Capability-Based Planning in Humanitarian Operations:

A Hybrid Optimization and Simulation Framework for Strategic Acquisition in the Armed Forces

Gonzalo Barbeito (UniBW)
MajGen (ret.) Dr. Dr. Dieter Budde (UniBW)
Prof. Dr. Max Krüger(UniBW)
Prof. Dr. Stefan Pickl (UniBW)

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CORMTESSA

Agenda

1. Introduction
2. Approach & Model Description
3. First Results
4. Outlook

Part I

Introduction

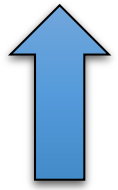
Current Scenario (Yearly Aggregated):

- More than 500 disasters strike our planet
- death toll over 75.000 people
- affecting more than 200 million people

Perspectives:

- Increasing Population
- Technological Advances

} Frequency
Severity



"The field of Disaster and Emergency Management (DEM) handles **resources** and **activities** that will deal with the **humanitarian** aspect of emergencies."

[Altay and Green, 2006]

"Increased relevance in research since the **2004 Tsunami in the Indian Ocean**"

[Abidi et al., 2014, Habib et al., 2016, Behl and Dutta, 2019]

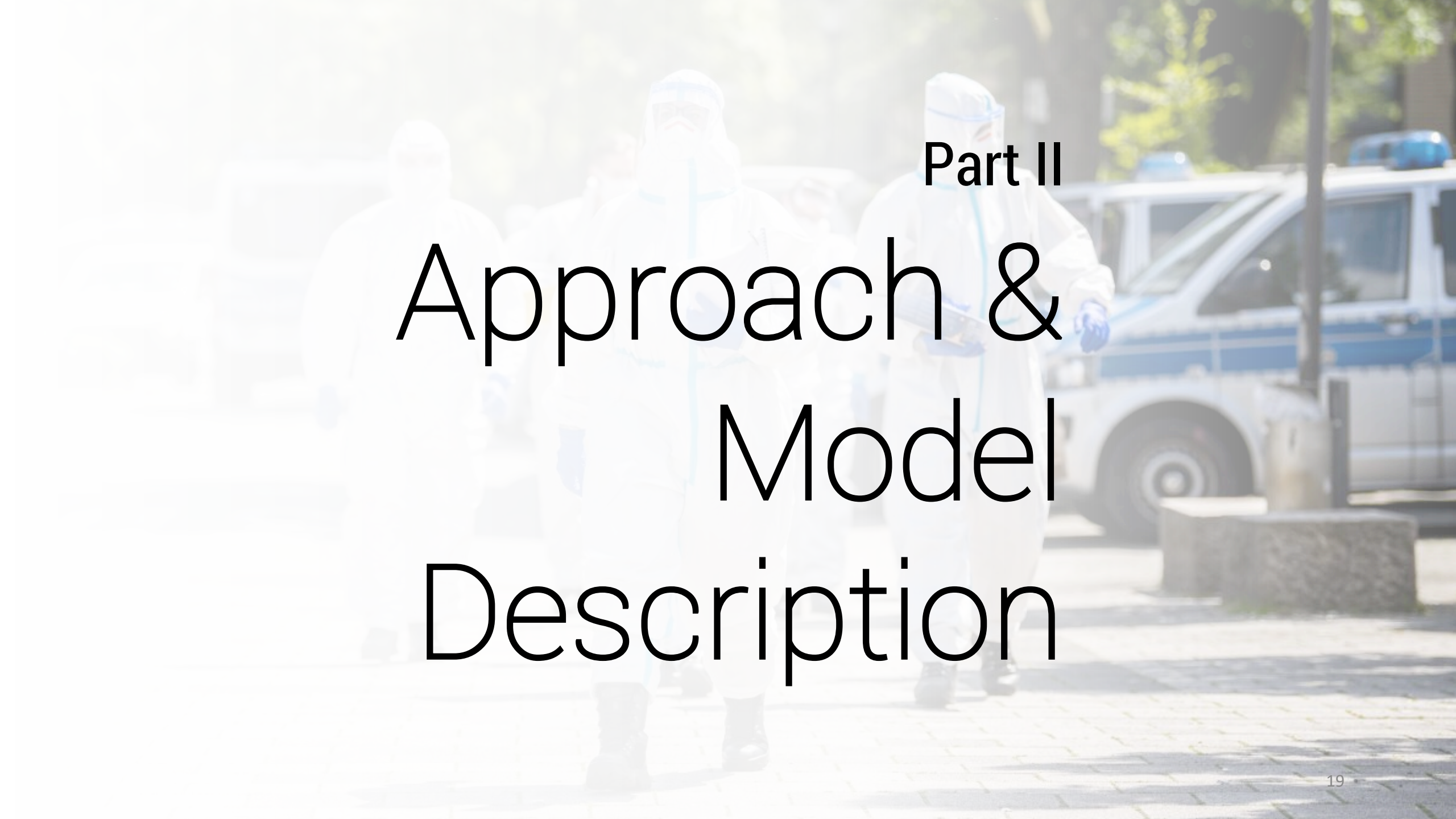
1. Relief demand characterization **(Demand)**
2. Timely relief supply and distribution **(Distribution)**
3. Insufficient resources to fully address the demand **(Supply)**

[Sheu, 2007,Balcik and Beamon, 2008, Caunhye et al., 2012]

Complex Operations:
Civil + **Military Actors**

2. Timely relief supply and distribution **(Distribution)**
3. Insufficient resources to fully address the demand **(Supply)**

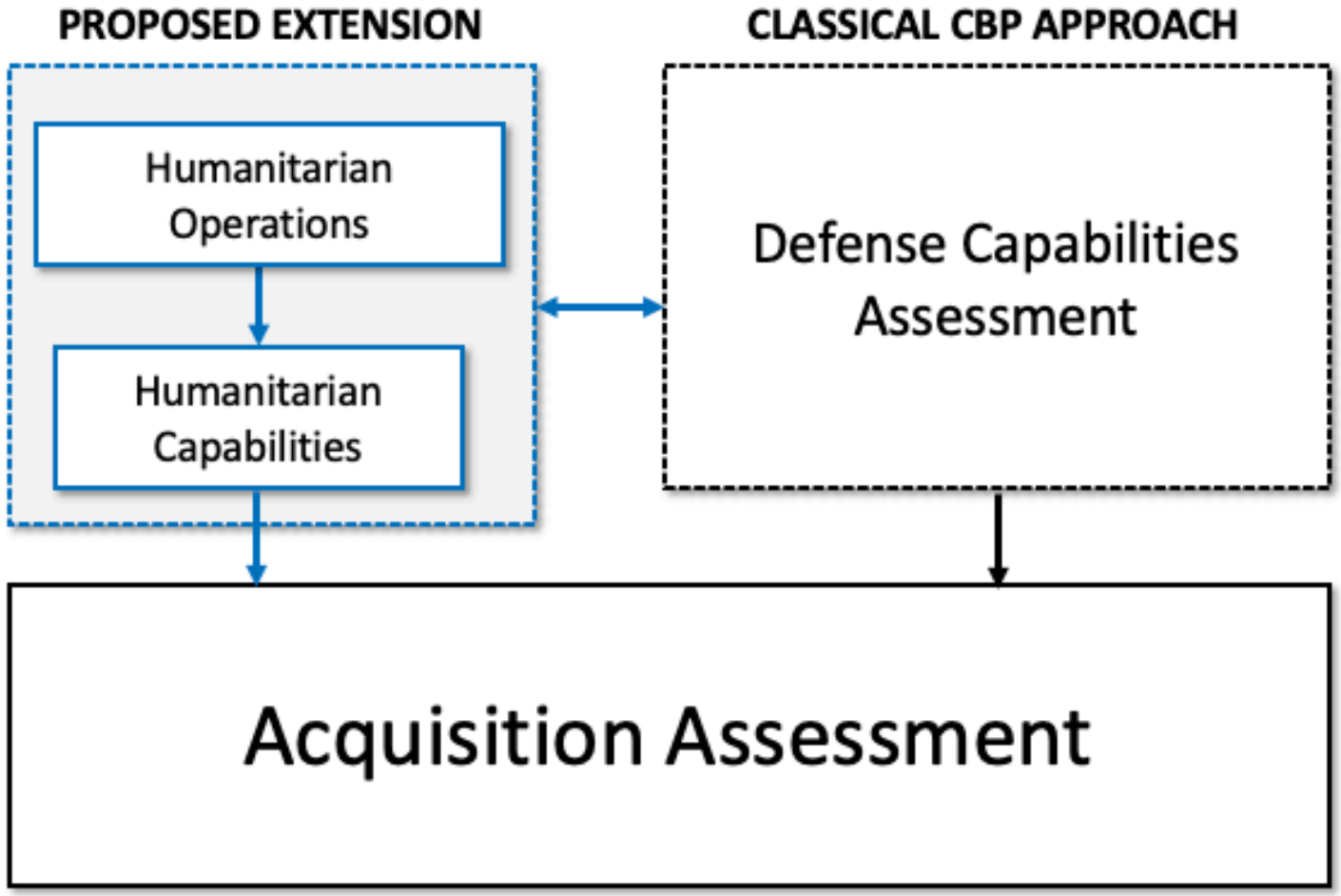
Research Question:
How can humanitarian capabilities for military support in DEM be characterized, when framed within a broader strategic acquisition plan in the Armed Forces?



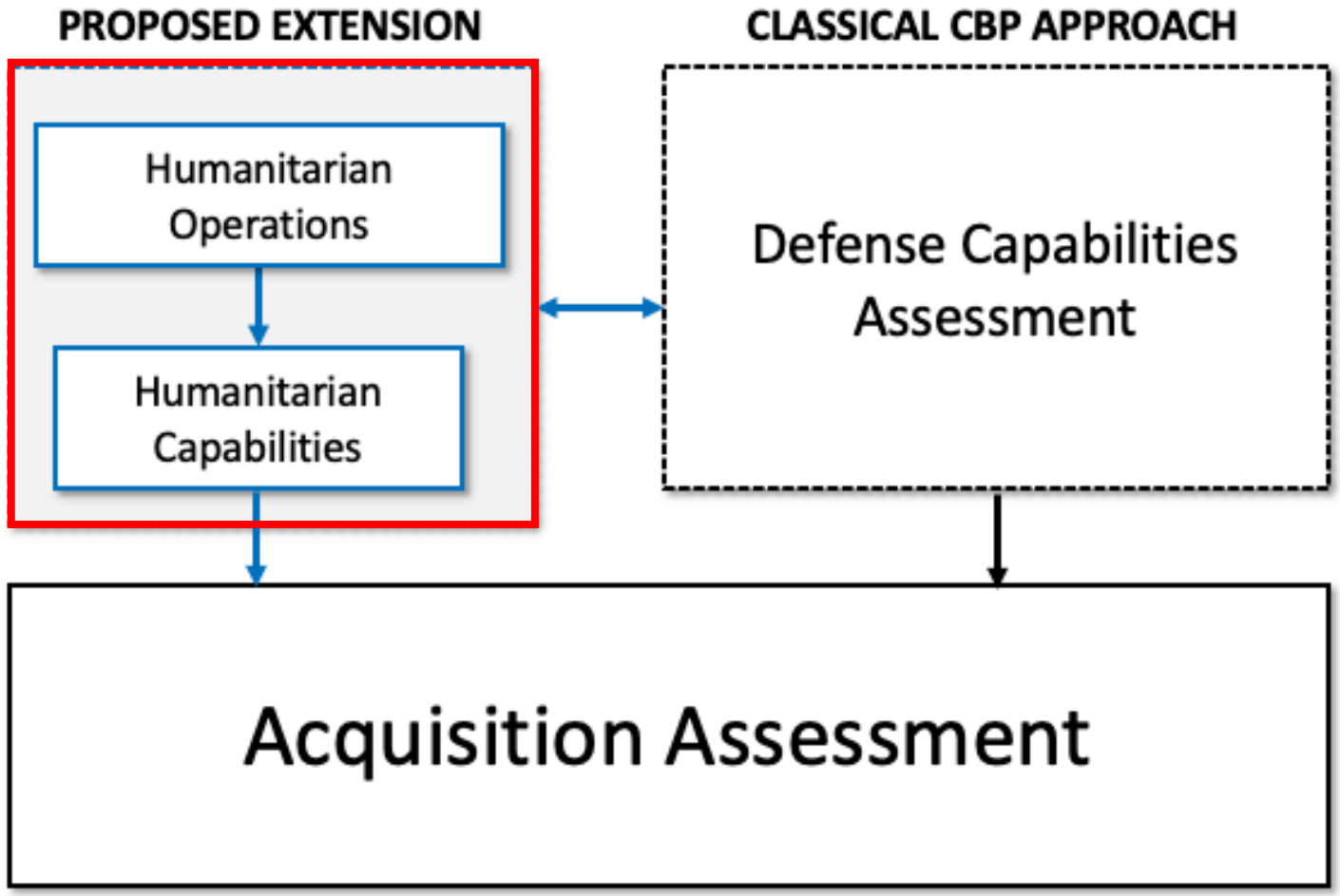
Part II

Approach & Model Description

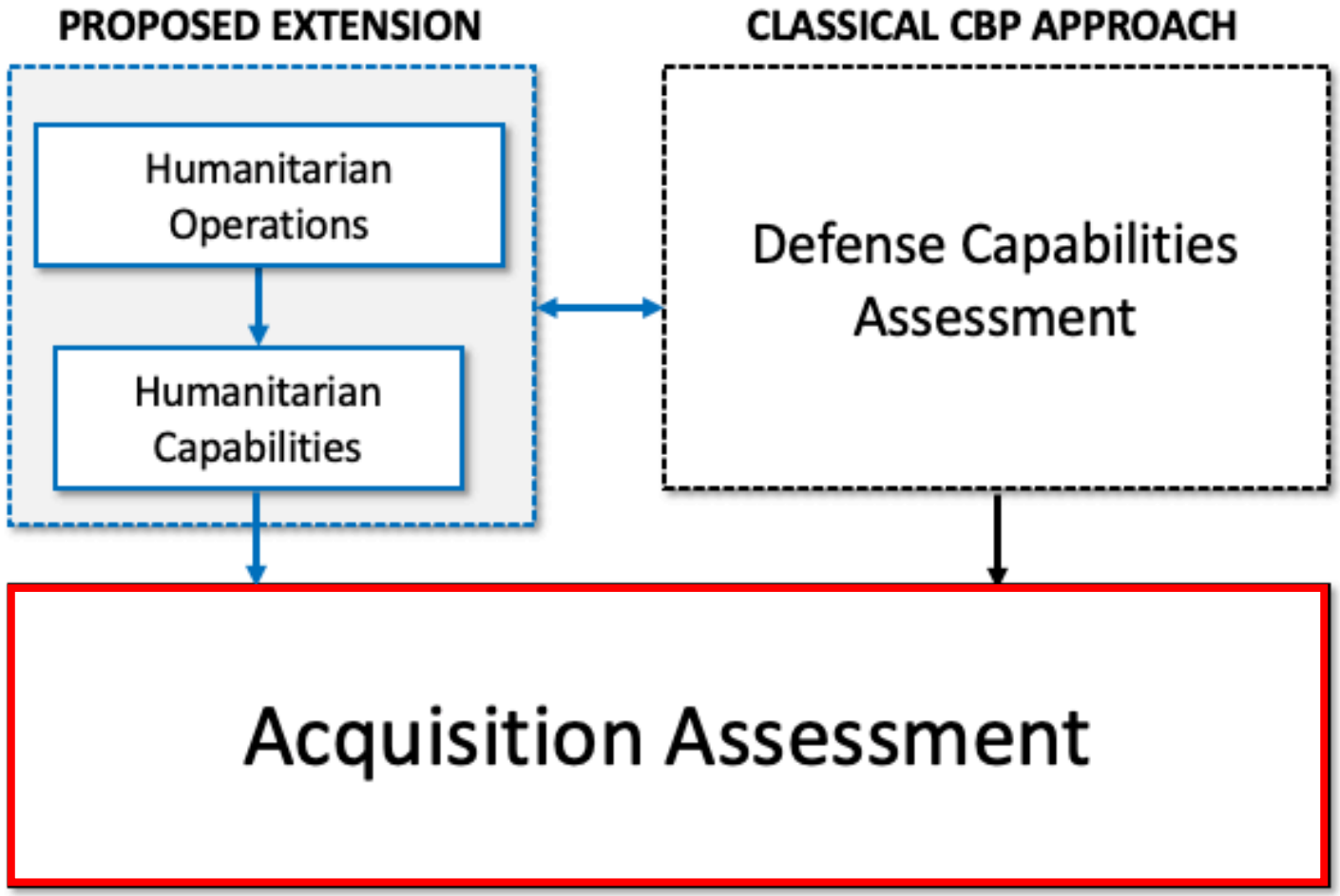
General planning framework to **provide an organization with capabilities suitable for a wide range of modern-day challenges and risks**, simultaneously framing these capabilities **within an economic framework** (Davis, 2002)



Problem (a)


PROPOSED EXTENSION
CLASSICAL CBP APPROACH
Humanitarian Operations
Humanitarian Capabilities
Defense Capabilities Assessment
Acquisition Assessment

Problem (b)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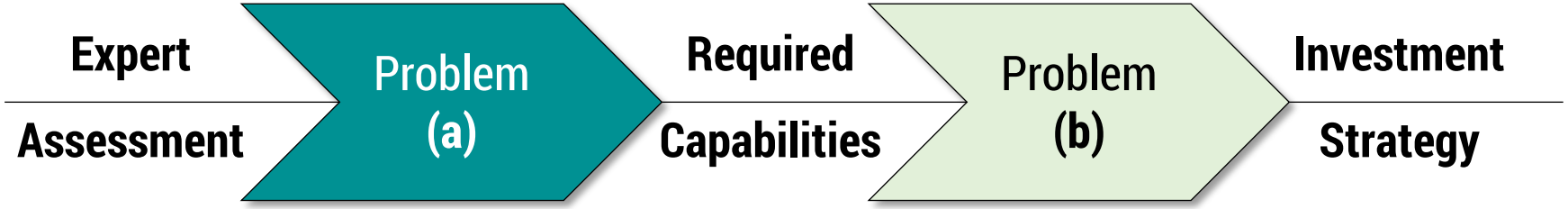
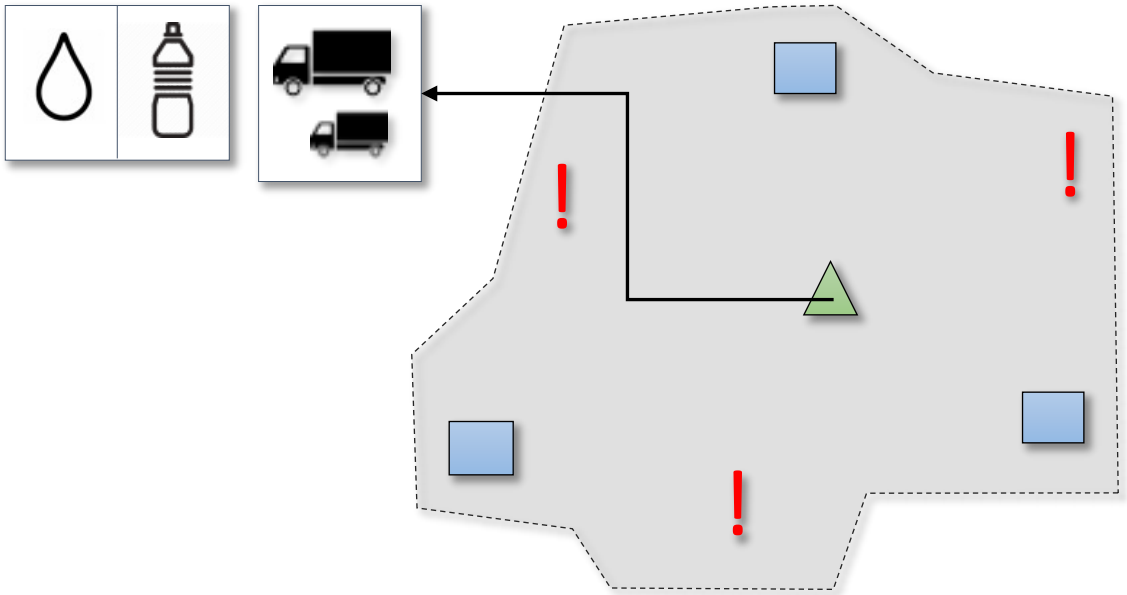
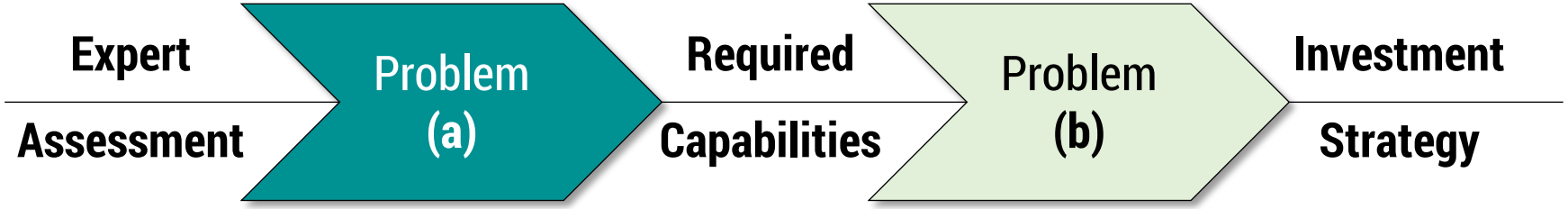




3 Shelters
3 Depots
1 Fleet Base

Heterogeneous Fleet
Distribution of Water

Rich Routing Behavior



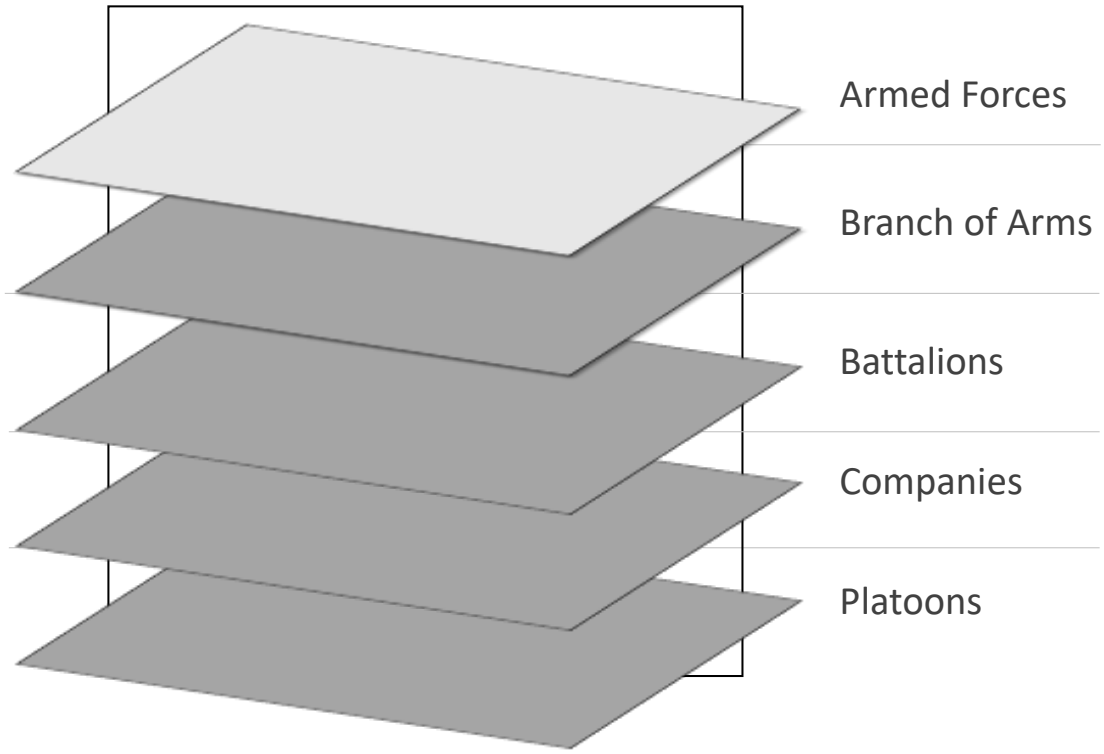
Rich VRP:

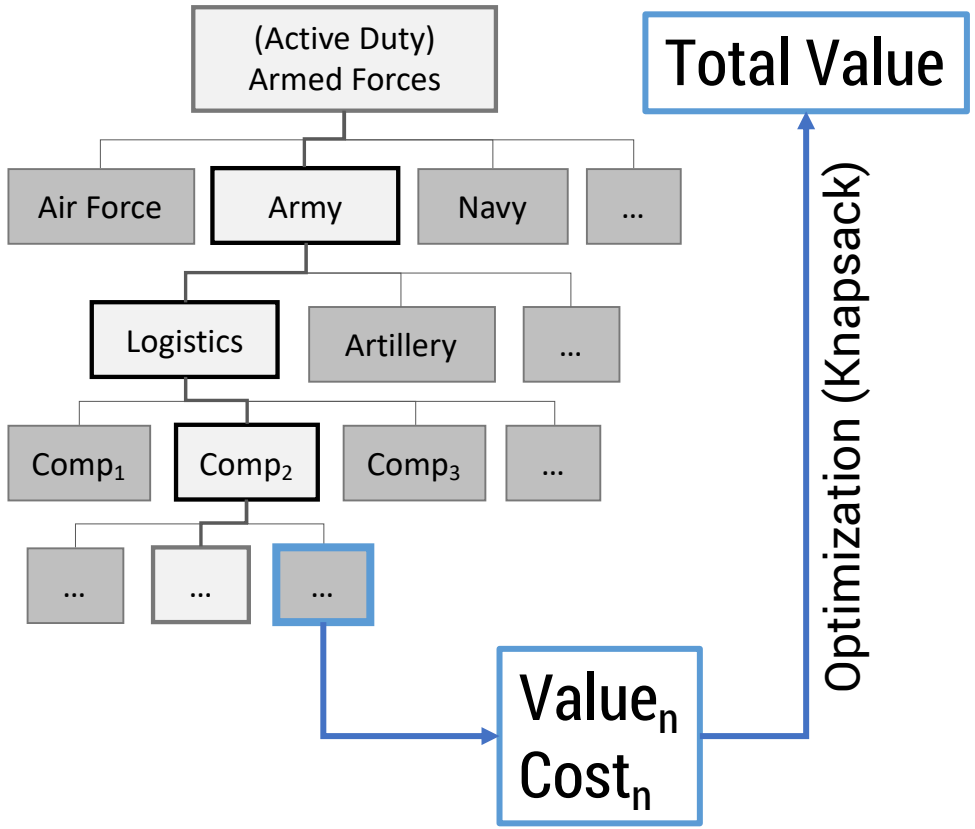
1. *Split-Delivery*
2. *Multi-Echelon*
3. *Multi-Depot*
4. *Heterogeneous Fleet*
5. *Multi-trip*
6. *Multi-Commodity*
7. *Transshipment*
8. *Dimensional Constraints*
9. *Driving Regulations (Time & Distance)*

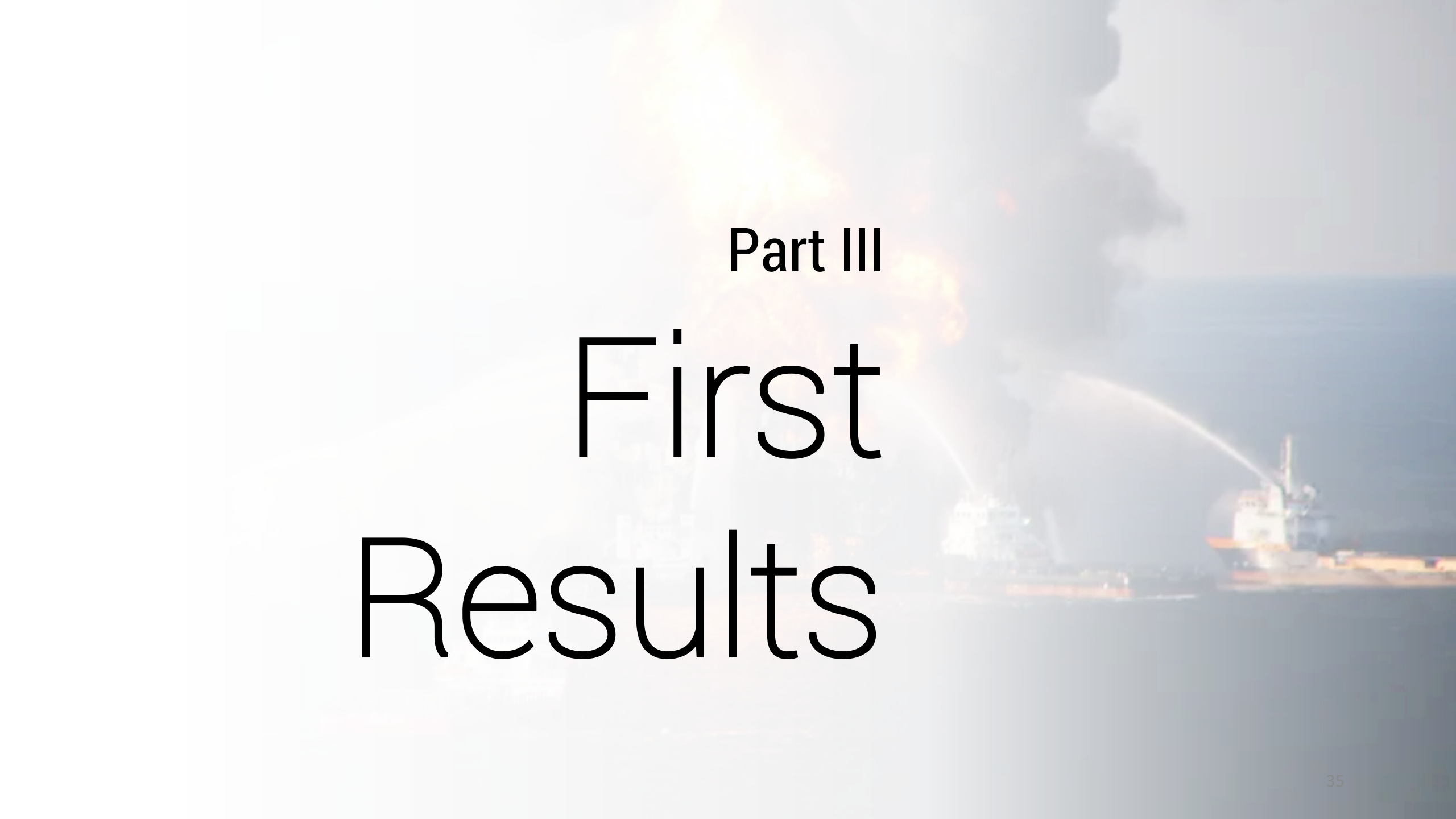
Required Capabilities:

1. Depots
2. Transport

Approach Architecture







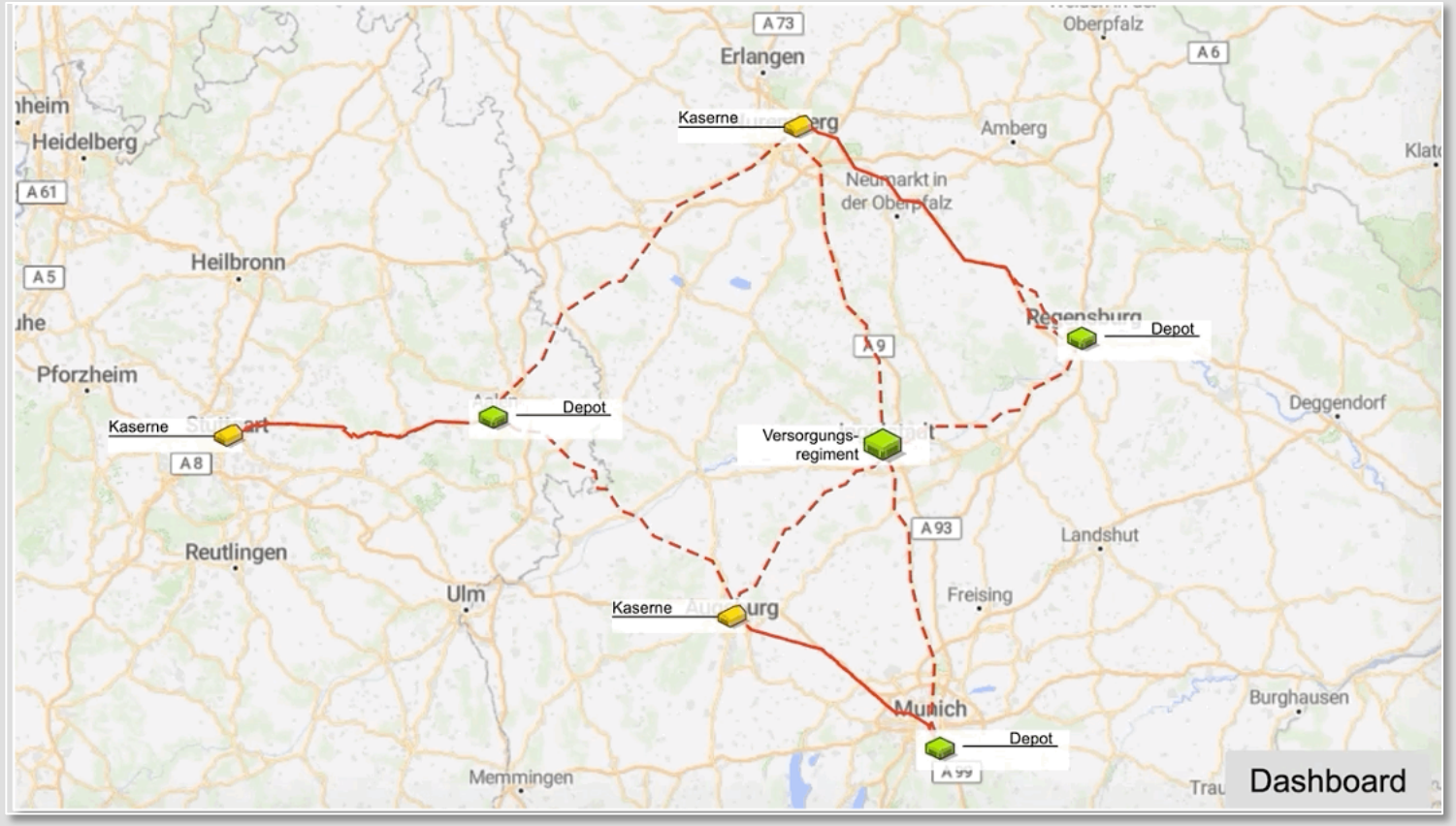
Part III

First Results

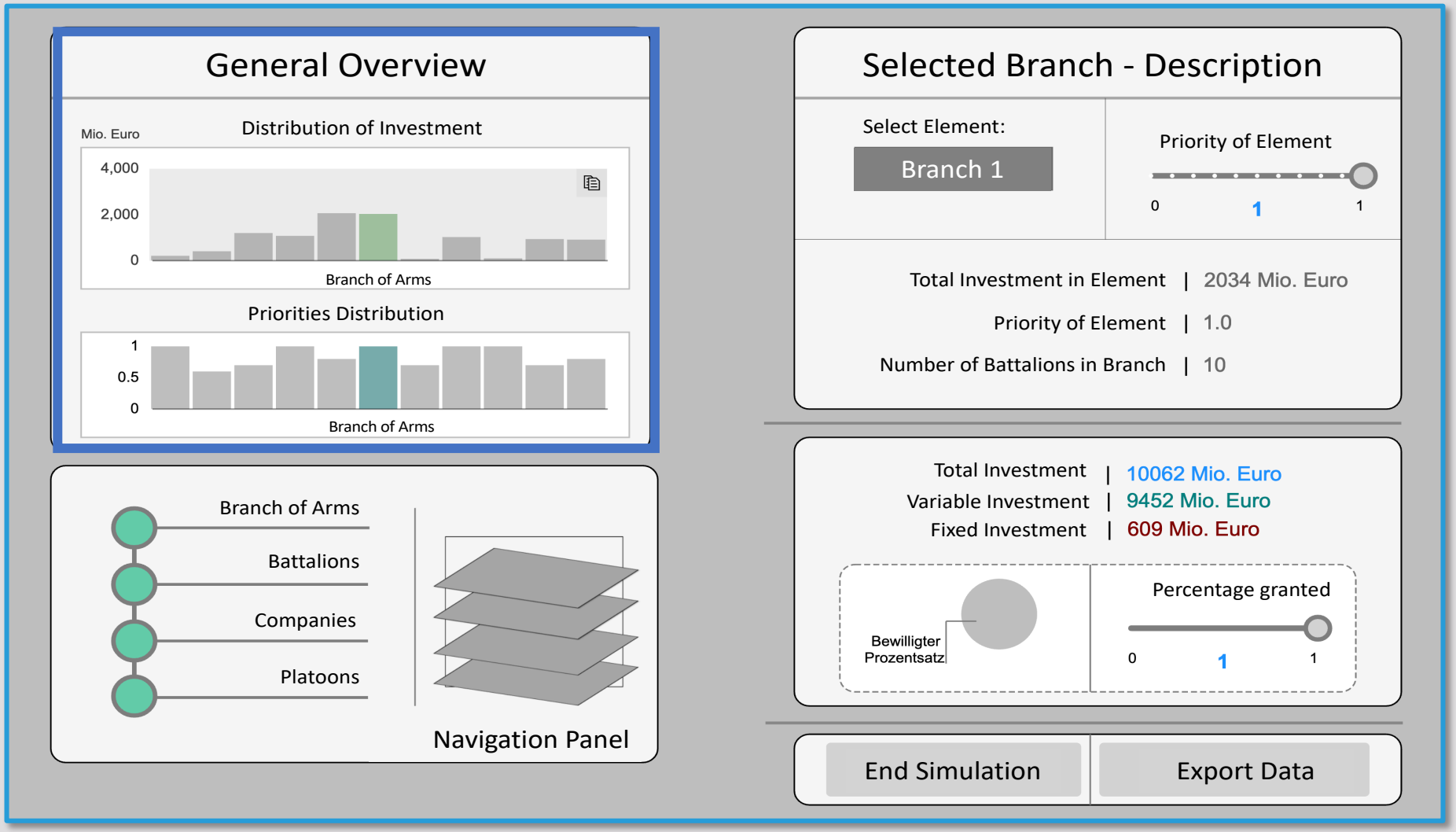
Monte Carlo Process

	Shelter A	Shelter B	Shelter C	Trucks A	Trucks B	Trucks C	Total Costs	Total Population
9	4303	4431	4815	0	0	0	0	13549
1	4614	3985	4113	0	0	0	0	12712
7	4127	3576	4332	10	10	9	24910	12035
5	4263	3407	4791	10	10	10	25946	12461
8	4007	3340	4513	10	10	9	24440	11860
6	3866	3318	4076	10	10	10	26702	11260
4	4314	3299	3669	10	10	6	20730	11282
3	4093	3230	3980	10	10	10	25805	11303
2	3984	3042	3210	10	10	4	17893	10236
0	4416	2612	3908	10	10	8	23181	10936

GIS – Result Exploration



Optimal Investment Strategy



Part IV

Outlook

1. Novel CBP-based framework for military decision support in the context of humanitarian actions.
2. First results seem promising as a strategy development tool
3. Next Step: Development of Digital Twin for the Relief Distribution System

Thank you for your attention!

Contact |
gonzalo.barbeito@unibw.de

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