, and treatment options. Army RM doctrine does not include framing guidance. ISO, IRGC, IRM, and JRAM recommend planners look at broad risk categories prior to identifying

hazards. Framing addresses organizational objectives and guides planners' efforts toward pertinent risk categories.

IRM uniquely considered opportunities within the RM reporting step. IRM defines opportunity risks as risks with potential to enhance organizational achievement.[224] ISO also addressed opportunities within treatment options, but not as a planning step. Army RM doctrine only briefly mentioned opportunities within real-time RM.[225]

Only Army RM developed controls as a RM step. Army RM doctrine instructed planners to develop controls for each identified hazard.[226] While similar to other framework steps, developing controls implies each hazard must actually have assigned mitigation measures. ISO, IRGC, IRM, and JRAM provided additional hazard treatment options which did not require mitigation measures. Similarly, implementing controls as a RM step implies enacting controls. Each other framework used broad step titles to encompass all treatment options.

Overall, RM steps sufficiently met tailorable, standardized, and consistent RM requirements. Steps only moderately met insightful requirements. Steps did not provide insight into treatment options, potential branch plans, or provide risk cost estimates. Steps did, however, provide a systematic structure in which planners could incorporate techniques to address these areas.

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[224] IRM, *Professional Standards in Risk Management*, 34, 252.

[225] HQDA, ATP 5-19, 4-9.

[226] HQDA, ATP 5-19, 1-10 – 1-11; HQDA, DA PAM 385-30, 9.

Sources, Drivers, and Categories

All five examined frameworks discussed risk sources. Definitions differed slightly between each, but dividing sources into risk categories or types was common. Four examined frameworks divided risk sources into categories. Army and JRAM frameworks used two categories each. IRGC used three categories. IRM provided four example categories, but did not specify a limit. ISO differed and did not provide example source categories. Table 19 depicts risk source categories.

Table 19. Risk Source Categories

Risk Source Categories			
ATP 5-19 & DA PAM 385-30	IRGC	IRM	JRAM
Accidental	Natural	Strategic	Threats
Tactical	Human Behavior	Hazard	Hazards
	Interactions between multiple sources	Operational	
		Financial	

Source: Created by author.
NOTE: Four frameworks discussed risk source categories. Categories are compared here.

Source categories allow planners to systematically identify risks. A single operation may have multiple risk source categories. Identifying each allows comprehensive RM. Planners ensure they do not overly focus on one category and forget another. Categories also facilitate meta-analysis. Planners can evaluate categories to determine which most affect operations. Categorical meta-analysis allows planners to recommend policy adjustments or organizational resource distribution.

Three frameworks discussed risk drivers. IRGC and JRAM use similar definitions. IRGC provided more detailed driver explanation, while IRM provided a clear risk driver-category model. Source categories and drivers played an important role in conceptualizing, identifying, and depicting risk. Table 20 lists example risk drivers.

Table 20. Example Risk Drivers

Risk Drivers		
IRGC	IRM	JRAM
Emerging risk knowledge	External	Vulnerability
System complexity	Internal	Resilience
Social and cultural dynamics		Criticality
Development		Accessibility
Natural resources and environment		Recognition
Competing interests		Damage impact
Variability in risk susceptibility		Resources

Source: Created by author.
NOTE: Three frameworks provided example risk drivers. IRGC and JRAM listed example drivers, while IRM discussed drivers categorically as either external or internal.

Overall, risk sources, drivers, and categories facilitated tailorable, standardized, and consistent RM. However, sources, drivers, and categories were not insightful with regard to accurate predictions, mitigating risks, or determining costs or branch plans.

Treatment Options

IRGC, IRM, and JRAM frameworks list four similar risk treatment options. The ISO differs with six. However, one could argue “increasing for opportunity” falls under

"retain" and "removing the source" under "change". Consolidating differing ISO treatment options would lead to four options similar to other frameworks. Table 21 compares treatment options.

Table 21. Framework Treatment Options

Risk Treatment Options				
ATP 5-19 & DA PAM 385-30	ISO	IRGC	IRM	JRAM
Avoid*	Avoid the Risk	Avoid	Terminate	Avoid
Reduce*	Change	Reduce	Treat	Reduce
Transfer*	Share	Transfer	Transfer	Transfer
Accept*	Retain	Retain	Tolerate	Accept
	Increase for Opportunity			
	Remove the Source			
*Discussed briefly, but not explicitly listed in RM doctrine				

Source: Created by author.
NOTE: Each framework divided treatment options similarly. While ISO, IRGC, IRM, and JRAM each explicitly listed and defined treatment options in their publications, Army RM publications did not.

Army RM does not explicitly list treatment options. Treatment option discussion is limited to commanders deciding to accept or avoid hazards after assessing residual risk levels from proposed controls.[227] Transfer discussion is limited to assigning larger hazards to commanders best suited to mitigate or eliminate them.[228] According to each other framework, not every hazard requires controls. Decisions to accept, avoid, reduce, or transfer occur prior to control development. When hazards do require controls, post-

[227] HQDA, ATP 5-19, 1-10.

[228] Ibid., 4-13.

control development decisions ensure risk levels fall within tolerance. Not assigning controls to every hazard allows planners to allocate more time and resources to other priorities.

Army RM doctrine did not explicitly list treatment options. Adopting JRAM options would maintain continuity between Army and Office of the Joint Chiefs terminology. Army RM doctrine's step three title emphasizes control implications rather than treatment alternatives to include accepting some level of risk. Making risk decisions should precede and succeed control development.

Treatment options performed very well against RM requirement categories. Treatment options facilitated RM tailorability through flexible application and as a means to guide control development. Frameworks with standardized treatment options could rapidly consolidate, assess, prioritize, and mitigate hazards in a consistent and understandable manner. Furthermore, treatment options provided insight into control measures and management plans, risk costs, and where planners should consider branch plans or sequels.

Matrices

ISO, IRGC, IRM framework literature discussed several risk estimation and depiction techniques. Techniques ranged from strictly quantitative to strictly qualitative. Risk matrices received added attention due to their simplicity, small organization applicability, and tailorability. Because Army RM and JRAM strictly used risk matrices, analysis focused on this technique.

Risk matrices provide a simple means to estimate risk levels. Given a hazard probability and consequence, matrices provide a risk level. Using matrices does not involve complex analysis or computational skills.

Small organizations benefit from matrices due to their simplicity and ability to incorporate qualitative risk areas. With predefined terms, matrices allow planners to more objectively depict concepts otherwise subjective. Objectivity facilitates hazard discussion and risk level agreement.

Each framework discussed tailoring matrices. Tailoring included defining consequence, probability, and risk levels. Table 22 compares framework consequence, probability, and risks level divisions.

Table 22. RM Consequence, Probability, and Risk Level Comparison

RM Consequence, Probability, and Risk Levels				
ATP 5-19 & DA PAM 385-30	ISO	IRGC	IRM	JRAM
Number of Consequence Levels				
4	Customized	5	Scale	4
Number of Probability Levels				
5	Customized	5	Scale	4
Number of Risk Levels				
4	Customized	3*	3	4
*Only three named levels, but sections overlap creating five shaded areas on matrix				

Source: Created by author.
NOTE: Frameworks divided consequence, probability, and risk levels differently. Risk matrix appearance varied based on these differences.

Most frameworks employed between three and five defined consequence, probability, and risk levels. Levels played less a role in estimating and depicting risk compared to term definitions and plotted risk level-tolerance relationships.

Defining consequence and probability are crucial to improving objectivity. Most frameworks advise defining consequence levels for each risk category. IRM provides a quality example. In their example, IRM depicts three consequence levels. Each level contains three definitions. The first definition on each level relates to financial risk, second to organization strategy or operational activities, and third to stakeholder concerns. Table 23 depicts the IRM example.

Table 23. IRM Consequence Definitions

High	Financial impact on the organisation is likely to exceed £x Significant impact on the organisation's strategy or operational activities Significant stakeholder concern
Medium	Financial impact on the organisation likely to be between £x and £y Moderate impact on the organisation's strategy or operational activities Moderate stakeholder concern
Low	Financial impact on the organisation likely to be less that £y Low impact on the organisation's strategy or operational activities Low stakeholder concern

Source: Institute for Risk Management (IRM), *A Risk Management Standard* (London: IRM, 2002), 7.
NOTE: Each consequence level (high, medium, low) contains three distinct definitions corresponding to a separate risk category.

JRAM also defined consequence levels differently for strategic and military risks. Table 24 depicts these distinct definitions.

Table 24. Tailored Consequence Levels

CJCSM 3105.01 *Joint Risk Analysis* Tailored Consequence Levels		
Generic	**Strategic**	**Military**
Extreme	Existential – permanent destruction relative to interests	Mission failure. Objectives unachievable, no sourcing solutions exist for critical requirements
Major	Catastrophic – high order, long-term damage to interests	Objectives partially achieved/shortfalls for critical requirements
Moderate	Major – considerable, mid-term damage to interests	Objectives partially achieved/world-wide sourcing solutions for most requirements
Minor	Limited – confined, short-term damage to interests	Mission success, Objective achievable, joint force fully sustained, requirements sourced

Source: Created by author.
NOTE: CJCSM 3105.01 defines four consequence levels for strategic risks and military risks.

ATP 5-19 failed to define consequence levels with such clarity. Table 25 depicts ATP 5-19 sample consequence definitions.

Table 25. ATP 5-19 Sample Consequence Definitions

Level	Sample consequences
I Catastrophic	• Complete mission failure or the loss of ability to accomplish a mission. • Death or permanent total disability. • Loss of major or mission-critical systems or equipment. • Major property or facility damage. • Severe environmental damage. • Unacceptable collateral damage.
II Critical	• Significantly degraded mission capability or unit readiness. • Permanent partial disability or hospitalization of at least 3 personnel. • Extensive major damage to equipment or systems. • Significant damage to property or the environment. • Significant collateral damage.
III Moderate	• Degraded mission capability or unit readiness. • Minor damage to equipment or systems, property, or the environment. • Lost days due to injury or illness.
IV Negligible	• Minimal injury or damage. • Little or no impact to mission or unit readiness. • First aid or minor medical treatment. • Little or no property or environmental damage.

Source: Adapted from Headquarters, Department of the Army, Army Techniques Publication 5-19 *Risk Management* (Washington, D.C. Government Printing Office, 2014), 1-9.
NOTE: Definitions within each consequence level are unclear and topic order (indicated by color) is inconsistent.

Table 25 depicts three Army RM consequence definition issues. First, not every level has the same definition quantities. Second, categorical order changes from level to level (colored risk areas illustrate consequence level shifts). Third, unclear categorical applicability. For example, Table 25 defines death as a catastrophic consequence. LSCO planners expect numerous fatalities. Table 25 does not specify a categorical context in which death constitutes a catastrophic consequence (i.e. tactical or accidental incident). Nor does Table 25 specify at what threshold or quantity death becomes catastrophic (i.e. one death or one hundred).

DA PAM 385-19 provides quantitative definitions that clearly distinguish between consequence levels and address two accident related risk categories. Values reflect Class A through D accident regulations. Table 26 lists these categories.

Table 26. DA PAM 385-30 Consequence Levels

Severity	Symbol	Quantitative value — Injury or Illness[1]	Quantitative value — Dollars[1]
Catastrophic	I	1 or more death or permanent total disability	Loss equal to $2 million or more
Critical	II	1 or more permanent partial disability or hospitalization of at least 3 personnel	Loss equal to or greater than $500 thousand but less than $2 million
Moderate	III	1 or more injury or illness resulting in lost time	Loss equal to or greater than $50 thousand but less than $500 thousand
Negligible	IV	1 or more injuries or illnesses requiring first aid or medical treatment	Loss less than $50 thousand

Notes:
[1] Quantitative values are based on definitions for Class A through D accidents. See AR 385–10.

Source: Headquarters, Department of the Army, Department of the Army Pamphlet 385-30, *Risk Management* (Washington, DC: Government Printing Office, 2014), 7.
NOTE: Consequence levels are defined quantitatively for two different accident risk categories: injury and dollars.

Clear definitions with categorical application increase accurate risk estimation. Army RM doctrine does not distinguish between training and operational risks. Corresponding consequence level definitions should also clearly articulate risk category applicability. Army RM doctrine does not provide planners problem framing instruction to identify risk categories. RM doctrine should also provide planners example quantitative RM term definitions.

Frameworks universally agreed specific probability definitions improve objectivity and quantitative values produce more accurate estimates. Original Army RM doctrine provides example categorical probability definitions. Categorical probability definitions facilitated specificity. FM 100-14 considers four categories: single item, item fleet or inventory, individual soldier, and all soldiers. Along with improved objectivity, well defined probability categories make estimation easier.

All five frameworks also described tailoring risk matrices. Tailoring began with customized consequence and probability definitions and concluded with planners delineating risk levels. Each framework discussed weighting matrices. Weighting involved holding either consequence or probability more important, changing matrix symmetry. Weighting depends on tolerance.

Comparing published military matrices demonstrates tailorability. ATP 5-19 and DA PAM 385-30 provide symmetrical matrix examples. MIL STD 882E provides a weighted, risk averse matrix example. CJCSM 3105.01 provides a matrix example with even radial patterned risk levels. Figure 26 compares these three military matrices.

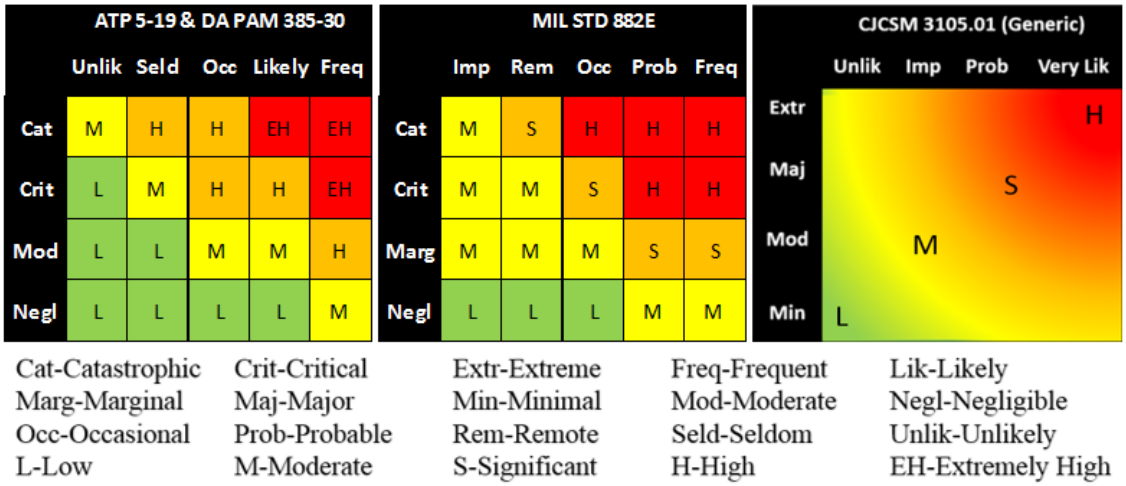

Figure 26. Comparing Risk Matrices

Source: Created by author.
NOTE: This figure depicts risk level differences among three published military risk matrices. A hazard with equal probability and consequence may correspond to a different risk level depending on matrix used.

IRM and IRGC discuss risk tolerance and its relationship to risk absorbing capacity and treatment options. Within both these models, a hazard's risk level only had meaning when compared to tolerance levels. IRM expounded further and also incorporated organizational appetite.

IRGC provided unique insight into depicting risk levels and defining consequence and probability. One IRGC matrix example did not have a uniform consequence and probability level distribution. This example widened the risk reduction area while simultaneously reducing both tolerable and intolerable regions.

ISO 31010 *Risk Management – Risk Assessment Techniques* considers advantages and disadvantages for fifteen estimation and depiction methods. Planners should understand implemented technique capabilities and limitations.

Overall, IRM best explained matrix tailoring. The IRM matrix also best depicted relationships between risk levels, tolerance, and treatment options. While Army LSCO doctrine reiterates tailoring RM, Army RM doctrine does not fully address how. Army RM doctrine could benefit from an IRM matrix model to expand upon matrix customization instructions and limitations.

As a theme, matrices best met RM requirement categories. Matrices proved incredibly tailorable while facilitating consistent and standardized RM. Matrices, when used together with treatment options, proved very insightful.

Principles

Only Army RM, ISO, and IRM specified risk principles. While differing in quantity, framework principles shared common themes. Themes shared with Army RM doctrine include: integration, continuous application, and appropriate organizational levels. RM principles act as framework foundations. The Army RM foundation compares well to ISO and IRM foundations.

Themes shared between the ISO and IRM frameworks include: dynamic, customized, structure, and comprehensive. Dynamic and customized broaden RM applicability and also allow more detailed assessments. Army RM does not include dynamic and customized as principles and only briefly discusses them in doctrine. RM frameworks are inherently structured and including this as a principle seems redundant. Army RM applies to all activities and operations.[229] Hence, Army RM is comprehensive in philosophy despite not including comprehensive as a principle. However, examples

[229] HQDA, ATP 5-19, v.

within Army RM doctrine overwhelmingly focus on accidental risk. In this regard Army RM is not comprehensive.

Among the frameworks, unique themes include: accepting no unnecessary risk, available information, and human factors. Only Army RM adopts accepting no unnecessary risk as a principle. Due to Army operation's life and death nature, accepting no unnecessary risk in accident prevention is applicable. Best available information and human factors seem more suited as risk drivers than RM principles.

Overall, RM principles facilitated tailorable and standardized RM. However, principles did little to provide risk assessment consistency or provide any quantitative insight. RM principles portrayed a management philosophy, but played a negligible role in estimating and depicting risk. Table 27 lists RM principles from three frameworks.

Table 27. Risk Management Principles

RM Principles		
ATP 5-19 & DA PAM 385-30	ISO	IRM
Integrating RM into all phases of missions and operations	Inclusive	Aligned with other business activities
	Integrated	Embedded within business processes
Applying RM cyclically and continuously	Continual improvement	Iterative, dynamic, responsive to change
	Dynamic	
	Customized	
Making risk decisions at the appropriate level		Proportionate to risk level within organization
	Structured and Comprehensive	Comprehensive, systematic, structured
Accepting no unnecessary risk		
	Best available information	
	Human and cultural factors	

Source: Created by author.
NOTE: Principles from three RM frameworks are compared. Principle alignment is arranged by topic similarity.

Cross-cutting Aspects

Cross-cutting aspects tie multiple RM steps within a framework together. Overarching similarities include management and communication. Army cross-cutting aspects did not include communication. However, communication is emphasized in RM doctrine frequently enough to warrant inclusion as a cross-cutting aspect.[230]

[230] HQDA, ATP 5-19, 1-16, 4-3.

Major differences involved stakeholder engagements and leadership. IRGC emphasized stakeholders should have RM input.[231] ISO considers leadership quality and presence critical throughout RM.[232]

Overall, cross-cutting aspects supported tailorable and standardized RM, but did not meet RM requirements for consistent and insightful. Cross-cutting aspects played no role in estimating or depicting risk. Table 28 lists framework cross-cutting aspects.

Table 28. RM Cross-Cutting Aspects

RM Cross-Cutting Aspects				
ATP 5-19 & DA PAM 385-30	ISO	IRGC	IRM	JRAM
Assessment (Steps 1-2)	Integration (All steps)	Communication (All steps)	Modifications (All steps)	Appraisal (Steps 1-3)
Management (Steps 3-5)	Design (All steps)	Stakeholder engagement (All steps)	Audit (All steps)	Management (Steps 3-5)
	Implementation (All steps)	Context (All steps)		Communication (All steps)
	Evaluation (All steps)			
	Improvement (All steps)			
	Leadership and Commitment (All steps)			

Source: Created by author.
NOTE: Each framework grouped two or more RM steps into cross-cutting aspects. Some aspects simply divide steps into categories, others introduce ideas to be applied during each step.

[231] EPFL IRGC, *Introduction to the IRGC Risk Governance Framework.*

[232] IEC, IEC/FDIS 31010:2009, 5

Character

All frameworks described treating either risk sources or risk impacts. Only IRGC provided management strategies to treat risk based on risk characteristics. Management strategies include: routine-based, robustness-focused, resilience-focused, risk-informed, precaution-based, and discourse-based. IRGC management strategies guide treatment options and temper organizational expectations. Adopting a similar model to Army RM could improve Army leader risk comprehension and inform policy or mission development. Table 29 depicts IRGC risk management strategies.

Table 29. IRGC Risk Management Strategies

Risk Character	Strategy Target	
	Risk Impact	Risk Source
Simple	**Routine-based** regulations, policies	
Complex	**Robustness-focused** built strength, contain	**Risk-informed** apply treatment option
Uncertain	**Resilience-focused** prepare for surprise	**Precaution-based** be prudent, flexible
Ambiguous	**Discourse-based** build tolerance, confidence, trust	

Source: Created by author. Adapted from International Risk Governance Center (EPFL IRGC). *Introduction to the IRGC Risk Governance Framework,* rev. ed., (Lausanne, Switzerland: EPFL IRGC, 2017), 25.
NOTE: Planners evaluate risk character and determine whether to target risk impact or source. Together, risk character and target strategy inform a RM approach.

Risk character met tailorable, standardized, and consistent RM requirements and met some insightful requirements. As a means to determine RM strategies, character facilitated a flexible, intuitive RM approach and rapidly guided planners toward a

strategy. Table 29 is a simple, reasonable, tool to frame RM strategies. While character provides insight into conceptualizing management strategies, its utility remains in the initial RM steps and provides little insight into identifying risk costs, risk areas, potential branch plans, or predicting mission outcomes.

Theme to Requirement Category Evaluation

Using information from thematic comparisons above, this section evaluated each theme against RM requirement categories to determine which themes best addressed Army requirements. Evaluation determined each theme sufficiently met and enabled RM tailorability and standardization requirements. However, only five of seven themes enabled RM consistency and only two themes enabled insightfulness. Results indicated treatment options and matrices performed best across all four requirement categories and were the only two themes to satisfactorily meet insightful requirements. Table 30 displays these results.

Table 30. Theme to RM Requirement Evaluation

Theme to Requirement Evaluation							
Requirement Category	RM Steps	Categories, Drivers, Sources	Treatment Options	Matrices	Principles	Cross-cutting Aspects	Character
Tailorable							
Standardized							
Consistent							
Insightful							

Source: Created by author.
NOTE: This table evaluates how well each RM theme met doctrinal RM requirements. Green indicates satisfactorily met requirements. Orange indicates partially met requirements. Red indicates did not meet requirements. Only treatment options and matrices satisfactorily met all requirement categories.

Requirement Category to Framework Evaluation

Next, requirement categories were compared to each RM framework to determine which framework best addressed RM requirements. Results indicated Army RM provided a moderately good framework; nevertheless, it performed worst compared to each other framework. IRGC and IRM sufficiently met all RM requirements. Table 31 depicts these results.

Table 31. Requirement Category to Framework Evaluation

Requirement Category to Framework Evaluation				
RM Framework	Tailorable	Standardized	Consistent	Insightful
Army				
ISO				
IRGC				
IRM				
JRAM				

Source: Created by author.
NOTE: Green indicates satisfactorily met requirements. Orange indicates partially met requirements. Red indicates did not meet requirements. Army RM performed worse than other frameworks when compared to requirement categories. IRGC and IRM performed better than other frameworks and were the only frameworks to satisfactorily meet all requirements.

Analysis

Analysis focused on determining risk estimation and depiction techniques which can improve Army RM. Overall, Army doctrine provides a useful RM framework. Army RM principles and cross-cutting aspects are sufficient. However, slight modifications to RM steps, treatment options, and DRAW can improve RM process clarity. Furthermore, RM doctrine should incorporate significant modifications with regard to risk categories,

drivers, sources, character, and matrix utility. Modifications will facilitate better risk estimation and depiction.

Army RM principles sufficiently compared to other RM framework principles. RM principles had no impact on risk estimation and depiction. Similarly, Army RM cross-cutting aspects (assessment and management) sufficiently compared to other RM framework cross-cutting aspects. Cross-cutting aspects also had no impact on risk estimation and depiction.

Slight modifications to RM steps, treatment options, and DRAW can improve RM process clarity. Army RM steps one through four require modification. Step one must discuss framing to properly guide hazard identification. Army RM should either add an initial framing step, creating six RM steps, or make framing step one's first sub-step. Framing identifies risk categories from which planners identify risk drivers and risk sources. Framing will lead to more comprehensive risk assessments and facilitate risk meta-analysis.

Sub-steps within Assess Hazards (RM step two) require modification. Customizing definitions and risk matrices must precede determining each hazard's risk level. Consequence and probability definitions must align with risk categories.

The Army RM step three title and sub-steps require modification. Step titles must not imply certain risk treatments. Currently, "develop controls and make risk decisions" implies each hazard must be treated with controls. Controls are methods to reduce risk. Risk reduction is only one treatment method.

Sub-steps should include establishing risk tolerance levels which will allow planners to make informed treatment determinations. Changing step three's title and sub-

steps will reduce treatment implication confusion. Likewise, Army RM step four's title requires modification. Step four's title again refers to one treatment option. Step four's title should encompass implementing all risk decisions.

To support recommended RM step changes, Army RM doctrine must explicitly list and define treatment options. Defined treatment options will allow planners RM flexibility. When some hazards do not require controls, planners can allocate more time and resources to other planning priorities.

Form 2977, DRAW, serves as a good tracking and feedback tool. Planners use this tool as a feedback mechanism during and after mission execution. However, slight modifications can improve utility. Other RM frameworks recommend using similar tools to record hazards, treatment decisions, responsibility, and effectiveness. Other frameworks recommend recording hazard, stakeholders, category, drivers, sources, initial probability and consequence, treatment option, control (if needed) with implementation decision points, residual probability and consequence.[233]

RM doctrine should incorporate significant modifications with regard to risk categories, drivers, sources, character, and RAM utility. To enable a more comprehensive RM approach, Army RM should add risk categories, drivers, and sources to doctrine. While not mentioned using these exact terms, current LSCO doctrine discusses several risk categories and drivers which support this concept.

Most doctrine publications discuss risk considerations. FM 3-0 provides a consolidated risk considerations list. ADP 3-0 and ADRP 3-07 provide planning

[233] IRM, *A Risk Management Standard*, 6; IEC, IEC/FDIS 31010:2009, 17.

considerations which directly relate to LSCO RM. While FM 3-0, ADP 3-0, and ADRP 3-07 do not separate risk and planning considerations into risk categories and drivers, these distinctions can be made. Future RM doctrine should consolidate example risk considerations from multiple publications. RM doctrine should also organize consolidated considerations into example risk categories and drivers to provide planners problem framing context.

Army RM doctrine should also enhance its matrix concept and expand upon matrix tailoring instructions. Any matrix model should include tolerance and treatment depiction discussion. A detailed RM tailoring discussion will lead to more applicable RM products and more accurate estimates.

Summary

Analysis compared RM framework themes with doctrinal RM requirement categories to determine themes which best met RM requirements. Analysis also compared RM requirement categories with each framework to determine which models best estimated and depicted risk. Results indicated ISO, IRGC, IRM, and JRAM performed better than Army RM. Furthermore, analysis indicated only IRGC and IRM models sufficiently met insightful category requirements. Chapter five adapts techniques from other frameworks to improve Army RM.

CHAPTER 5

RECOMMENDATIONS AND CONCLUSION

Introduction

The Army introduced its current RM framework in 1998. Senior leader emphasis on preserving combat power drove RM implementation. Data used to support RM doctrine highlighted accidents as Desert Shield and Desert Storm's highest casualty producing category. While doctrinal RM also applied to combat operations, content focused on accident prevention. Subsequent RM publications exacerbated this accident prevention focus.

With renewed LSCO emphasis, current leaders should not forget enemy action loss percentages during World War II, Korea, and Vietnam. Against a near peer enemy, LSCO has potential to return enemy loss casualty percentages to levels comparable to pre-Desert Shield and Desert Storm conflicts. RM, as a means to preserve combat power during LSCO, must consider both accidental loss and loss from enemy action.

Chapter five presents Army RM modification recommendations in response to the primary research question. This chapter begins with a problem statement and research question review. Recommended RM doctrine modifications follow. Recommendations begin with broader concepts such as RM steps and sub-steps, then focus on improving LSCO risk estimation and depiction. Examples accompany modification recommendations to provide context and clarity.

Problem Statement

Current Army RM doctrine fails to provide sufficient operational risk estimation and depiction instructions. Furthermore, Army RM doctrine fails to provide a process which illuminates risk prioritization and treatment options. To investigate current doctrinal RM shortcomings, this research leveraged a single primary research question and four associated secondary research questions.

Research Question

How can planners better estimate and depict operational risk during large scale combat operations?

Secondary Research Questions

1. How does the Army conduct risk management?
2. Where does risk management fit into mission planning?
3. What LSCO elements must an operational risk management model address?
4. What techniques can assist in estimating and depicting risk?

Recommendations

Analysis identified eight RM recommendation areas. Recommendations begin with broader concepts such as principles, RM steps and sub-steps, and conclude with risk estimation and depiction techniques. Chapter four analysis framed recommendations. RM frameworks referenced include: Army RM, International Organization for Standardization (ISO), International Risk Governance Council (IRGC), Institute of Risk Management (IRM), and Joint Risk Analysis Methodology (JRAM).

Analysis found no need to modify Army RM principles or cross-cutting aspects. Army RM principles and cross-cutting aspects sufficiently compared to other frameworks. Furthermore, principles and cross-cutting aspects had no significant impact on risk estimation or depiction.

Current doctrinal RM steps require slight modification. Modifications include adjusting step titles and including additional sub-steps. Current RM steps include:

1. Identify the hazards
2. Assess the hazards
3. Develop controls and make risk decisions
4. Implement controls
5. Supervise and evaluate

Step three and four titles refer to developing and implementing controls. These titles imply all hazards require mitigation measures. Step titles should not emphasize any specific treatment option. Recommended steps include:

1. Identify hazards
2. Assess hazards
3. Make risk decisions
4. Implement decisions
5. Supervise and evaluate

Eliminating reference to controls in RM steps reduces inclinations to apply controls to every hazard. Not assigning controls to every hazard frees planning time and mission resources. Making risk decisions includes deciding which hazards to accept,

avoid, transfer, and reduce. Reduced hazards will require controls, other hazards will not. Implementing decisions broadens step four to include other treatment options.

Sub-steps within these main steps also require modification. Step one should have two sub-steps, step two should include one additional sub-step, and step three should have four total sub-steps.

Step one sub-steps should include problem framing and hazard identification. Problem framing establishes RM context and guides planners through risk category and driver identification. Hazard identification involves identifying hazards and recognizing their relationship to sources, drivers, and categories.

Step two should include a customize tools sub-step. Prior to estimating probability and consequence, planners must deliberately define levels within each. Defined probability and consequence levels facilitate more accurate risk estimation. Adding a customize tools sub-step reminds planners to tailor RM products to the assigned mission.

Step three should have four sub-steps: (1) establish tolerance, (2) determine treatments, (3) determine residual risk, and (4) make decisions. Establish tolerance is a commander function which delineates acceptable and unacceptable risk levels. Planners determine treatment options based on plotted hazard risk level and commander tolerance. After planners calculate residual risk, commanders make final risk decisions. Step three recommended sub-steps remind commanders to provide input. Recommended sub-steps also reiterate available treatment options rather than emphasizing controls.

Analysis focused on Army RM steps one through three. Therefore, analysis did not find a need to modify sub-steps within steps four and five. Planners implement risk

decisions in step four, then supervise and evaluate in step five. Consolidating step and sub-step recommendations renders a new RM process depicted in Figure 27.

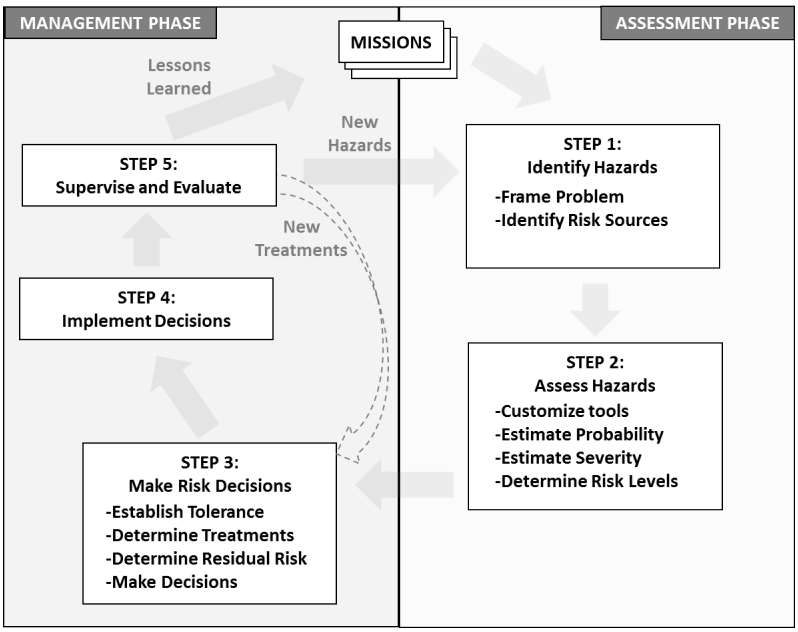

Figure 27. Recommended Risk Management Steps

Source: Created by author.
NOTE: This diagram incorporates recommended changes to steps and sub-steps while maintaining a familiar aesthetic to original Army RM diagrams.

Army RM should adopt problem framing into its framework. Problem framing establishes RM context and guides planners through risk category, and driver identification. Areas critical to mission success, such as key tasks, may warrant distinct risk categories.

Framing also helps planners recognize internal and external incident drivers. Planners may recognize internal risk drivers while analyzing combat power. Similarly, analyzing operational and mission variables may facilitate external driver recognition.

Recent LSCO doctrine contains several risk considerations applicable to driver identification. To facilitate category, driver, and source identification, future RM doctrine should consolidate risk considerations found within recent LSCO doctrine. Table 32 depicts an example consolidated risk category, driver, and source list.

Table 32. Consolidated Risk Considerations

Consolidated Risk Considerations		
Risk Categories	**Risk Drivers**	**Sources**
Strategic Risk	Decisive Action Elements	Natural
Tactical Risk	Combat Power Elements	Man-made
Accidental Risk	Joint Operations Principles	Interaction between sources
Logistical Risk	Operational Variables	
	Mission Variables	
	Basic Tactical Concepts	

Source: Created by author.
NOTE: Risk categories, drivers, and sources are important problem framing concepts which enable comprehensive RM.

Hazard identification involves identifying hazards and aligning them with sources, drivers, and categories. Alignment ensures planners understand how each risk impacts a mission and facilitates meta-analysis. Figure 28 illustrates an example category-driver relationship using an adapted IRM model.

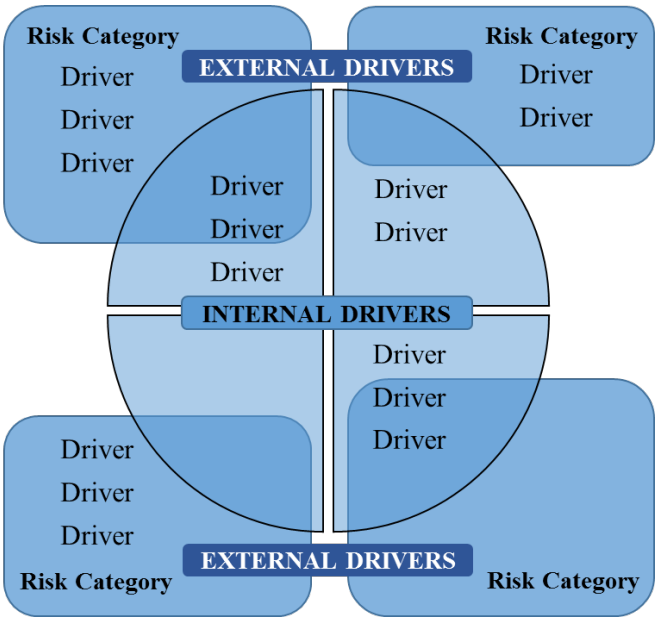

Figure 28. Problem Framing Diagram

Source: Created by author. Adapted from Institute for Risk Management (IRM), *A Risk Management Standard* (London: IRM, 2002), 3.
NOTE: This diagram depicts risk category and driver relationships.

Risk categories allow planners to systematically identify risks. Risks tie directly to sources and drivers within a risk category. A single operation may have multiple risk categories. Planners must ensure they do not myopically focus on one category and ignore another. Proportionate emphasis on each risk category facilitates comprehensive RM.

Driver quantities may vary between risk categories and not every risk category will have both internal and external drivers. Doctrine should guide planners in identifying risk categories and drivers rather than dictating specific ones. Pre-established problem framing templates may provide planning insight, but planners should also look for

categories, drivers, and sources unique to each operation. Figure 29 depicts an example operational risk problem frame.

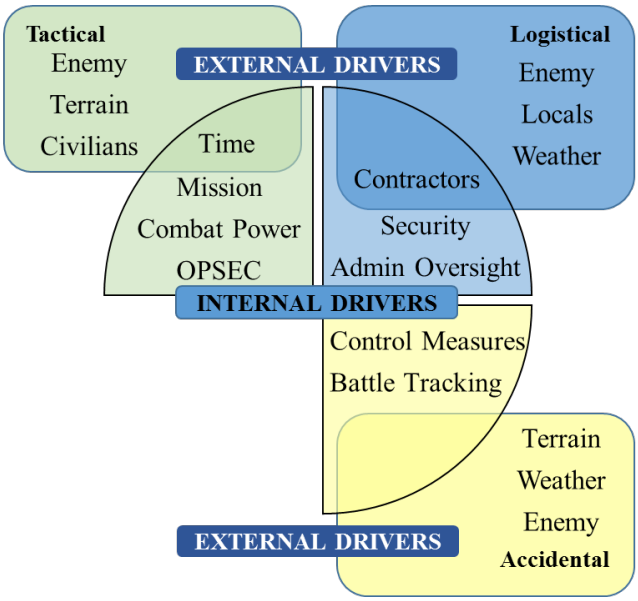

Figure 29. Example Operational Risk Problem Frame

Source: Created by author. Adapted from Institute for Risk Management (IRM), *A Risk Management Standard* (London: IRM, 2002), 3.
NOTE: This figure depicts example risk categories with corresponding internal and external drivers. Green represents tactical risks, blue represents logistical risks, and yellow represents accidental risks.

Figure 29 depicts three operational risk categories: Tactical, Logistical, and Accidental. Drivers are listed within each category. Using these drivers, planners determine hazards and risk sources. For example, planners may consider hazards related to internal drivers such as battle tracking and control measures. One such hazard is fratricide. When implemented correctly, internal drivers such as control measures and battle tracking reduce fratricide likelihood. When implemented incorrectly, fratricide

likelihood increases. Fratricide risk sources may include: ground force direct fire and indirect fire weapons, attack aviation, and close air support.

Similarly, external drivers such as poor terrain and weather may impact visibility and increase fratricide likelihood. Additionally, enemy actions, such as denied communication or digital spoofing, may also increase fratricide likelihood. Planners evaluate each source and driver to determine treatment options. Selected treatments largely depend on hazard risk level, risk character, commander tolerance, and resources available.

Future RM doctrine should introduce risk character as a means for planners to determine risk management strategies. Risk management strategies target either risk impacts or risk sources. Understanding risk character helps determine which management philosophy to apply. Management philosophies can temper expectations. Simple risks may be managed with routine-based regulations or policies. Commanders can expect to see simple risk management results soon. Ambiguous risks require discourse and time to evaluate. Commanders should build tolerance against ambiguous risks and not expect immediate changes. Doctrine should incorporate a model similar to the adapted IRGC model depicted in Table 33.

Table 33. IRGC Risk Management Strategies

Risk Character	Strategy Target	
	Risk Impact	Risk Source
Simple	**Routine-based** regulations, policies	
Complex	**Robustness-focused** built strength, contain	**Risk-informed** apply treatment option
Uncertain	**Resilience-focused** prepare for surprise	**Precaution-based** be prudent, flexible
Ambiguous	**Discourse-based** build tolerance, confidence, trust	

Source: Created by author. Adapted from International Risk Governance Center (EPFL IRGC), *Introduction to the IRGC Risk Governance Framework,* rev. ed. (Lausanne, Switzerland: EPFL IRGC, 2017), 25.
NOTE: Planners evaluate risk character and determine whether to target risk impact or source.

Army RM doctrine must also explicitly list and define treatment options. Multiple treatment options allow planners to allocate additional time and resources to planning priorities. Adopting JRAM treatment options will nest Army and Joint Staff terminology. JRAM treatment option terms include: accept, avoid, reduce, and transfer. Rather than reducing each risk with controls, planners may choose to accept, avoid, or transfer risk. Figure 30 depicts a revised risk decision tree which incorporates treatment options and RM step change recommendations.

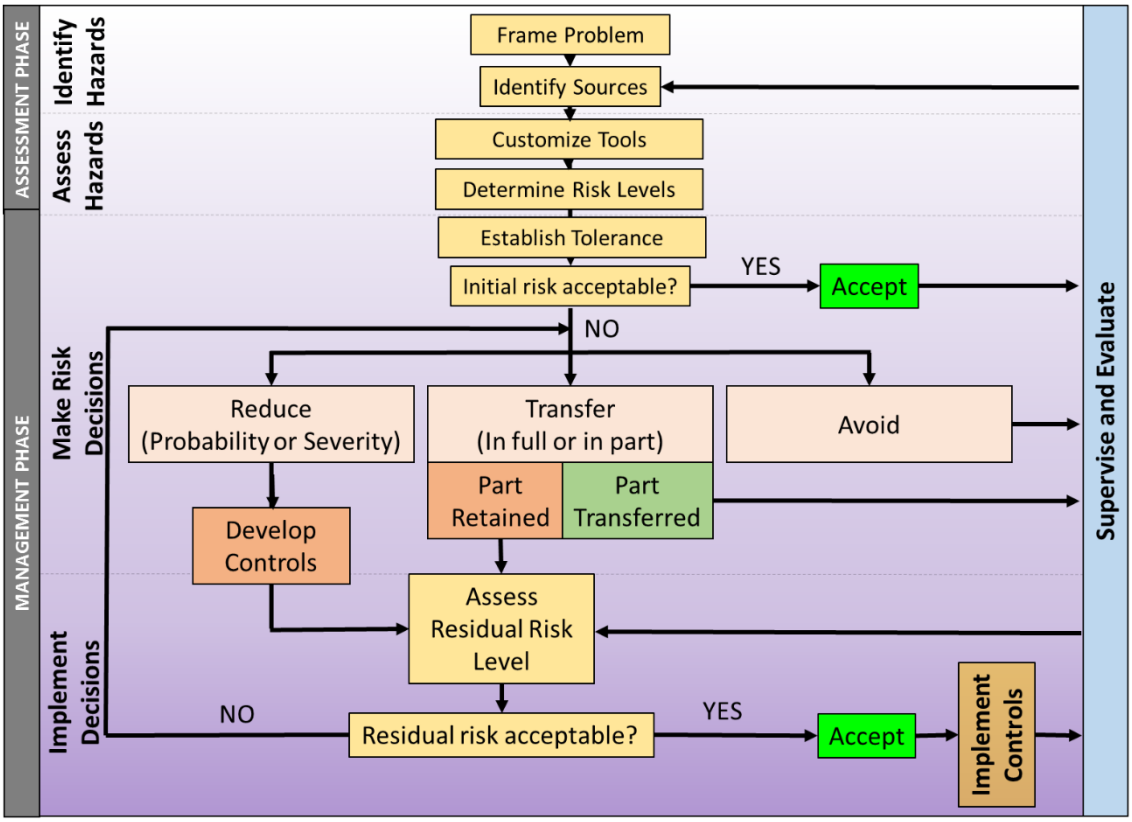

Figure 30. Recommended Risk Decision Tree

Source: Created by author. Adapted from Jan Emblemsvag, ed., "The Structure of Risk Treatment Stage," in *Risk Management for the Future: Theory and Cases* (Rijeka, Croatia: InTech, 2012), 16.
NOTE: This diagram walks planners through a revised risk decision cycle which incorporates recommended Army RM framework changes.

Proper RM requires customizing tools to meet operational needs. Current RM doctrine provides a RAM and DRAW as risk estimation and depiction tools. ISO, IRGC, IRM, and JRAM frameworks also recommended similar risk matrices and assessment worksheets. However, these frameworks expounded upon matrix and worksheet application to provide a more robust risk understanding. Emphasis on tailoring risk category definitions, using RAMs to facilitate mission planning, and expanding risk

worksheets for future planning reference were also common among ISO, IRGC, IRM, and JRAM publications.

Customizing RM tools involves selecting applicable tools and tailoring associated terms. Non-doctrinal RM frameworks list many RM tools and techniques. Risk matrices were common to all and sufficiently met Army RM doctrine requirements. Because matrices are easy to use, intuitive, and recommended by multiple RM frameworks, doctrine should keep matrices as a primary RM tool. However, doctrine should expound upon their application and list other techniques to provide planners options.

Tailoring consequence, probability, and risk level definitions increases risk estimate accuracy. Defining levels quantitatively produces even more accurate estimates. Different risk categories require different consequence, probability, and risk level definitions. Given equivalent information, defined terms should allow separate planners to deduce similar risk estimates. RM doctrine should expand tailoring discussion and provide LSCO examples. Table 34 provides tailored consequence definition examples.

Table 34. Example Consequence Level Definitions

Consequence Level	Risk Category Definition		
	Tactical	Logistical	Accidental
Catastrophic	Brigade less than 50% combat power	No critical requirement sourcing solution	Death or critical equipment non-mission capable
Critical	2 or more battalions less than 50% combat power	Critical requirement sourcing shortfall	Role II or above medical care required or critical equipment damaged
Moderate	1 battalion less than 50% combat power	Resupply delay greater than 72 hours	Role I care, loss of more than 7 days duty or equipment damage greater than $200,000
Negligible	No battalion less than 50% combat power	Resupply delay less than 72 hours	Role I care, returned to duty within 7 days or equipment damage less than $200,000

Source: Created by author.
NOTE: This example represents how a division staff may tailor risk category consequence level definitions prior to an operation. Definitions are quantitative, clear, and distinct for three different risk categories.

Planners use doctrine to guide tailoring RM term definitions. Most Army doctrine publications discuss planning concerns, limitations, and risk. Revised RM doctrine should emphasize staff responsibilities to define category consequence, probability, and risk levels according to doctrinal guidance and collective expertise.

Other RM frameworks use matrices for two reasons: estimating risk levels and determining potential treatment options. Current Army RM doctrine sufficiently explains estimating risk levels. However, current doctrine does not discuss using matrices to determine possible treatment options.

Army RM doctrine should adopt an IRM matrix model. IRM and IRGC matrices met more RM requirements than other evaluated frameworks. Both models would

improve Army RM matrix application. However, IRM provided more detailed application explanation and integrated matrices with treatment options. Integrating matrices with treatment options provides insight needed for planners to apply RM throughout the Army operations process. Insight provided includes: recommended treatment options based on hazard risk level, risk category and driver meta-analysis, risk decision points during mission execution, and risk prioritization for resource allocation.

Doctrine should also expand matrix tailoring discussion. Planners may adjust matrix risk levels based upon organizational risk absorbing capacity and commander tolerance. Matrices depict tolerance using commander approved judgement and critical lines. Judgement lines establish which hazards are acceptable. Understanding which hazards are acceptable frees planning time and resources. Critical lines establish which hazards are unacceptable. Establishing tolerance lines occurs during RM step three, just prior to JPP or MDMP COA Development. Planners generally do not include unacceptable hazards within initial planning estimates. Thus, understanding unacceptable hazards shapes COA development. Hazards plotted between judgement and critical lines require commander decision. With planner recommendations, commanders choose to accept, avoid, reduce, or transfer decision region hazards.

Treatment options generally align to matrix quadrants. Generally, low probability, low consequence hazards do not require controls. Controls are best applied to reduce hazards plotted with high probability and low consequence.

Controls include preventative measures or reactive measures. Preventative measures address risk sources. LSCO preventative measures may include obstacle emplacement or hardening stationary assets. Reactive measures address risk impacts.

LSCO reactive measures may include fires, a reserve force, or enacting pre-planned branches and sequels.

High probability, high consequence hazards must be avoided. Avoided high risk hazards should always be reported to higher echelon commanders. Avoided hazards may inadvertently transfer risk to another unit, creating a decision point for higher echelons. Higher echelon commanders may decide to allocate additional assets to reduce the risk and allow a subordinate to accept it.

Reducing high risk hazards may require resources beyond organic organizational capacity. Low probability, high consequence hazards are often partially or fully transferred to another organization. Such hazards may include cyber, space, or long range enemy fires attacks. Leaders should recognize avoiding hazards may actually transfer risk to others. For example, not flying an air interdiction mission due to severe weather may transfer additional risk to ground forces. Commanders weigh short term and long term treatment effects when making decisions.

Planners generate initial planning estimates using plotted hazard-treatment alignment. After commanders make treatment decisions, planners adjust estimates and treatment plans. Figure 31 depicts recommended treatment quadrants and example tolerance lines.

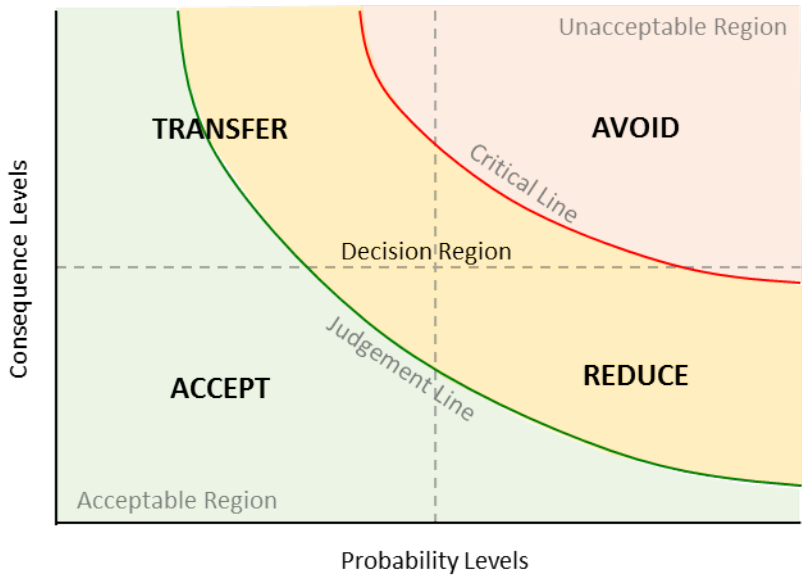

Figure 31. Recommended RM Matrix

Source: Created by author.
NOTE: Overlaying risk treatment quadrants with commander established judgement and critical lines provides planners treatment insight for any hazard plotted.

After developing treatment plans, planners evaluate and plot residual risk. With staff recommendations commanders decide residual risk level acceptability and overall mission risk level. One commander decision facilitation method is a composite matrix.

Composite matrices depict all hazards at once. Planners may also choose to depict composite matrices by operation phase to display temporal risk level shifts. Colors and shapes help distinguish risk categories or other risk information. Composite matrices depict RM holistically, enabling commander decision-making. Figure 32 depicts hazards plotted on an example composite risk matrix.

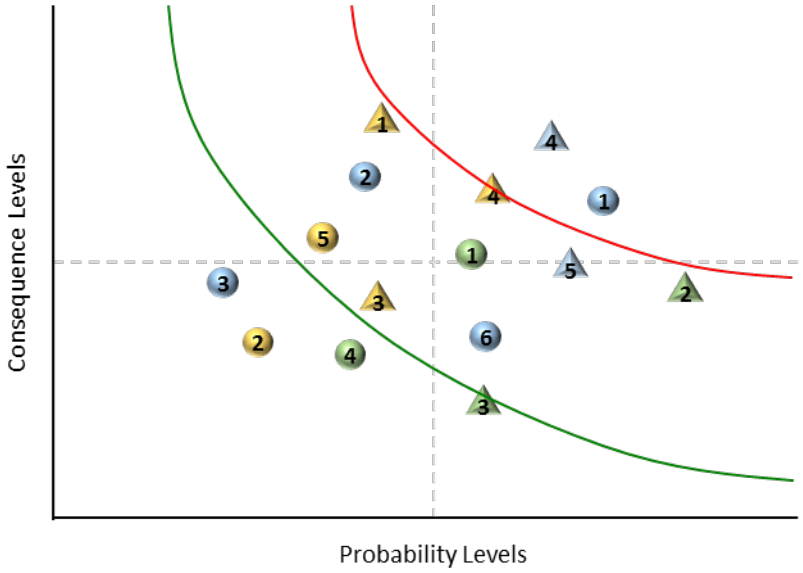

Figure 32. Composite Risk Matrix

Source: Created by author.
NOTE: Plotting a judgement line (green) and critical line (red) creates three risk levels. Planners treat hazards plotted below the judgement and above the critical lines according to their quadrant. Commanders determine treatment for hazards between both lines.

Composite matrices facilitate hazard meta-analysis. Figure 32 depicts hazards from three risk categories, each distinguished by color. Shapes distinguish hazards influenced by internal (triangle) and external (circle) drivers. Figure 33 illustrates how to conduct a meta-analysis given hazard information from Figure 32.

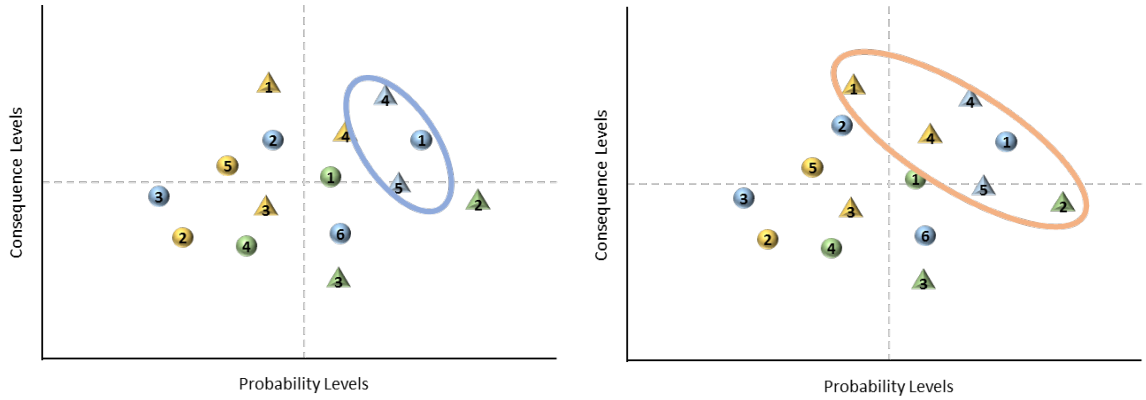

Figure 33. Composite Risk Matrix Analysis

Source: Created by author.
NOTE: Analysis revealed operational category hazards (blue) posed highest risk. Second, hazards internally driven (triangles) collectively posed higher risk than hazards externally driven.

Figure 33 highlights two factors. First, operational (blue) category hazards posed highest risk. Second, internally driven (triangles) hazards posed a higher risk than externally driven hazards. Planners may depict hazards categorically, by driver type, or by individual driver. While more identified hazards does not necessarily mean more risk, multiple high risk hazards with common traits may warrant concern. Meta-analysis enables planners to recommend policy or resource allocation adjustments.

When commanders accept residually high probability hazards, planners prepare branches or sequels. Branches, sequels, and controls requiring resources must be tied to decision points.[234] Failing to tie hazard treatments to decision points may result in unutilized resources and reduced combat power. When battlefield events do not meet resource allocation triggers, planners immediately recommend reallocating those

[234] JCS, JP 5-0, IV-5.

resources. These circumstances represent opportunities. Tracking hazards through operations helps commanders recognize opportunities or treatment decision errors.

Army RM recommends a standardized DRAW to record hazards, treatment decisions, responsibility, and effectiveness. Other RM frameworks recommend using similar tools. Planners use these tools as feedback mechanisms during, and after, mission execution. Analysis recommended DRAW adjustments. Recommended adjustments include adding hazard risk category, drivers, and sources involved, initial probability and consequence, treatment option, control (if needed) with implementation decision points, residual probability and consequence.[235] Table 35 depicts recommended DRAW modifications.

[235] JCS, JP 5-0, IV-5.

Table 35. Recommended Deliberate Risk Assessment Matrix

Subtask/Substep of Mission/Task	Hazard	Initial Risk Level	Treatment	How to Implement	Residual Risk Level
	Hazard: Source: Drivers: Risk Category:	Initial Probability: Initial Consequence: Initial Risk Level:	Treatment Option: Control (if needed):	How: Decision Points: Who:	Residual Probability: Residual Consequence: Residual Risk Level:
	Hazard: Source: Drivers: Risk Category:	Initial Probability: Initial Consequence: Initial Risk Level:	Treatment Option: Control (if needed):	How: Decision Points: Who:	Residual Probability: Residual Consequence: Residual Risk Level:

Source: Created by author. Adapted from Department of Defense, Form 2977, *Deliberate Risk Assessment Worksheet* (Washington, DC: Government Printing Office, 2014). NOTE: This template adds additional information requirements compared to Form 2977. Added requirements facilitate RM during mission execution and serve as a more complete future mission planning reference.

Recommended modifications address current RM utility shortfalls by making RM more consistent and insightful. Adding a risk category-driver model and defining risk related terms with respect to associated categories, provides planners a systematic process that they can explain to commanders. This systematic process makes subjective concepts more objective and consistent.

Incorporating treatment terminology and enhancing matrix application makes RM more insightful. Treatment option delineation on a RAM provides planners insight as to how to treat risk based on consequence and probability. Furthermore, planners can visualize when hazards cannot be reduced below tolerance. When hazards cannot be

reduced below tolerance, planners request additional resources or prepare branch or sequel plans.

Future Research Suggestions

This thesis broadly addressed Army RM. Other RM frameworks provided insight for improving LSCO risk estimation and depiction. While this thesis covers general steps and methods to improve risk estimation and depiction, several areas still require additional attention. Future investigation areas include: incorporating additional RM techniques and tools, selecting controls, and RM during mission execution.

This thesis improved upon risk matrices as a RM technique. This emphasis arose due to their applicability as a qualitative or semi-quantitative risk evaluation means. Risk matrix presence in already published doctrine also makes recommended change incorporation simple. However, other RM techniques and tools exist and may be better suited for certain combat scenarios. Future research should investigate other RM technique and tool applicability within LSCO. For applicable techniques and tools, research should also evaluate their feasibility within military command echelons.

Planners implement controls when they want to reduce hazard risk levels. Controls require resources and supervision. Planners must balance resources and supervision with all other mission tasks. Future research should explore LSCO control resource and supervision requirements based on risk complexity. Resources for future control research may include civilian RM publications, military doctrine, and historical case studies.

Mission execution management also requires more study. Mission execution management should consider both opportunity management and real-time RM during

crises. Future research should investigate planning for and recognizing opportunities. Recognizing battlefield opportunities allows commanders to reallocate resources. Resource reallocation can enhance combat power where and when most needed.

Contrasting opportunity management is crisis response. Executing real-time RM during crises will likely look different than deliberate RM. Army doctrine only broadly addresses opportunities and crises. Numerous civilian RM publications contain detailed opportunity management and crisis response discussions.

Conclusion

Recent doctrinal publications emphasizing LSCO expand RM application beyond ATP 5-19 discussion. Army RM doctrine needs revision to support LSCO risk estimation and depiction. Incorporating RM techniques from ISO, IRGC, IRM, and JRAM frameworks can meet this need. Recommended revisions include: modifying RM process steps and sub-steps; including problem framing as a means to identify risk character, categories, drivers, and sources; explicitly defining treatment options; providing a detailed matrix tailoring discussion; explaining hazard meta-analysis; and including additional feedback information in assessment worksheets.

LSCO RM should inform operations planning and facilitate mission execution decisions.[236] As an integrating process, alongside IPB and targeting, RM warrants more attention. With recommended changes, RM can be a proactive measure to increase combat power and enhance situational understanding. Recommended modifications will

[236] Meredith, "Operational Risk and the American Way of Warfare," 13.

provide planners requisite tools and instruction to execute meaningful RM within the Army's operations process.

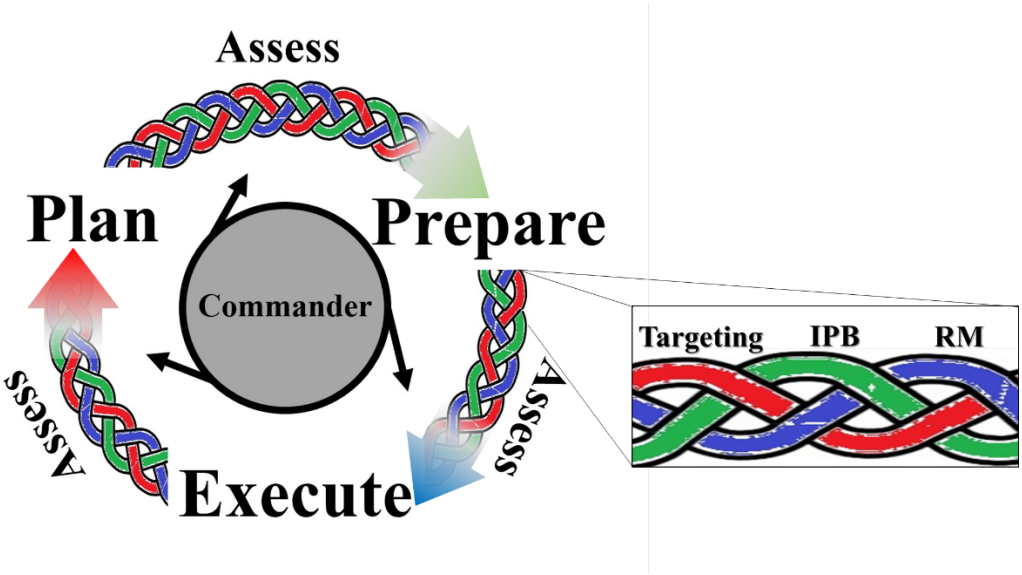

Figure 34. Operations Process with Integrating Processes

Source: Created by author.
NOTE: RM stands beside targeting and IPB to enable the Army operations process.

APPENDIX A

ARMY RISK MANAGEMENT EVOLUTION

Table 36. Army Risk Management Principles Evolution

RM Principles			
FM 100-14 (1998)	**FM 3-100.12 (2001)**	**FM 5-19 (2006)**	**ATP 5-19 (2014)**
Integrate RM into mission planning, preparation, and execution	Accept no unnecessary risk	Integrate CRM into all phases of missions and operations	Integrate RM into all phases of missions and operations
Make risk decisions at the appropriate level in the chain of command	Make risk decisions at the appropriate level	Make risk decisions at the appropriate level	Make risk decisions at the appropriate level
Accepting no unnecessary risk	Accept risk when benefits outweigh the cost	Accept no unnecessary risk	Accept no unnecessary risk
	Anticipate and manage risk by planning	Apply the process cyclically and continuously	Apply the process cyclically and continuously
		Do not be risk averse	

Source: Created by author.
NOTE: Table 36 depicts RM principle changes with each doctrinal RM publication.

Table 37. Army Risk Management Steps Evolution

RM Steps			
FM 100-14 (1998)	**FM 3-100.12 (2001)**	**FM 5-19 (2006)**	**ATP 5-19 (2014)**
Identify hazards	Identifying threats	Identify hazards	Identify the hazards
Assess hazards to determine risks	Assessing threats to determine risks	Assess hazards to determine risks	Assess the hazards
Develop controls and make risk decisions	Developing controls and making risk decisions	Develop controls and make risk decisions	Develop controls and make risk decisions
Implement controls	Implementing controls	Implement controls	Implement controls
Supervise and evaluate	Supervising and reviewing	Supervise and evaluate	Supervise and evaluate

Source: Created by author.
NOTE: Table 37 depicts RM step changes with each doctrinal publication. Peach and green colored steps represent RM phases introduced in FM 5-19. Peach highlights assessment phase steps and green highlights management phase steps.

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