

Protective Action Decision Making in Large-Scale Emergencies: The Role of Information Requirements and Job Aids in Community-Level Decision Making.

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14th of December 2020

Presentation Outline

1. Introduction about Protective Actions
2. Significance of this research
3. Research Problem
4. Literature Review
5. Research Task 1: Theoretical Modifications
6. Research Task 2: Verify Information Requirements ontology using cognitive task analysis tool
7. Research Questions
8. Research Study: Controlled Experiment research study examining job aids and information requirements
9. Results
10. Discussion
11. Conclusions

What is a Protective Action

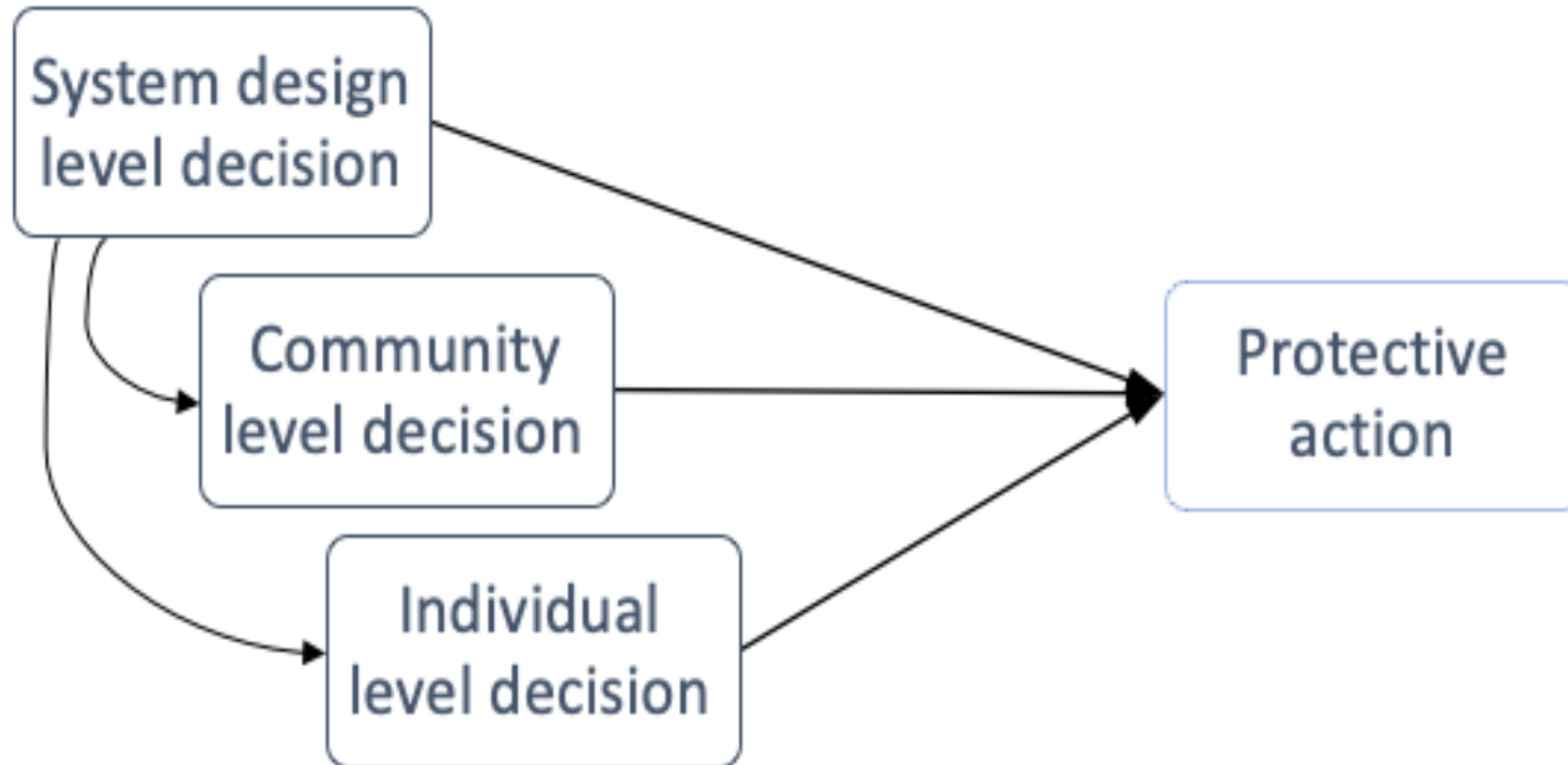
Protective Action decision-making in Emergency Management can be defined as the process of selecting options to protect life, property, operations, information, and the environment from the harms of a hazard.

What makes a PA decision a good decision?

Emergency Management Priorities

- Save lives
- Stabilize the incident
- Protect property
- Protect the environment

Examples of Protective Actions



Examples of Protective Actions

- Shelter-in-place
- Evacuate
- Lockdown
- Lock-out
- ‘Drop-Cover-Hold’
- Viral outbreak nonpharmaceutical interventions
- Viral outbreaks pharmaceutical interventions.

(The “I Love U Guys” Foundation, 2015)
(Ferguson et al., 2006)

Significance of this research

- There is a thorough focus on modeling PA decisions on a household-level, not much for community level Protective Action decision making
- Community-level PAs can protect millions of people from the adverse consequences of emergencies such as the COVID-19 global pandemic or the frequent wildfires invading communities at a moment's notice.

Research problem



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The classification of Protective Action decisions and Information Requirements used to make such decisions have not been consistently and rigorously documented. Furthermore, the efficacy of job aids supporting successful decision-making has not been explored.

Research sub-problems



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Sub-Problem 1

The literature has not provided a comprehensive and consistent taxonomy of Protective Action decisions and their Information Requirements. Such taxonomy would inform the design of job aids and training tools to support consistent successful Protective Action decisions.

Research sub-problems

Sub-Problem 2

The literature has not provided a comprehensive Protective Action Decision-Making model that includes classification of Information Requirements necessary during the pre-decision process.

Research sub-problems

Sub-Problem 3

- The efficacy of job aids in improving decision makers ability to solicit Protective Action information requirements has not been fully explored.

Research sub-problems



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Sub-Problem 4

The efficacy of job aids in improving decision makers ability to successfully determine appropriate Protective Action decisions to has not been rigorously analyzed, especially in the case of wild-fire evacuation pre-decisions.

Research Tasks Outline



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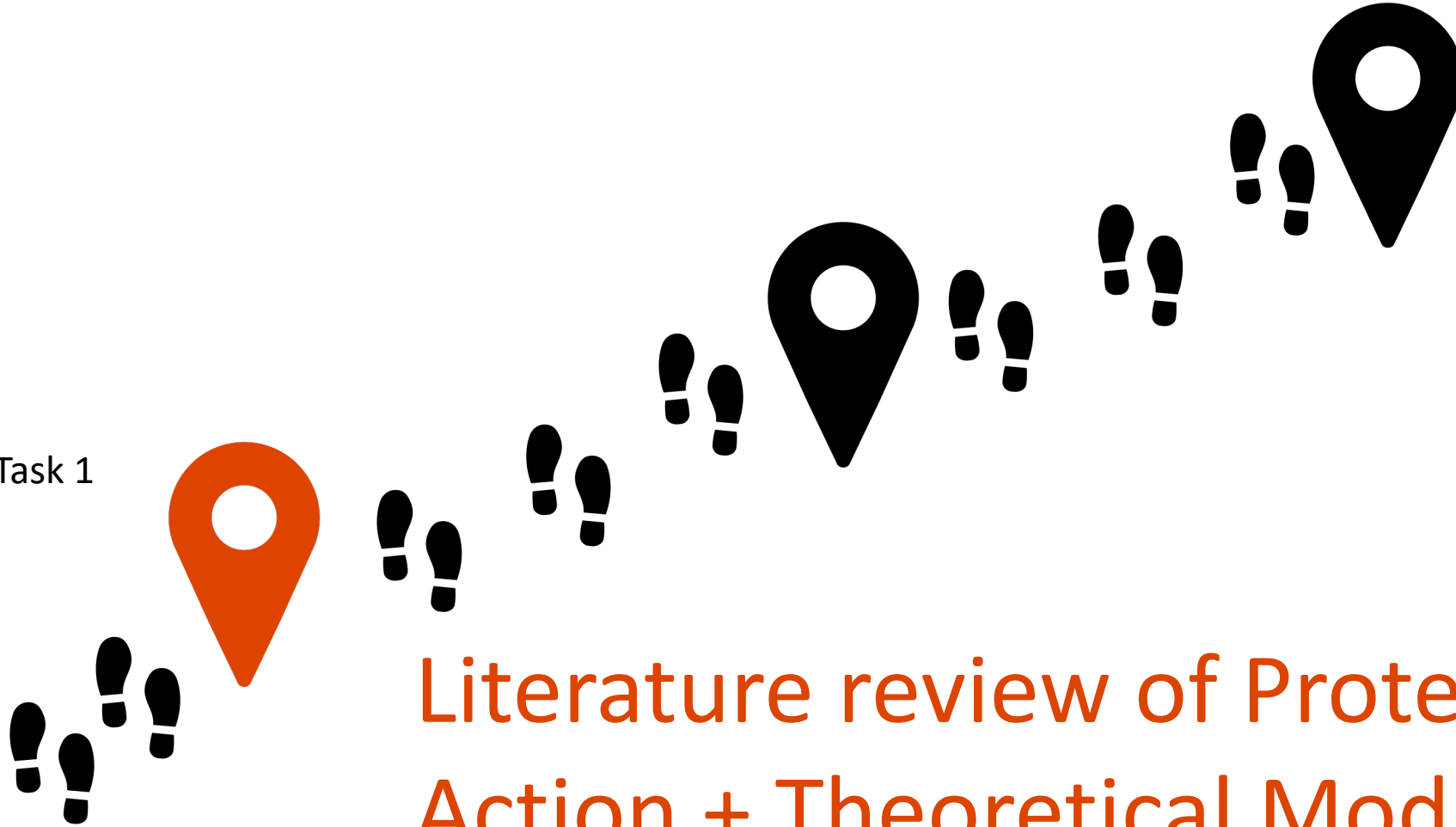


Research Tasks Outline



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Research Task 1

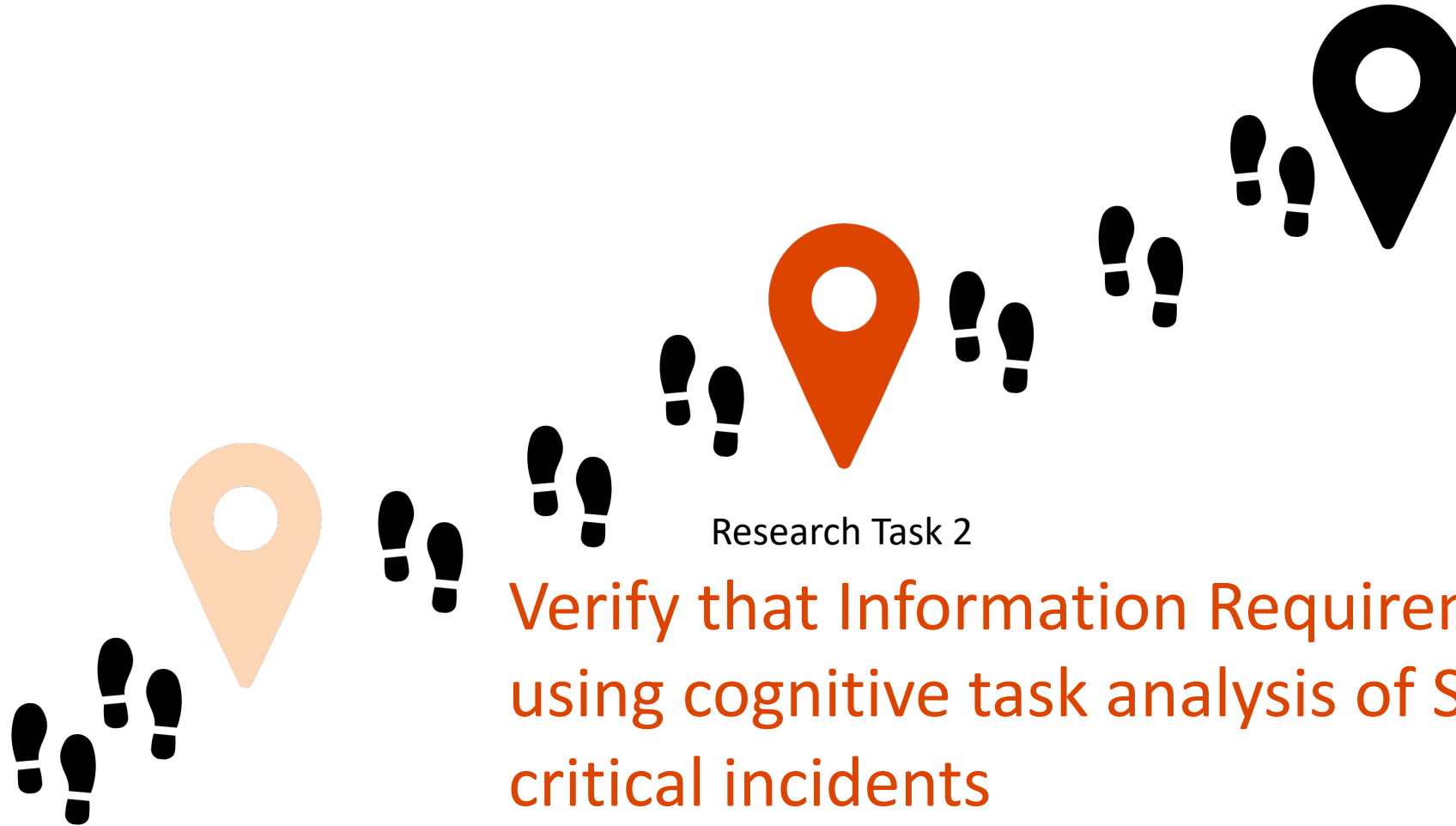


Literature review of Protective
Action + Theoretical Modifications

Research Tasks Outline



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Research Tasks Outline



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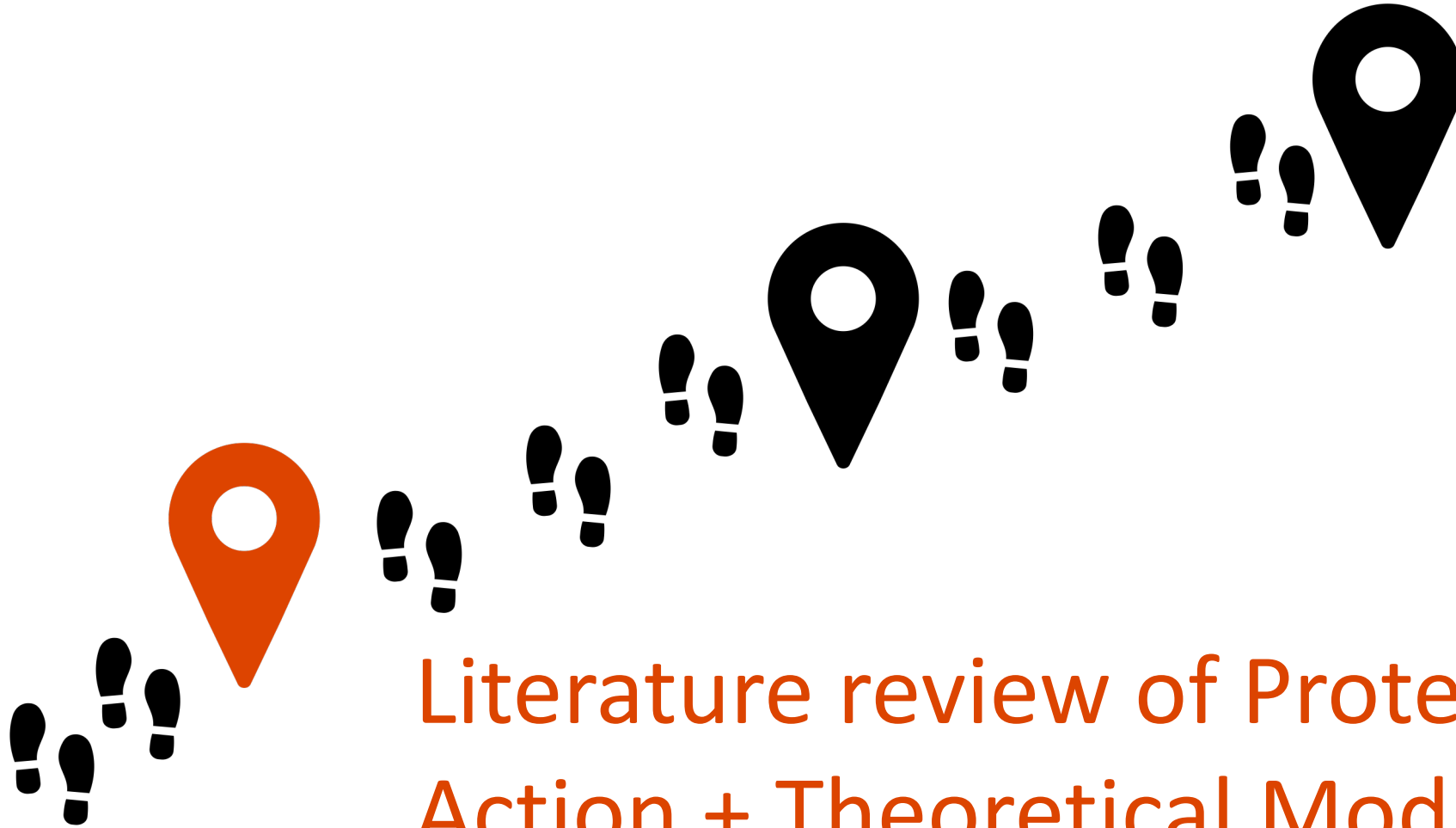
Research Activities

Step #		Inputs	Activity	Outcomes
Research Task 1	1	PADM	Review literature on Protective Action Decision Making (behavioral)	Identified gaps in the literature
	2	PADM, literature definitions of EM concepts	Review concepts relating to Emergency Management Protective Action Decisions	Ontology of information requirements that is driven from the literature.
	3	Steps 1,2	Produce a revised Protective Action Decision Making Modeling addressing information requirements ontology	DT-PADM
Research Task 2	4	SME accounts of critical incidents	Verify SHERS ontology using cognitive task analysis tool	Verified SHERS ontology Identified Information Requirements and operational components of PA decisions
Research Study	5	Research Tasks 1,2 and SME	Development of Job Aid and Validation Scenario	Wildland-Urban Fire response job aid, experimental scenario
	6	Step 5	Controlled Experiment research study examining job aids and information requirements	Validated description of information requirements and job aids efficacy in PADM

Research Tasks Outline



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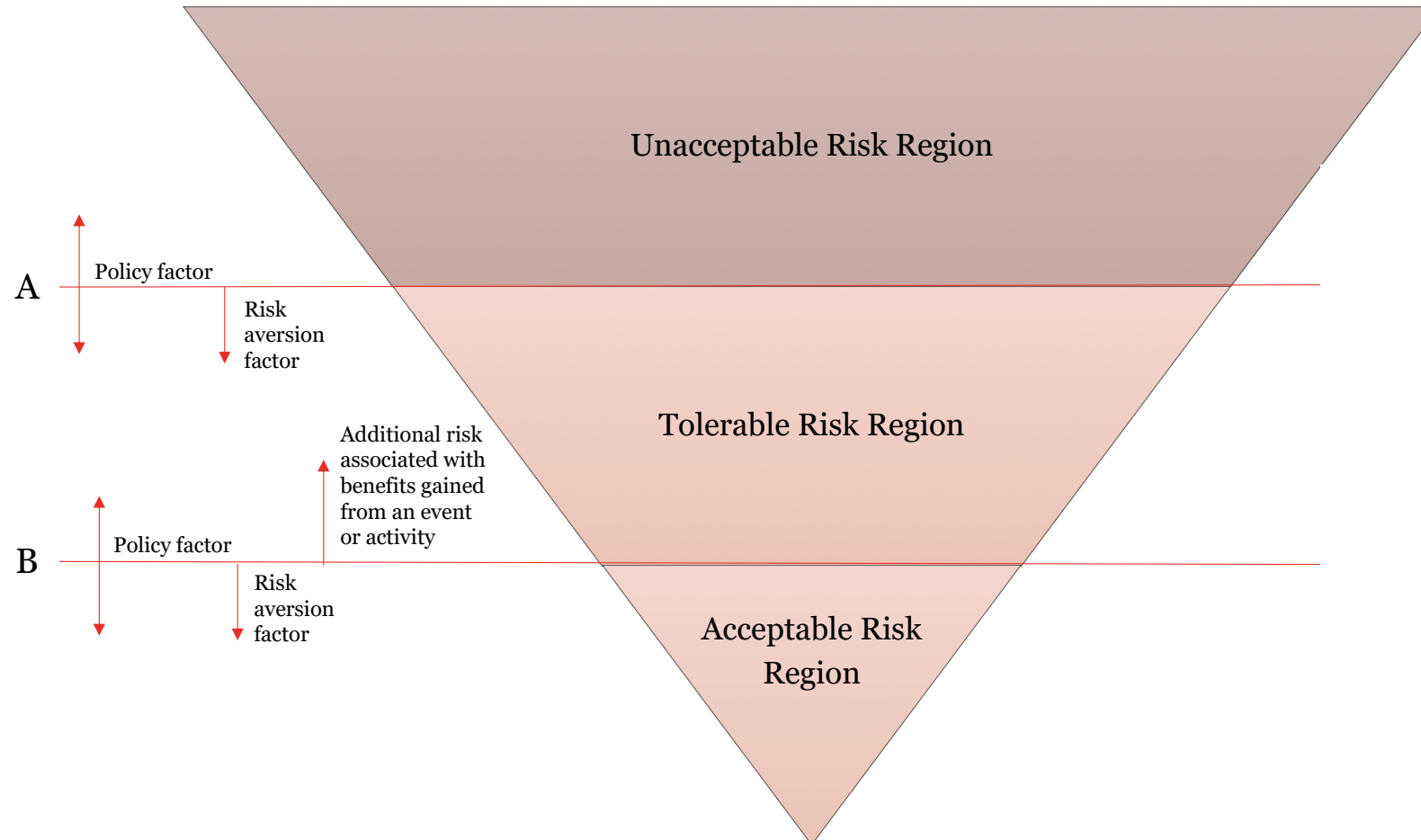


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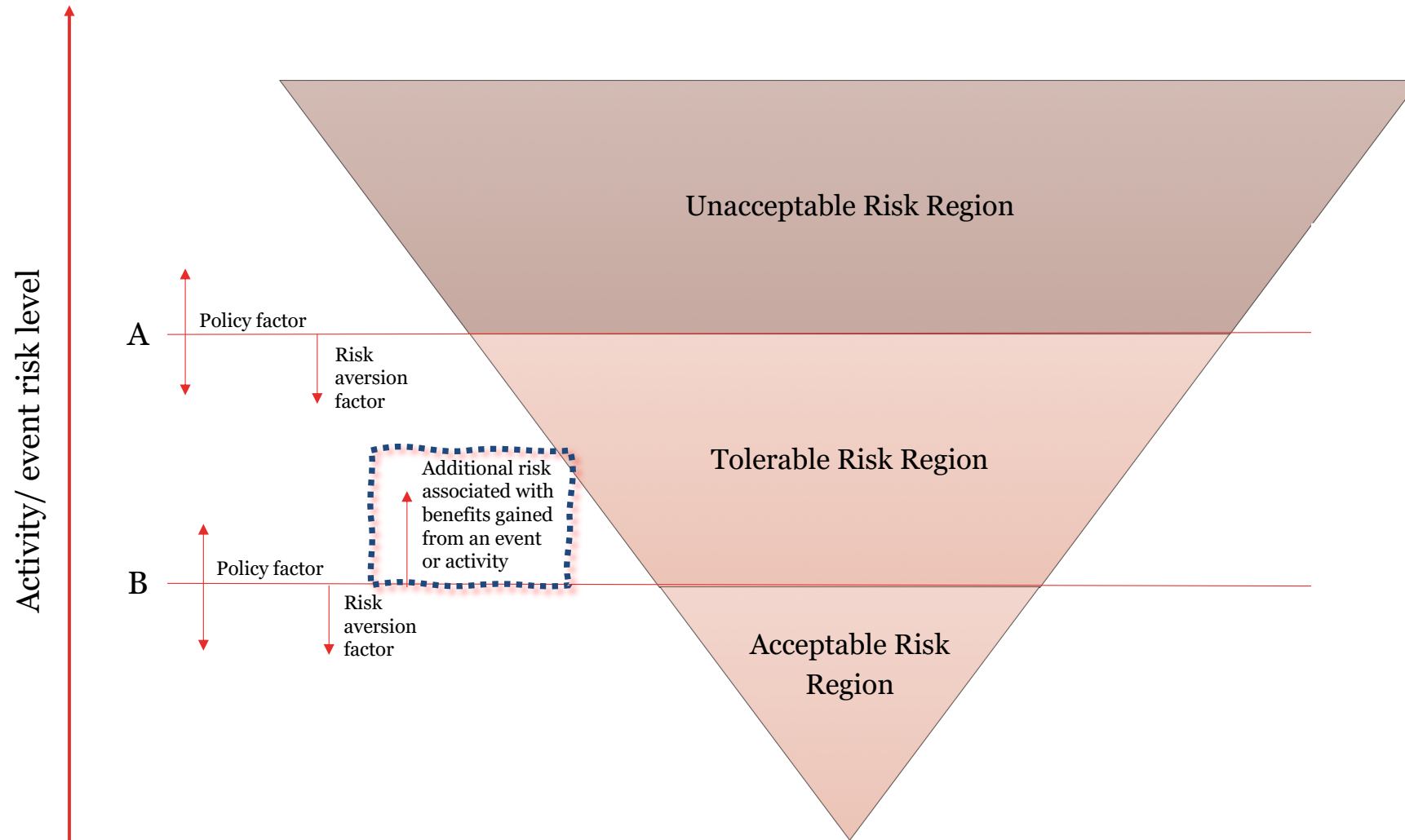
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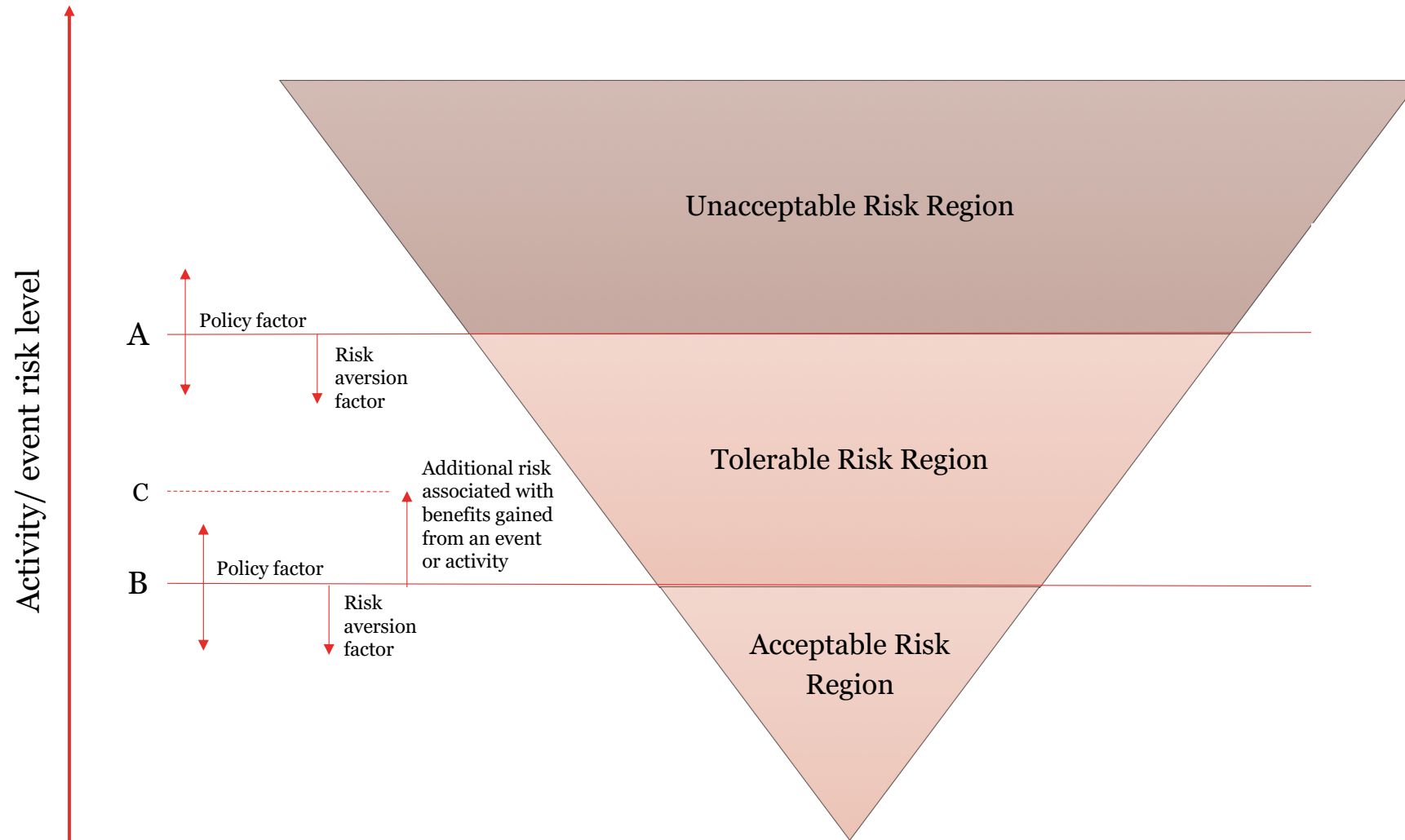
Risk Tolerability and Acceptance



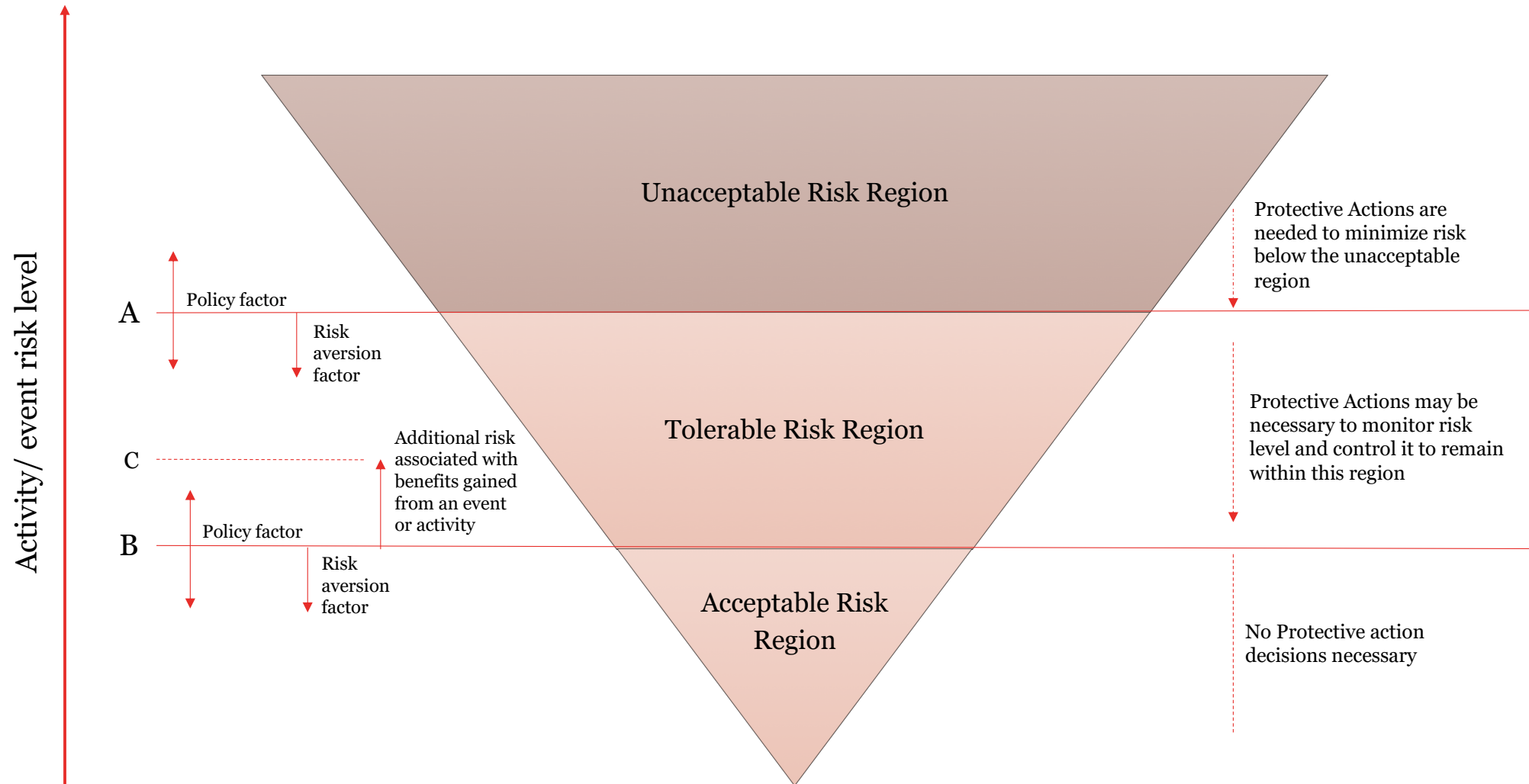
Risk Tolerability and Acceptance



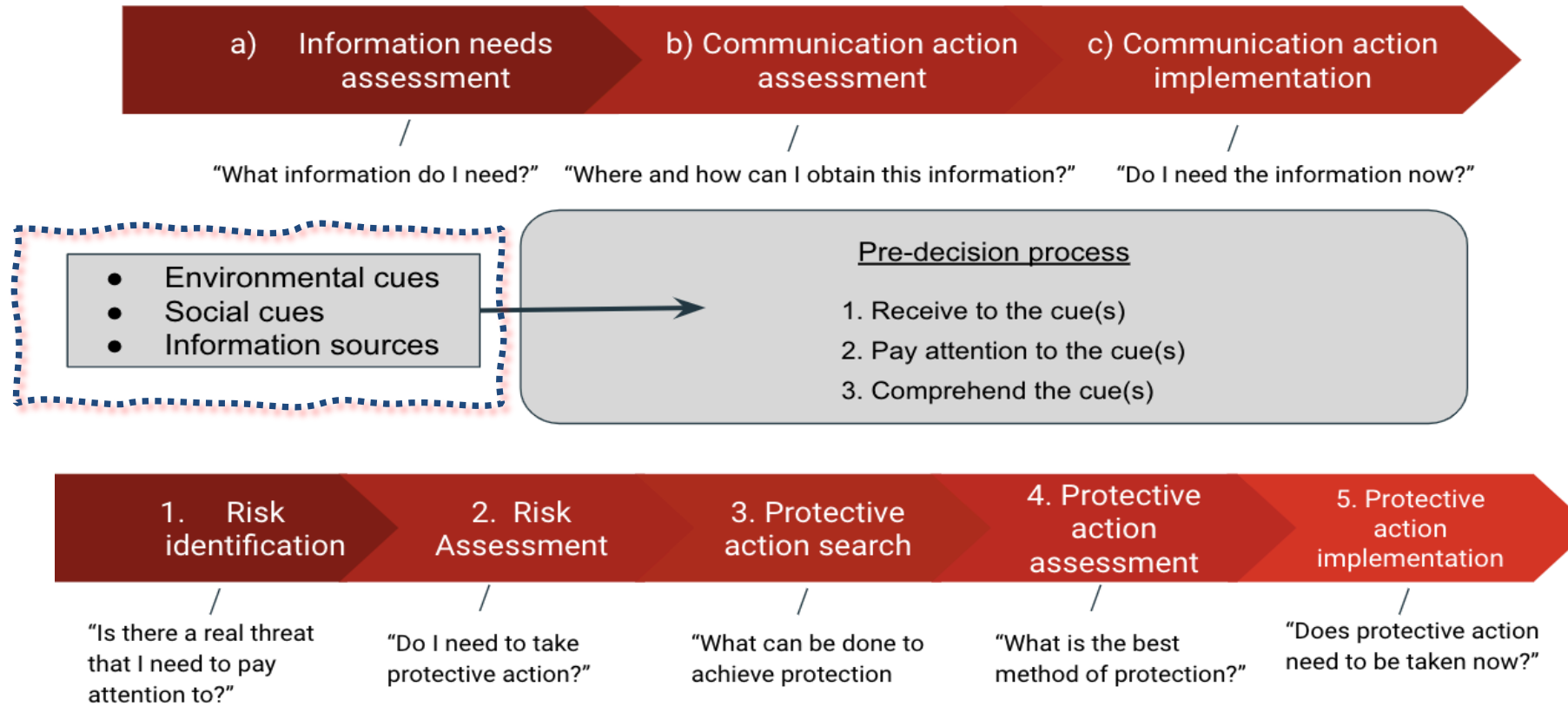
Risk Tolerability and Acceptance



Risk Tolerability and Acceptance



PADM as a starting point



Research Activities

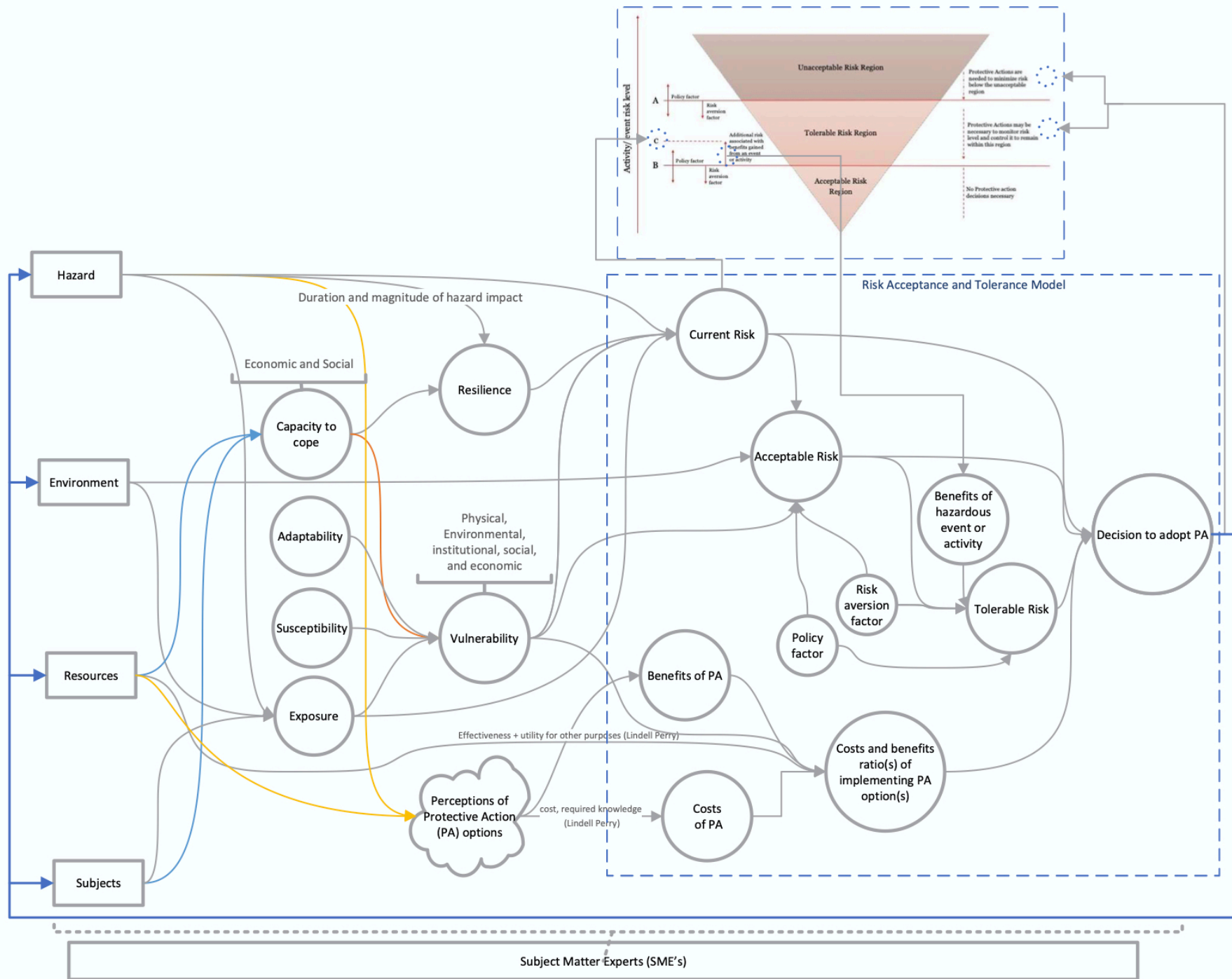
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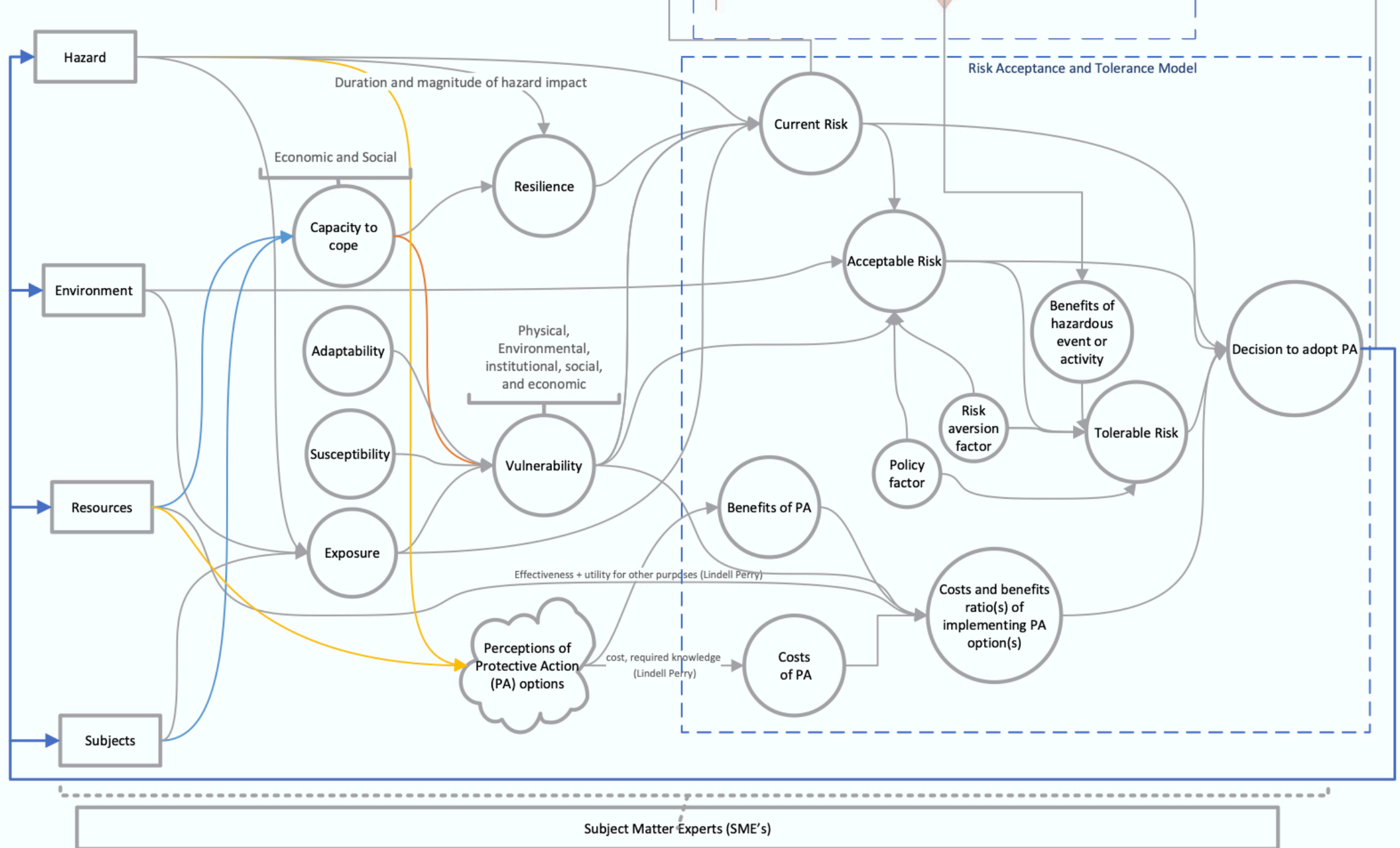
Concepts effecting PA decisions



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- Resilience
- Vulnerability
- Risk
- Risk Acceptance and Tolerance

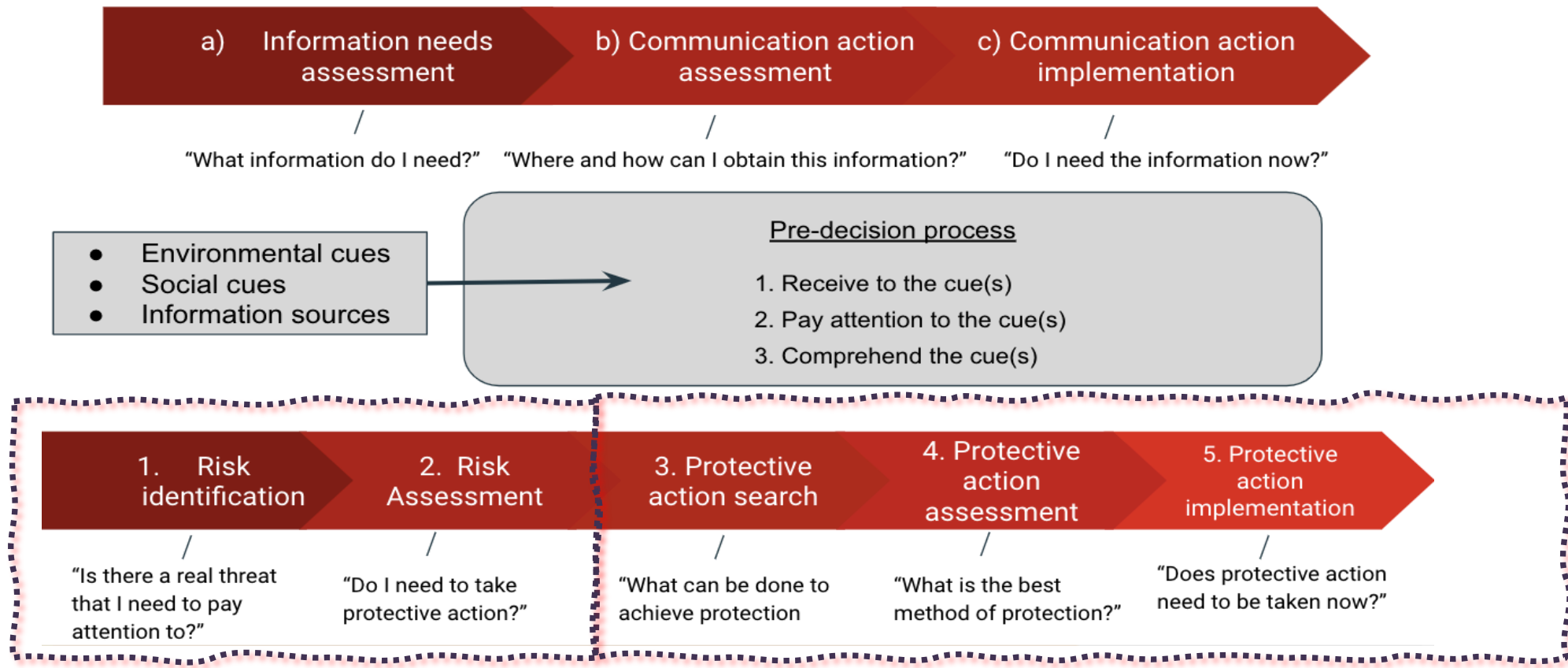




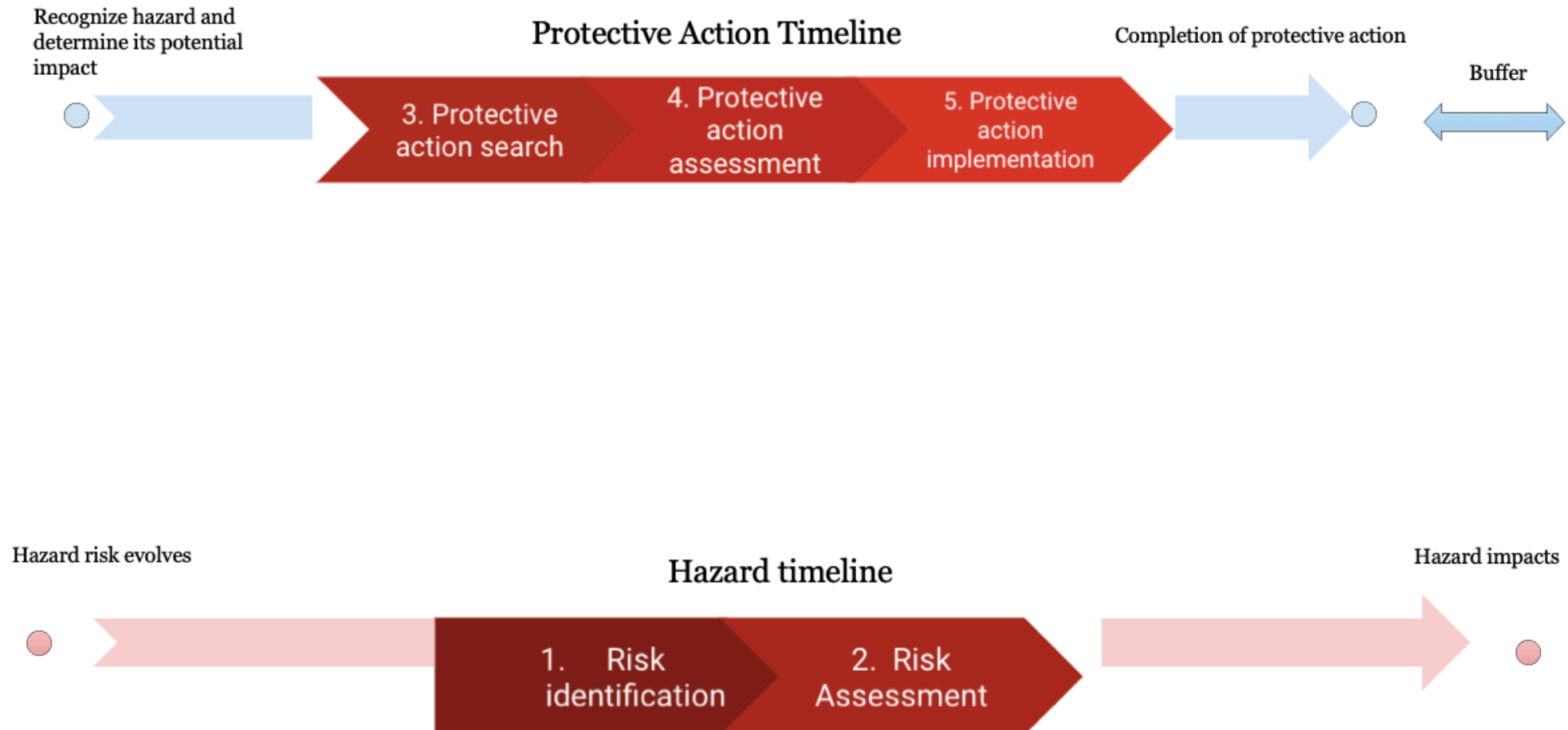
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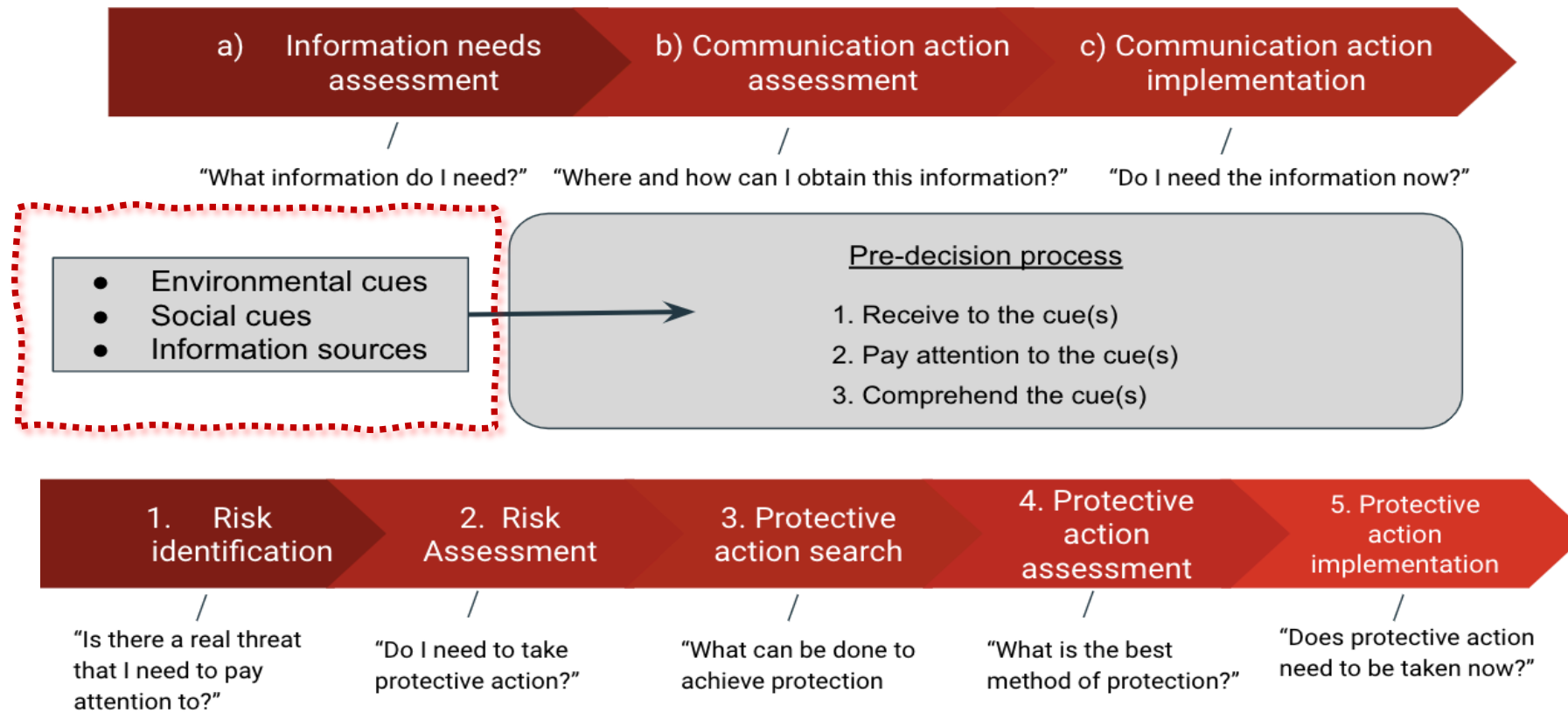
PADM is not detailed enough for community-level PA decision making



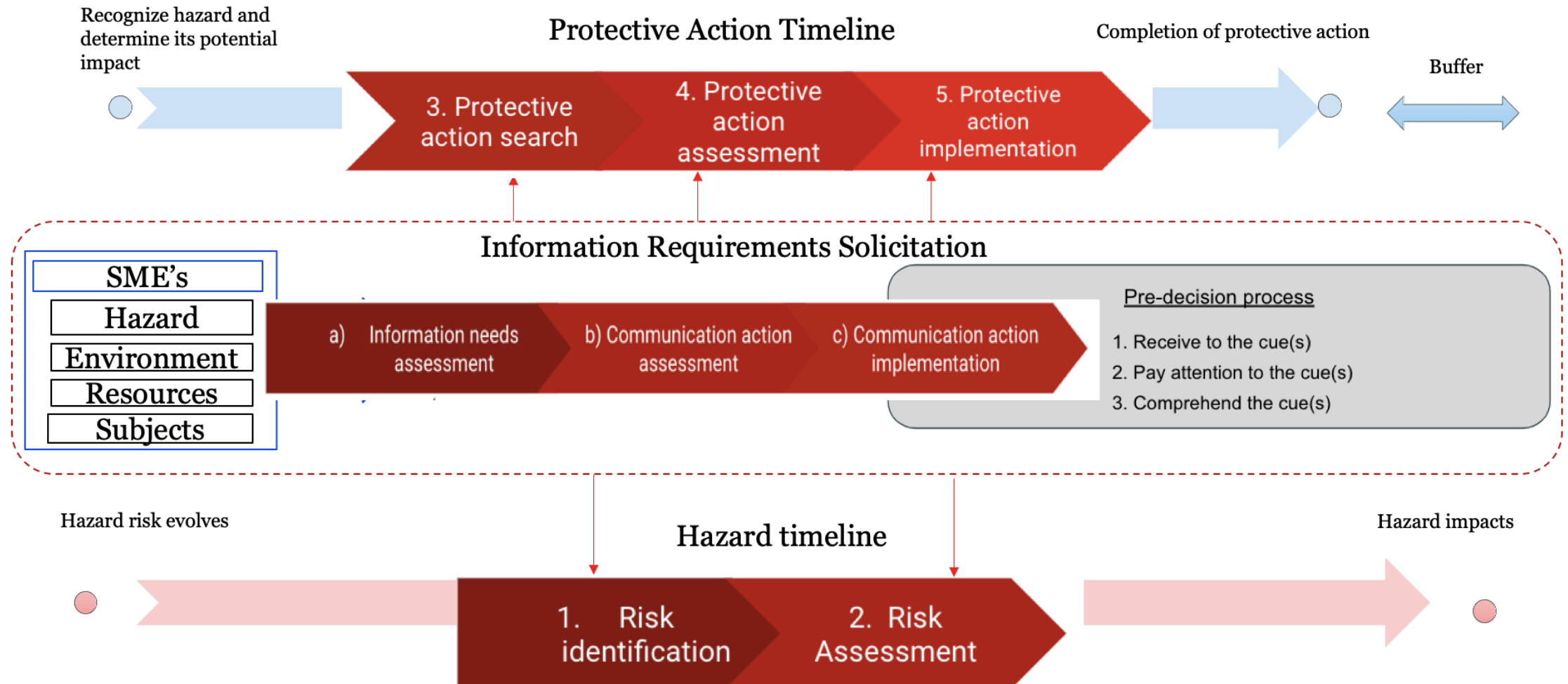
Dual Timeline Protective Action Decision Making (DT-PADM)



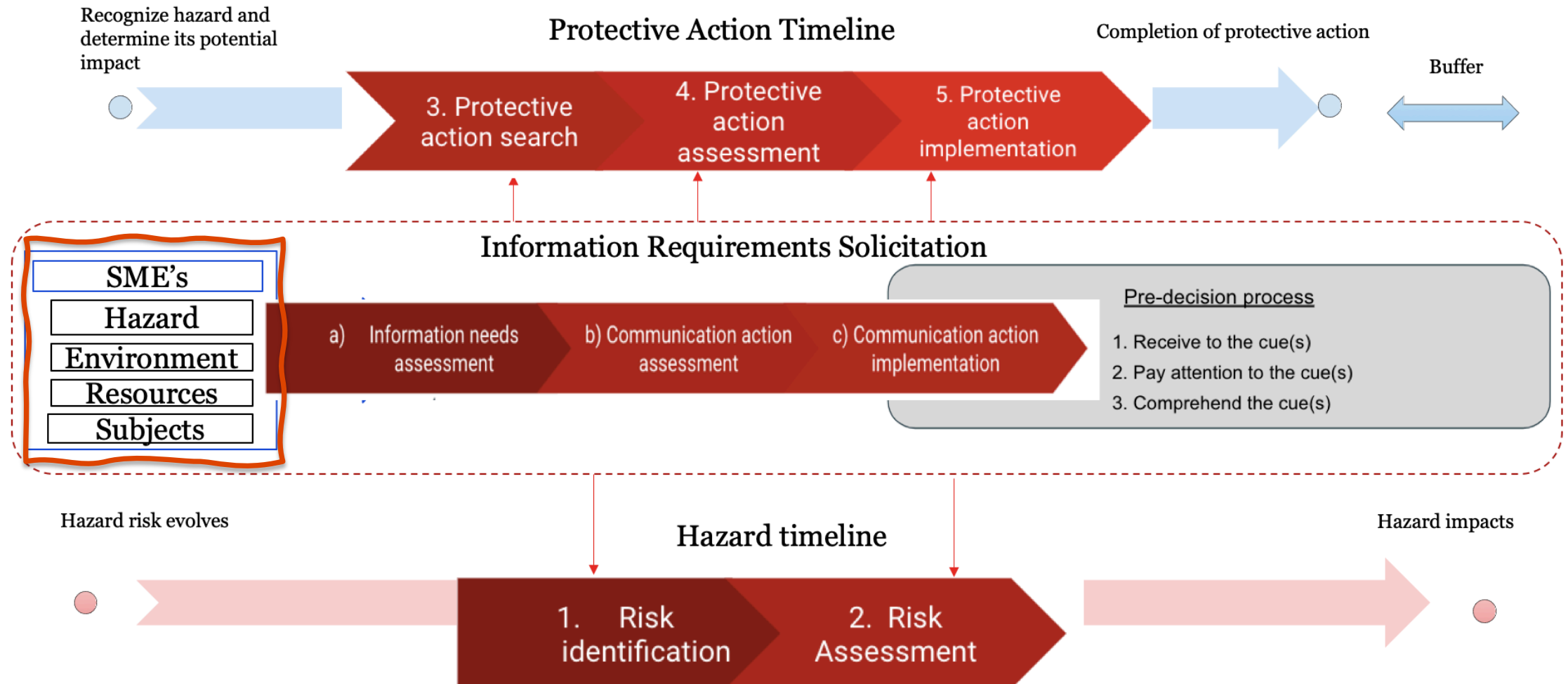
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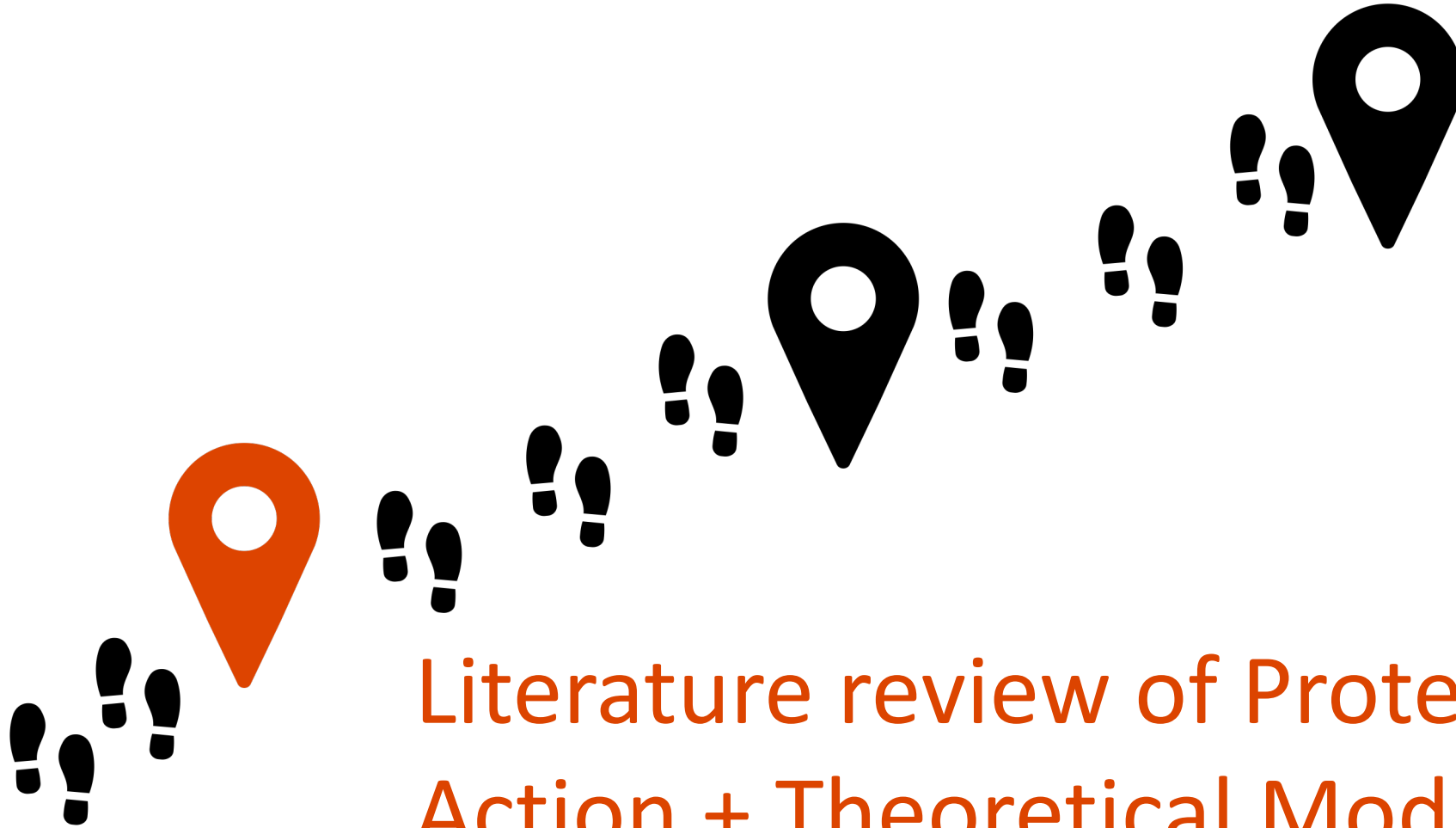
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Research Tasks Outline



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Literature review of Protective
Action + Theoretical Modifications

Research Tasks Outline



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Verify that Information Requirements ontology
using cognitive task analysis of SME account of
critical incidents

Research Activities

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Problem statement

The Information Requirements ontology presented need to be verified using real-life accounts of protective action decision making.

Research Task Question

Does SHERS ontology apply to real-life Emergency Management incidents involving Protective Action Decision Making?

1. Can the SHERS ontology be verified when eliciting Information Requirements from decision makers who dealt with Protective Action decisions on a community-level?
2. What are the critical decision points and information requirements decision makers consider during a community-level Protective Action?



Research Task 2 Methodology

Cognitive Task Analysis Methods



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- Cognitive Work Analysis (CWA)
- Applied Cognitive Task Analysis (ACTA)
- Cognitive Walkthrough
- Critical Decision Method (CDM)
- Critical Incident Technique (CIT)

Cognitive Task Analysis Methods



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Cognitive Task Analysis Methods



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- **Critical Decision Method (CDM)**

Used study decision-making in real-life situations

Allows participants to share their knowledge regarding challenging incidents

Used to Analyze skilled decision-making performance and generate an inventory of critical cues used to make decisions in order to identify training requirements



Interviewed Six SMEs



- Flash flooding evacuation and sheltering
- Winter snowstorm response
- Wildland-Urban fire evacuation
- Hurricanes and storms
- Flooding

- Alabama
- Colorado
- Oregon

Critical Decision Method Probes

Probe Type	Probe Content
Identifying critical incident and establishing timeline and	Describe an incident related to the topic where you were involved in a challenging critical decision-making process? Provide a brief account of the story from beginning to end. (Crandall Klein and Hoffman 2006) What where the decision point during the incident, could you put it in a timeline? (Reader 2014)
Cues	What were you seeing, hearing, smelling . . .?
Knowledge	What information did you use in making this decision, and how was it obtained? Were
Analogs	Were you reminded of any previous experience?
Goals	What were your specific goals at this time?
Options	What other courses of action were considered by or available to you?
Basis	How was this option selected/other options rejected? What rule was being followed?
Experience	What specific training or experience was necessary or helpful in making this decision?
Aiding	If the decision was not the best, what training. knowledge, or information could have helped?
Time Pressure	How much time pressure was involved in making this decision? (Scales varied.)
Situation Assessment	Imagine that you were asked to describe the situation to a relief officer at this point, how would you summarize the situation?
Hypotheticals	If a key feature of the situation had been different. what difference would it have made in your decision?

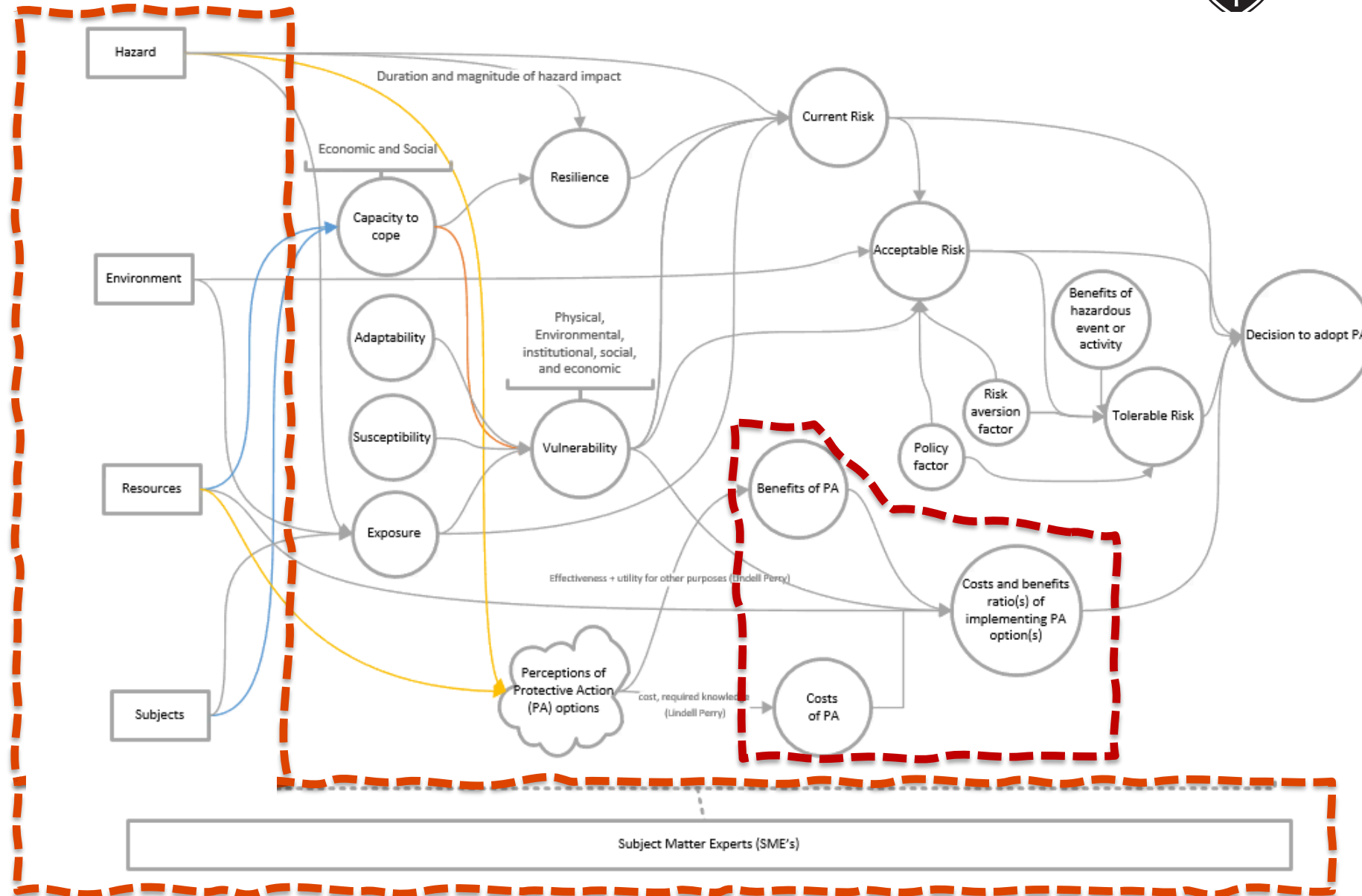
Outcomes of Critical Decision Method Interviews

- Information requirements
- Operational decision points and Protective Action considerations (Operational Criteria)

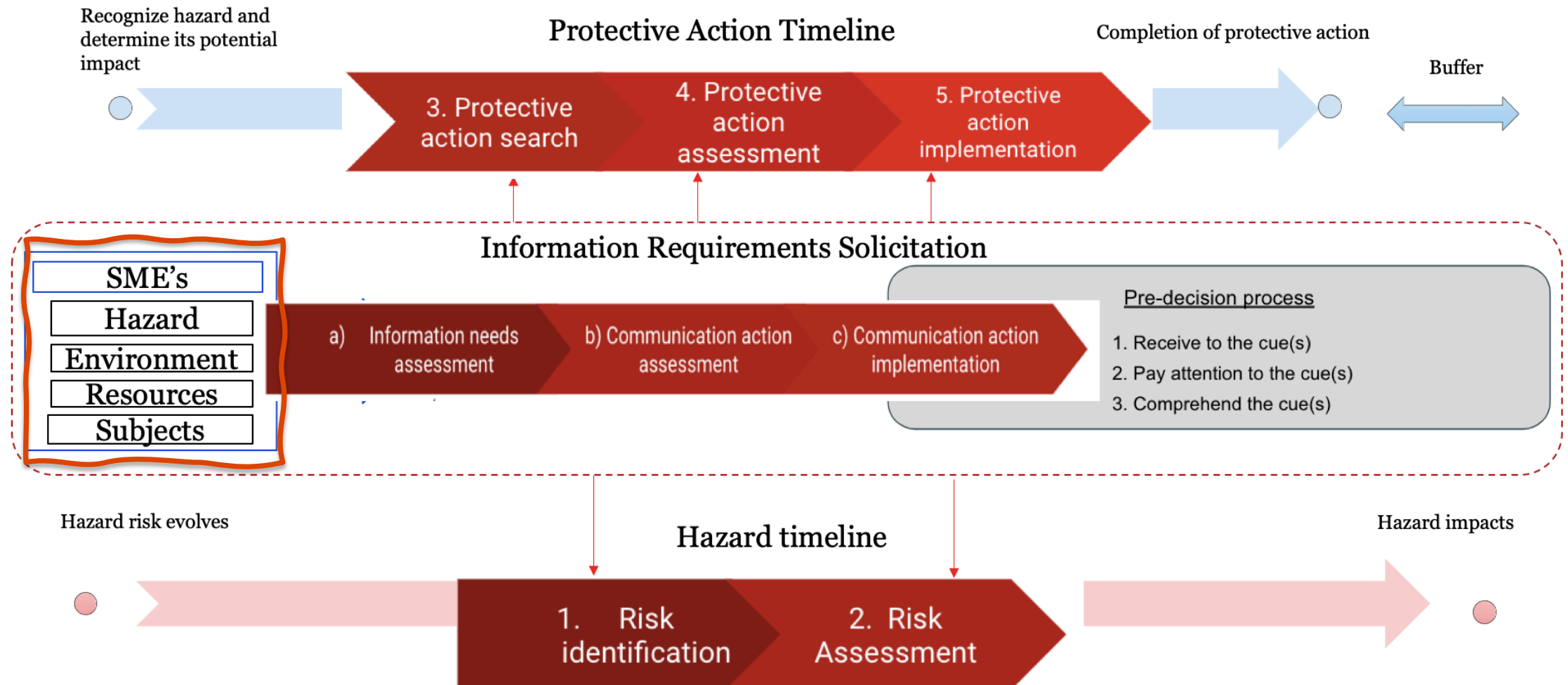
Examples:

1. SME related
 2. Hazard related
 3. Environment related
 4. Resources related
 5. Subjects related
1. Schedule PAs on a timeline, either on count-down or count up since the incident
 2. Establish an EOC for briefing
 3. Evaluate costs and benefits of PA

Discussion of Research Task 2



Dual Timeline Protective Action Decision Making (DT-PADM)



Research Activities

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Research Tasks Outline



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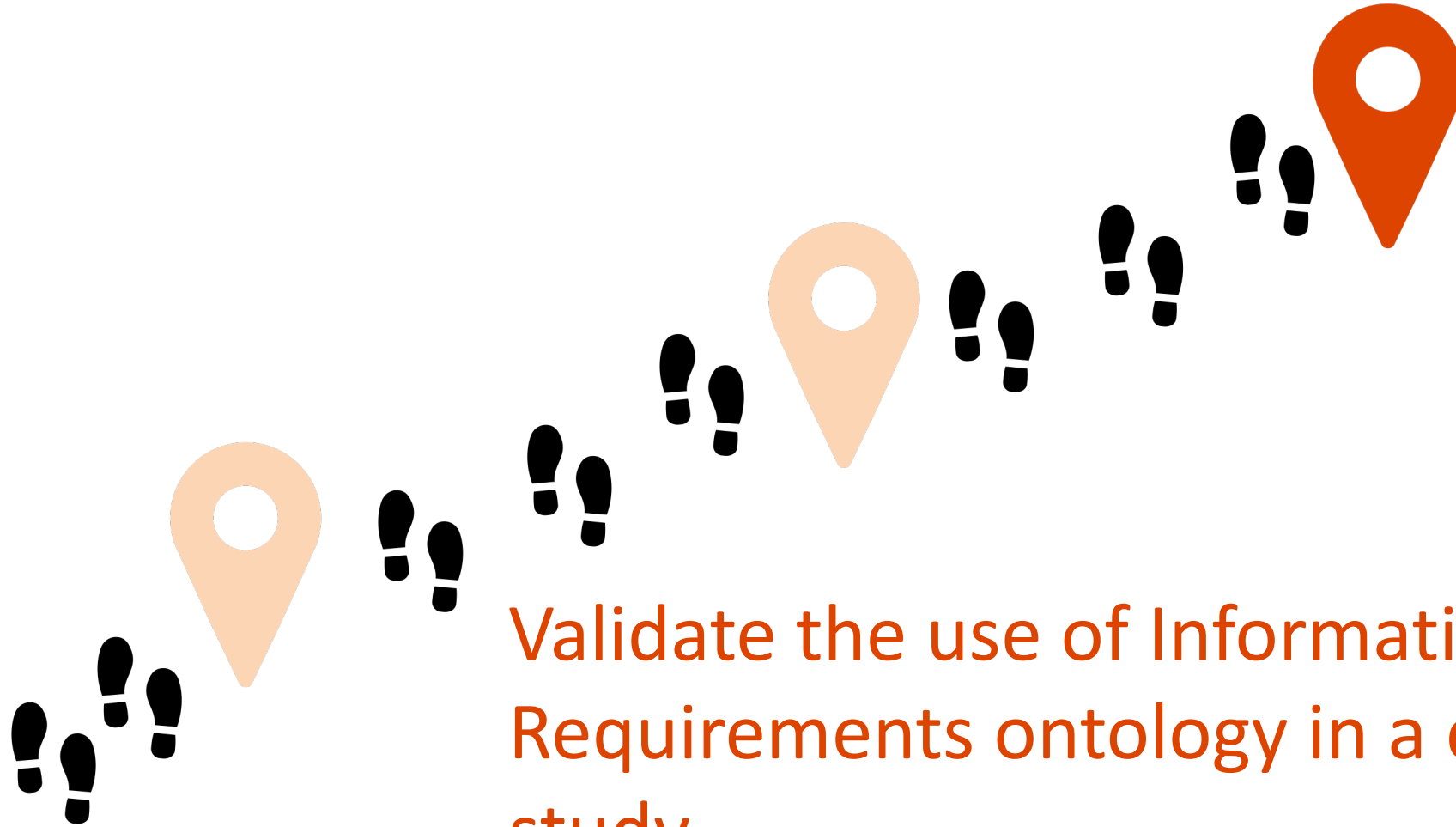


Verify that Information Requirements ontology
using cognitive task analysis of SME account of
critical incidents

Research Tasks Outline



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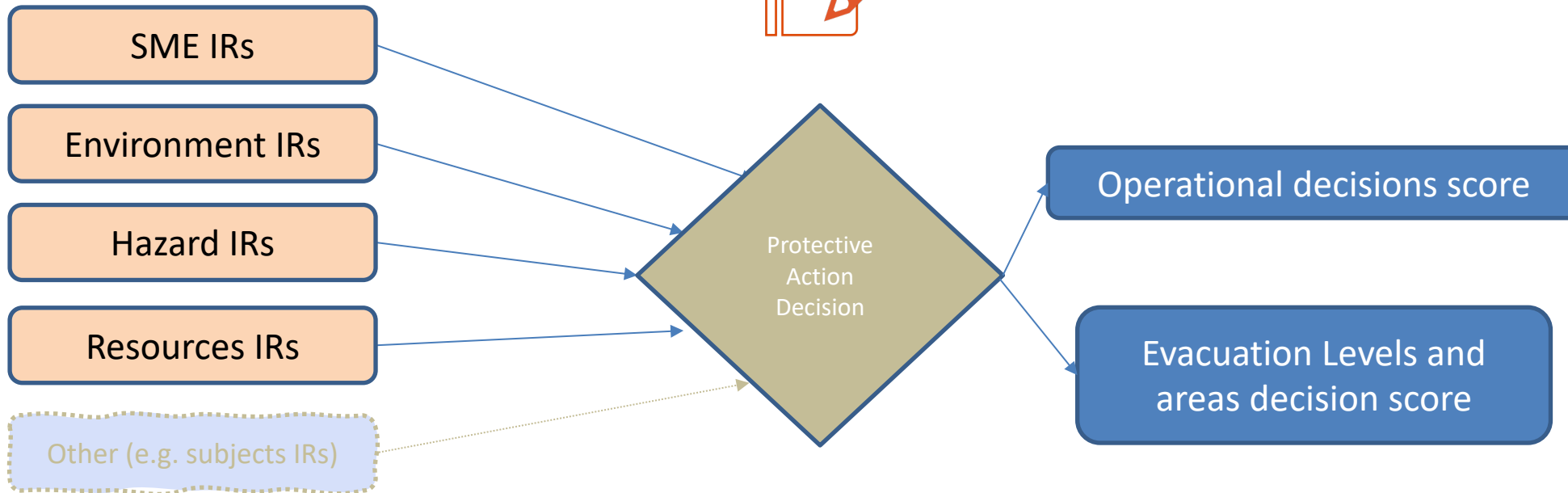
Validate the use of Information
Requirements ontology in a controlled
study

Research Problem

The documented literature in this dissertation was pursued to identify the required information for making appropriate Protective Action decisions. The classification of Protective Action decisions and Information Requirements used to make appropriate Protective Action decisions have not been consistently and rigorously documented. Furthermore, the efficacy of job aids supporting successful decision-making has not been explored.

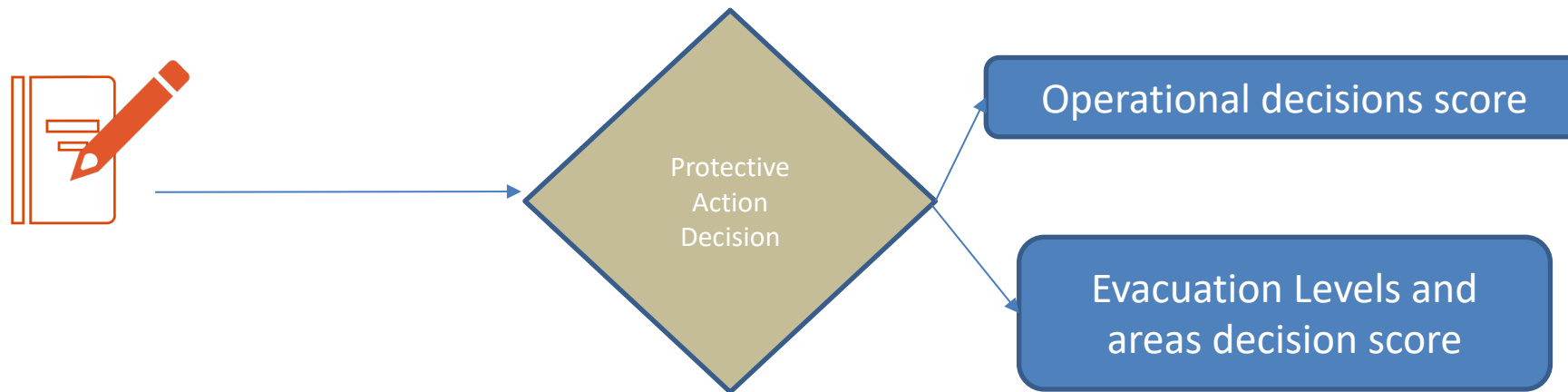
Research Primary Question

How can different classes of information requirements and job aids inform successful determination of operational and tactical components of a protective action decision?



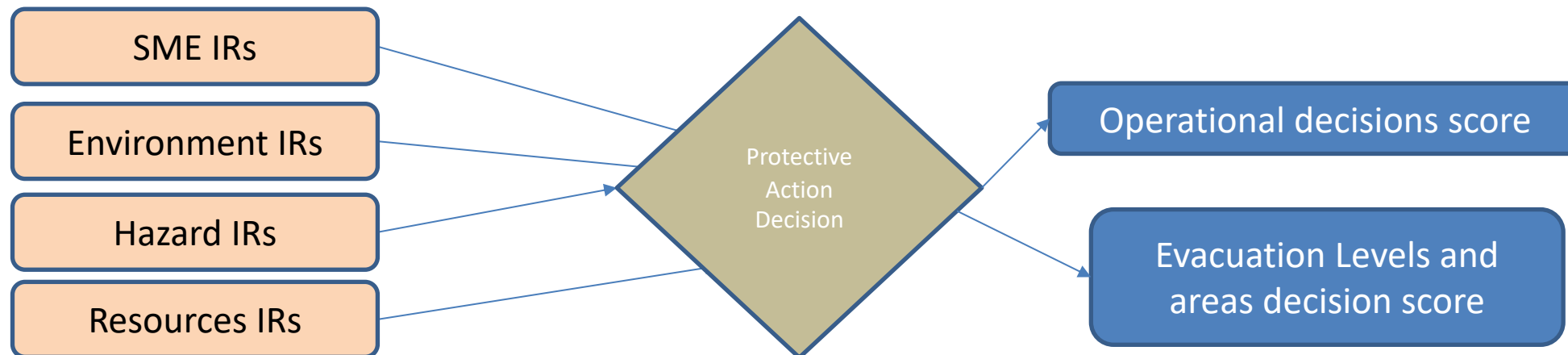
Research Sub-questions

1. How can the integration of information requirements classification in a job aid support Protective Action decision maker in successfully determining the operational and tactical components of their decision?



Research Sub-questions

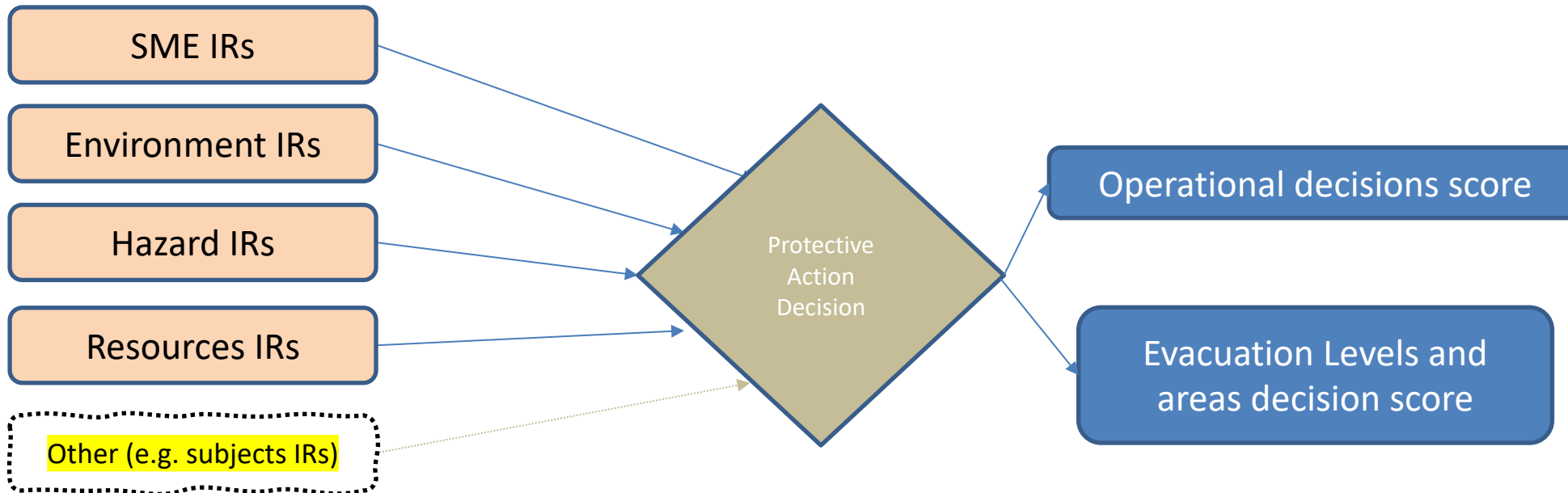
2. How does soliciting Subject Matter Experts recommendations, hazards Information Requirements, environment Information Requirements, and response resources Information Requirements, support a decision maker's ability in successfully determining the operational and tactical components of their decision?



Research Sub-questions

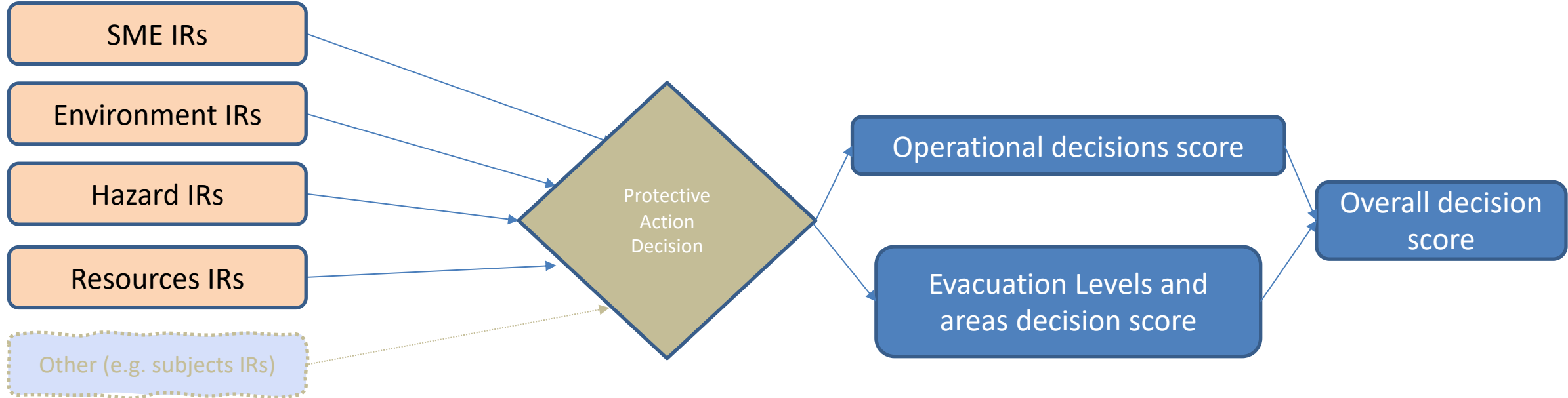
3. What other factors are contributing to the determination of operational and tactical components of the Protective Action decisions?

(exploratory study)



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Research Question

How can job aids and different classes of information requirements inform successful determination of operational and tactical components of a protective action decision?

Six hypotheses

Hypothesis 1

Integrating a decision-making **job aid** in the Protective Action decision-making process has an effect on **soliciting** Protective Action Decision-Making **Information requirements**.

Hypothesis 2

Integrating a decision-making **job aid** in the Protective Action decision-making process has an effect on decisions makers determining appropriate operational components (**Operational components**) necessary for a successful protective action.

Hypothesis 3

Integrating a decision-making **job aid** in the Protective Action decision-making process has an effect on decision makers selecting appropriate Protective Action options (**Tactical components**) necessary for a successful protective action.

Hypothesis 4

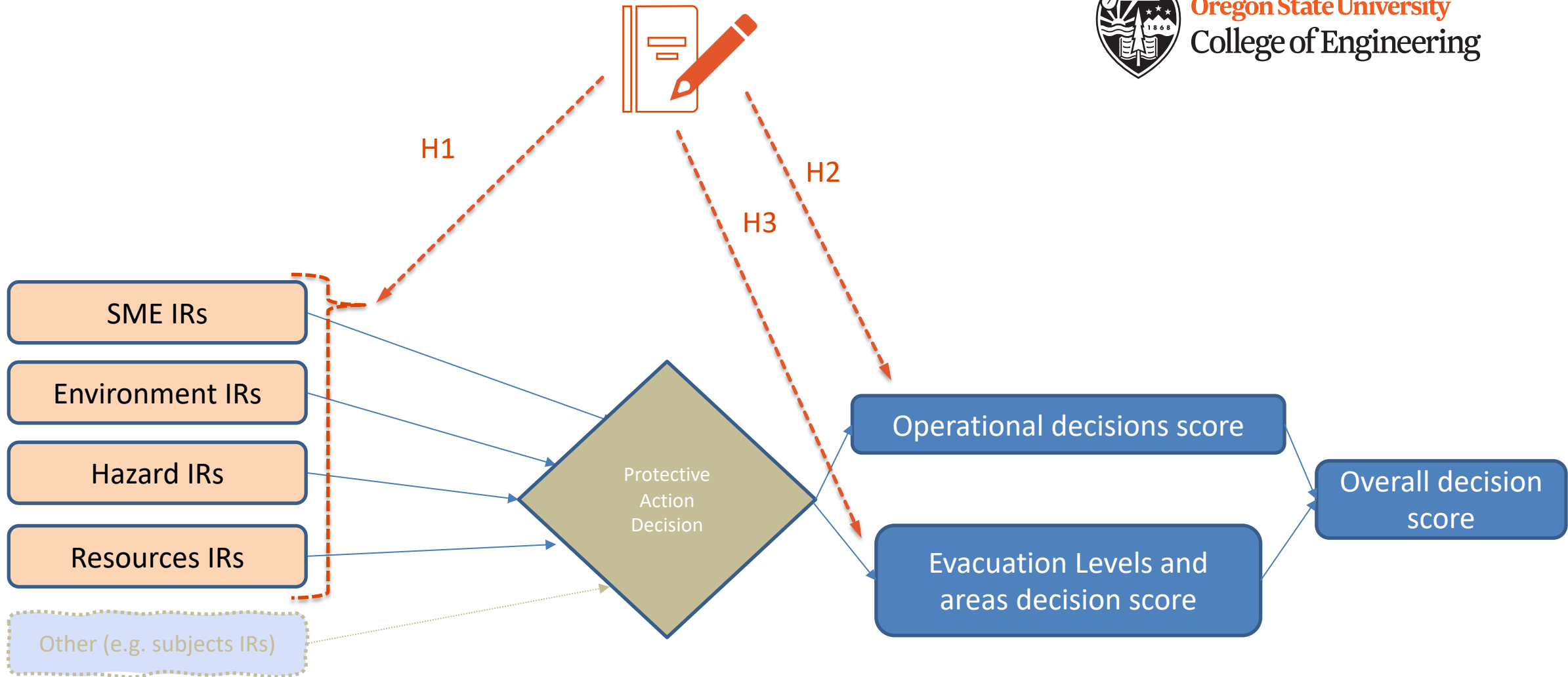
The **number of Information Requirements requested** by a decision maker support the decision maker's ability in successfully determining the **Operational components** of their decision.

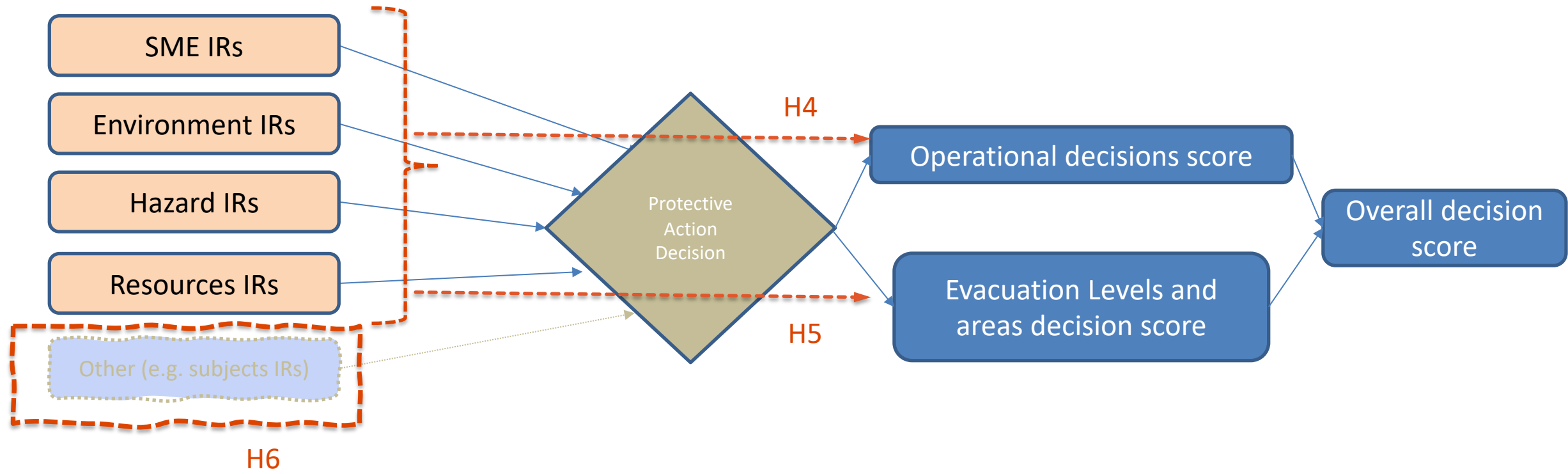
Hypothesis 5

The **number of Information Requirements requested** by a decision maker support the decision maker's ability in successfully determining the **Tactical components** of their decision.

Hypothesis 6 (part of an exploratory study)

Other categories of PADM Information Requirements exist and are used in decision-making in addition to in Subject Matter Experts recommendations, hazards Information Requirements, environment Information Requirements, and response resources Information Requirements.





Development of Job aid



A Decision Support tool for protective actions in Wildland-Urban Interface fire

Purpose: this decision support tool aims to guide your decision making around when and what protective actions to initiate in a case of wildland-urban interface fires.

Step	Instructions	User's Notes
Step I	<p>Look for a recommendation from the Fire Battalion Chief.</p> <p>Is there a clear recommendation from firefighters to evacuate a specific area?</p> <p>A. Yes, establish an EOC, appoint a PIO, initiate evacuation orders to that area. Go to step III.</p> <p>B. No, establish an EOC, appoint a PIO, and go to step II.</p>	
Step II	<p>Evaluate the following considerations:</p> <p>1. Recognize the hazard and determine its impact.</p> <ol style="list-style-type: none"> What do the firefighters say about the fire conditions? What is the speed at which hazard is evolving from non-incident to threatening the community What is the size, direction, and speed of the fire? How would you describe the behavior of the hazard? 	

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development. Consider
the operational period.

t this time, then determine

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o be set to evacuate (level 2),
o be ready to evacuate (level 1),
ered to shelter-in-place or stay off
dy included in levels 2 and 3)
ollowing actions:
e zones (polygons) of different risk
elter-in-place) to your staff.
safe routes of evacuation?
to receive people being

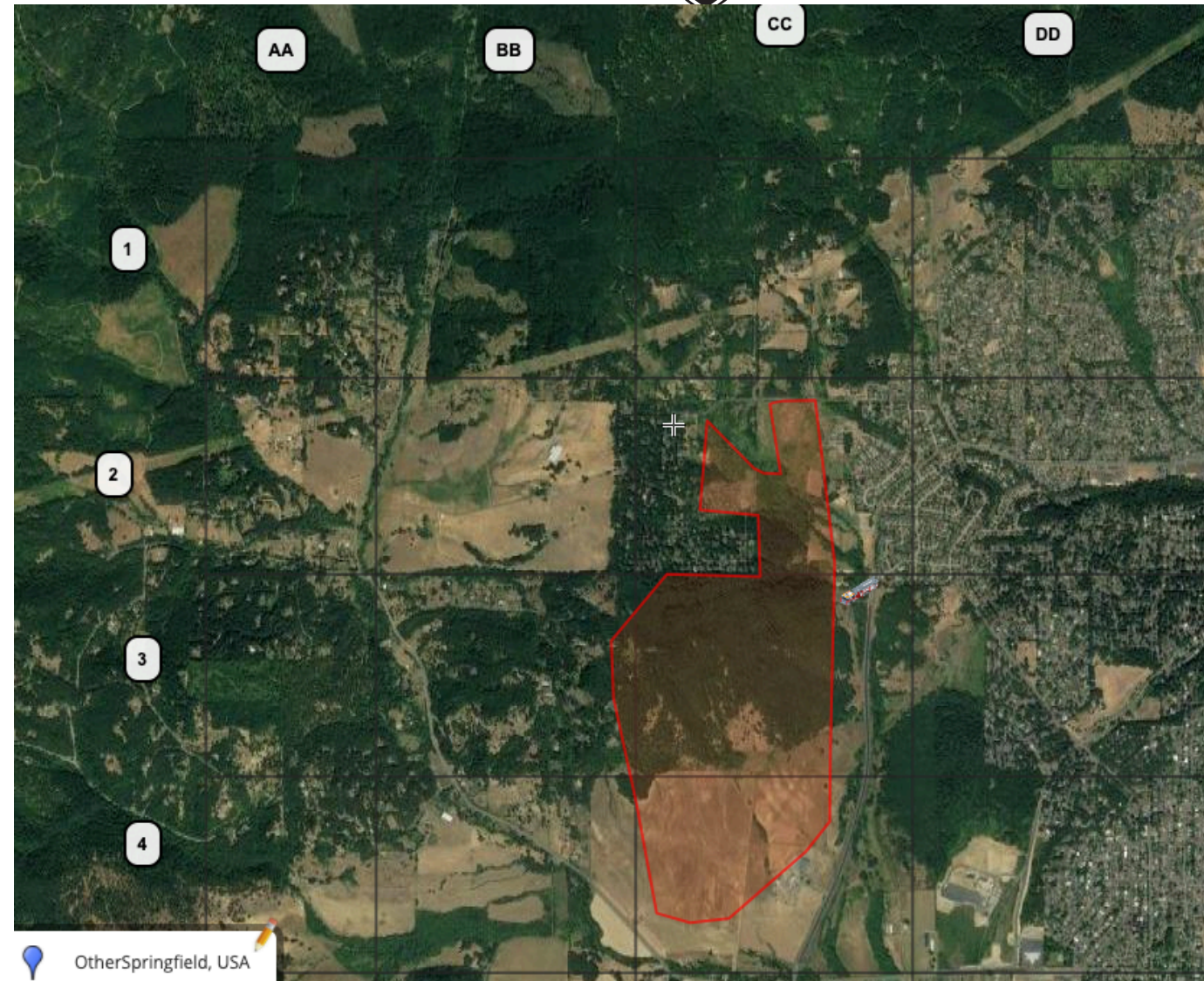
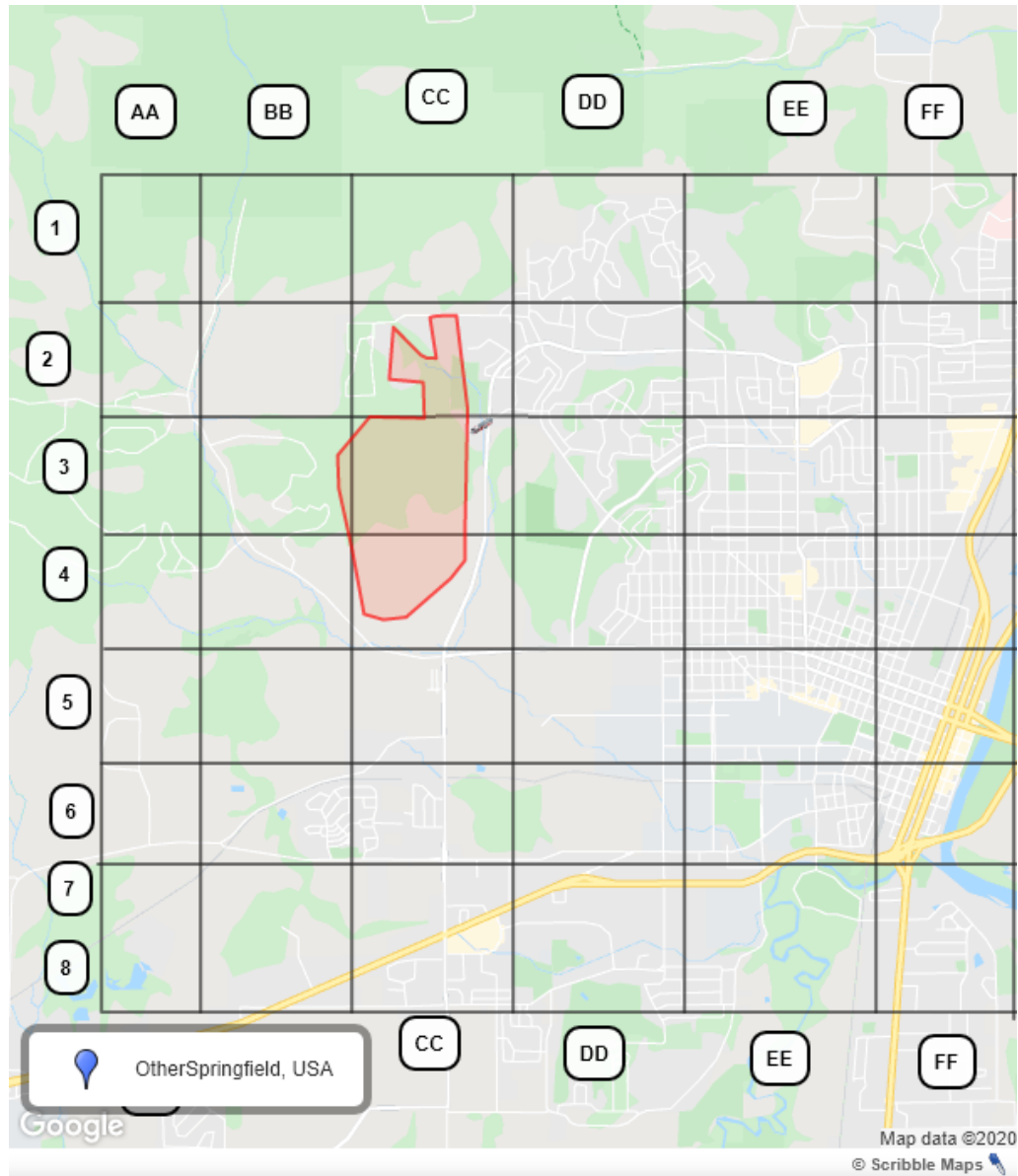
that needs to be communicated to
ation should be communicated?
es are needed? e.g. turn off

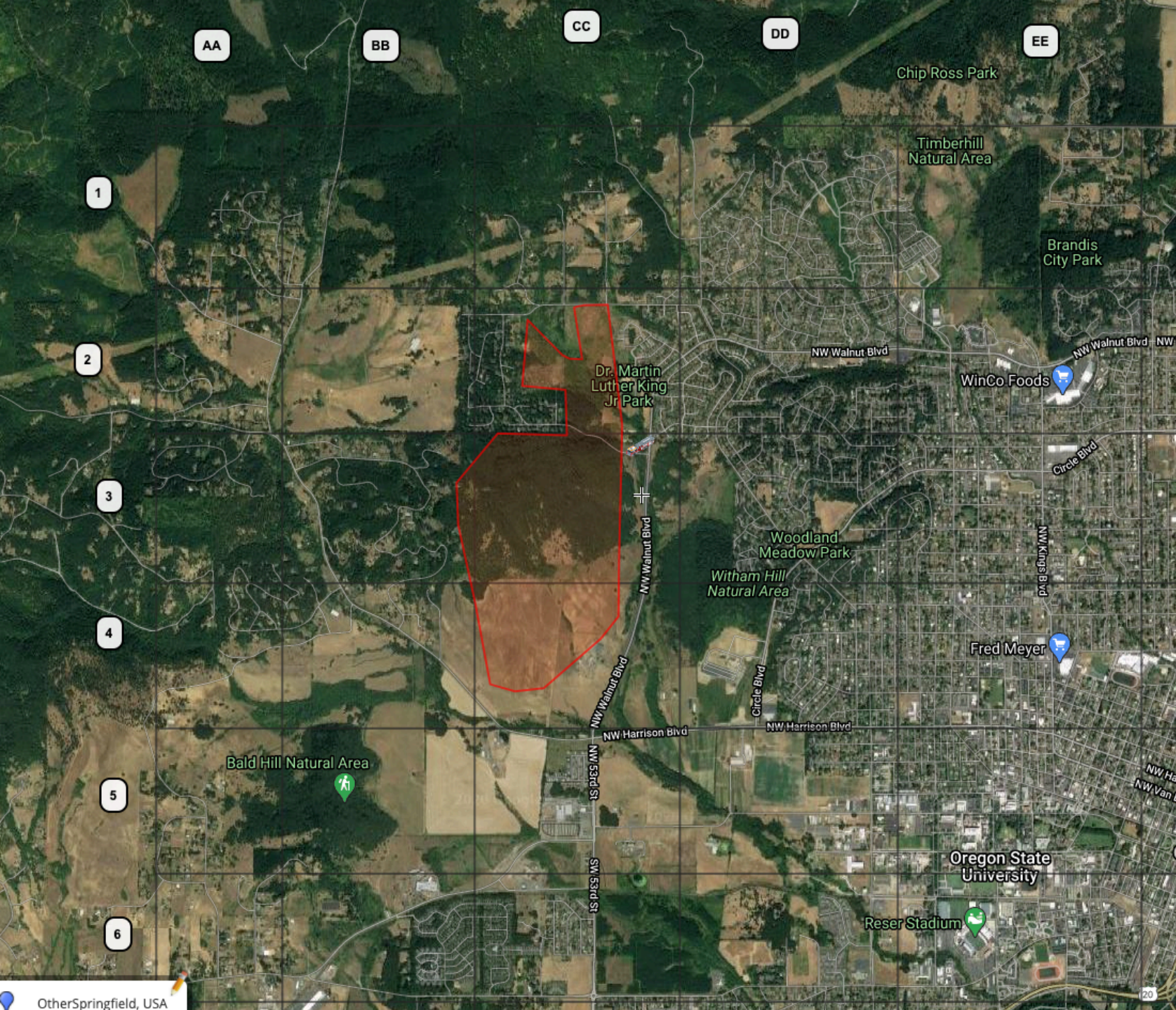
oint a PIO, and order evacuation
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h a reception center? (for info,

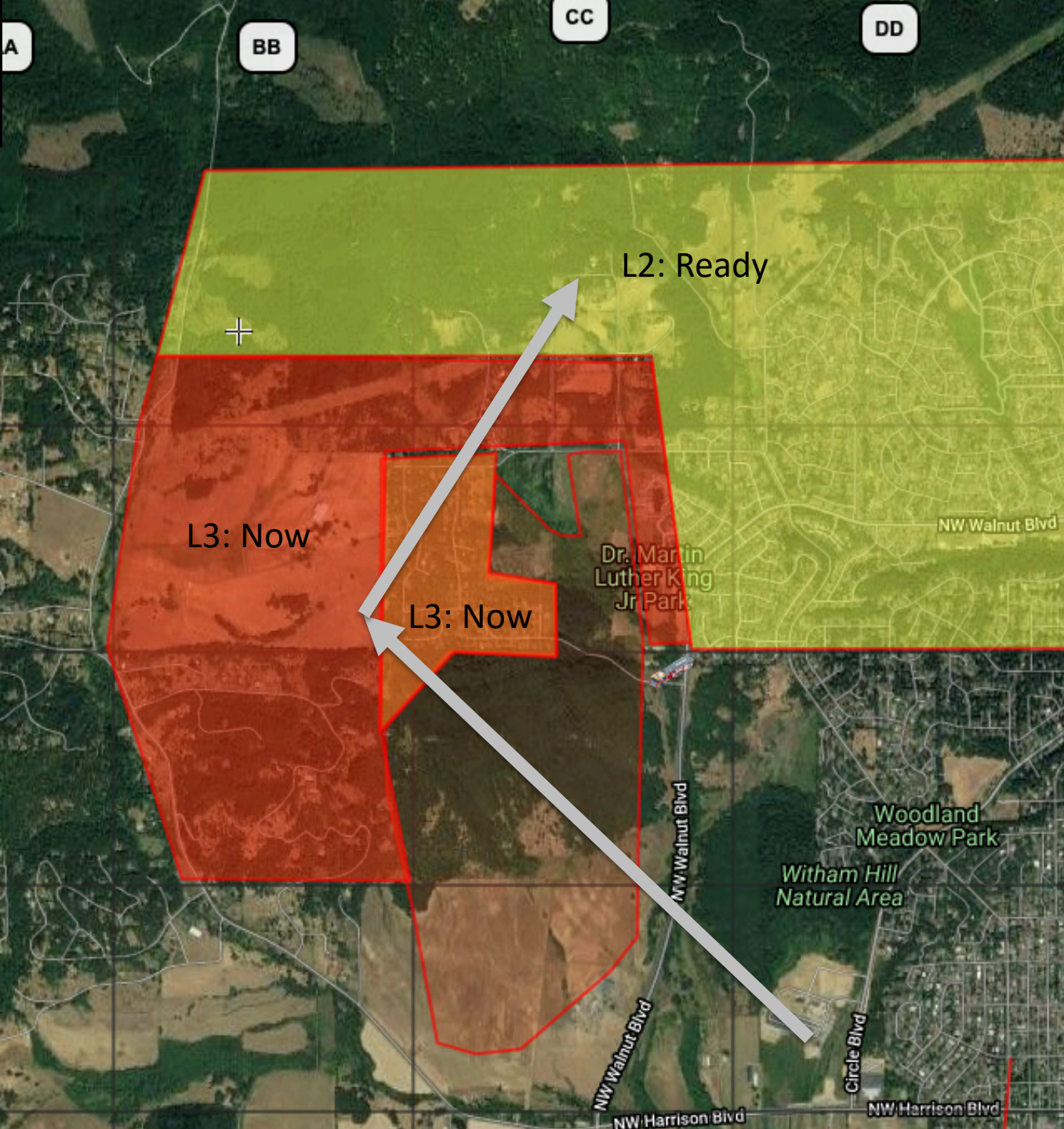
resources, basics, community call center)

Methodology





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Current wind speed and forecast

35 miles per hour (56 km/hr) coming from the SE
and gusts up to 70 miles per hour (110 km/h)

Wind speed and direction forecast

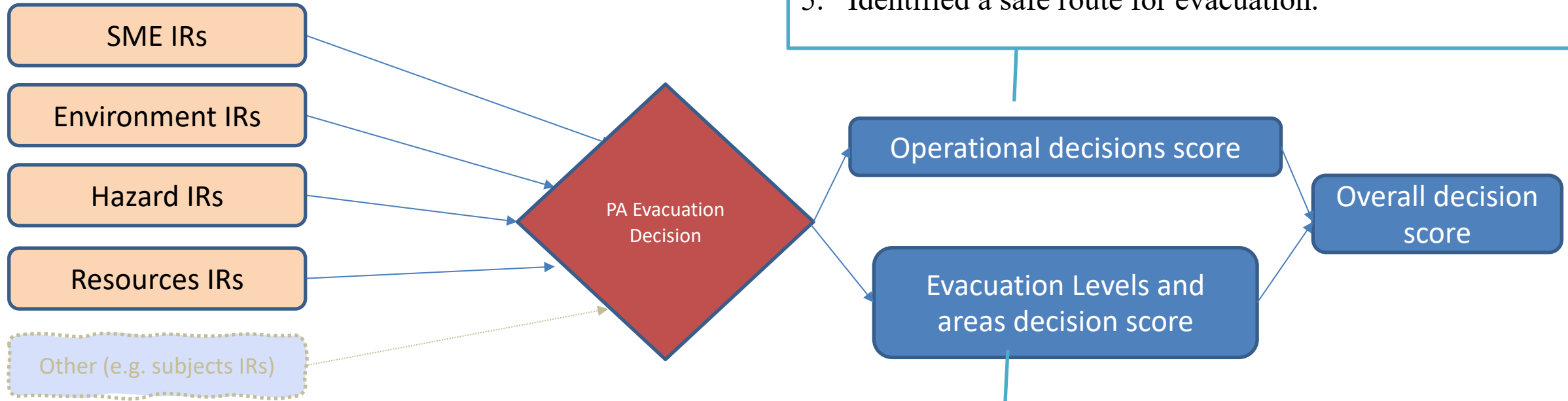
Wind expected to go to 45 miles per hour overnight
(56 expected to go to 72 km/h overnight) and gusts
up to 70 miles per hour (110 km/h)

Wind expected to change direction in four hours

Fire behavior

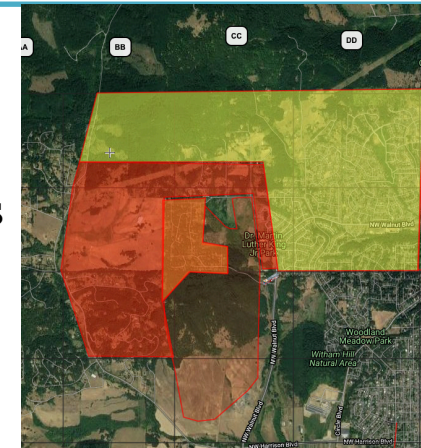


Tactical components of the decision



1. Activated an Emergency Operating Center
2. Activated Public Information Officer
3. Ordered an evacuation message to be communicated,
4. Identified a safe destination
5. Identified a safe route for evacuation.

Evacuating the right areas
at the appropriate levels



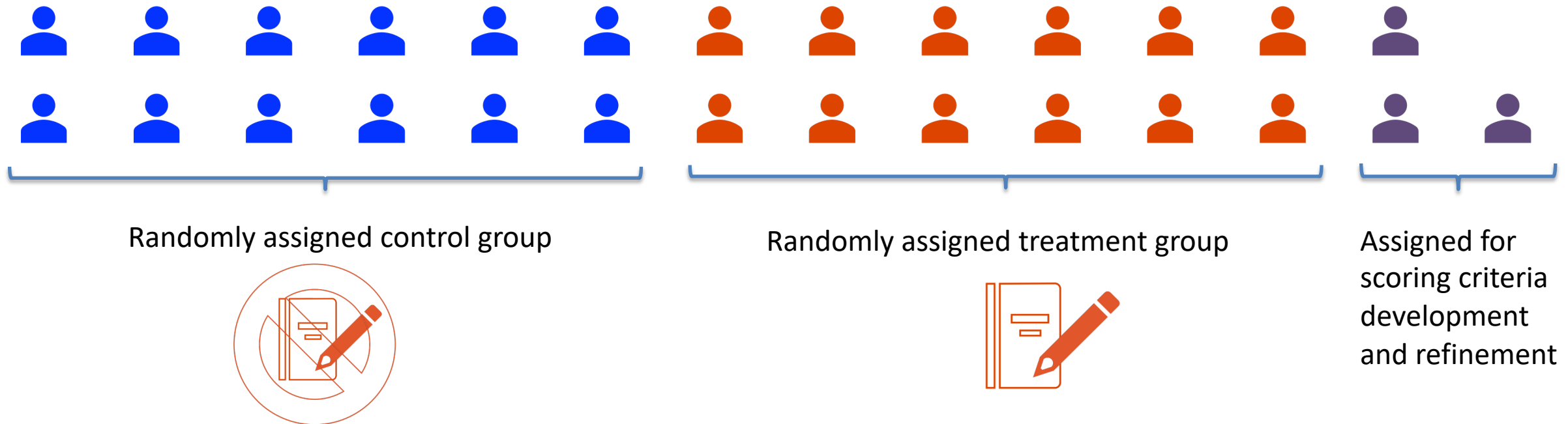
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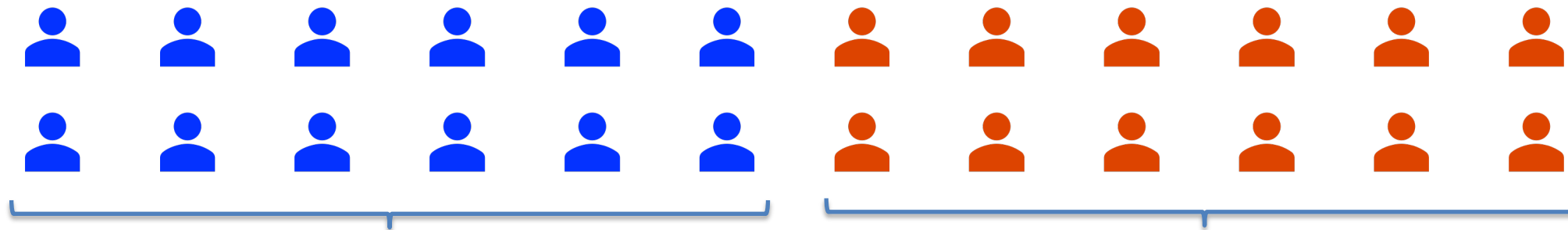
71



Interviewed 27 Participants

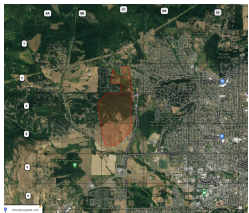


Interviewed 27 Participants

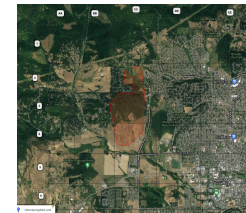


Randomly assigned **control** group

Randomly assigned **Treatment** group



-> Questions -> PA Decision



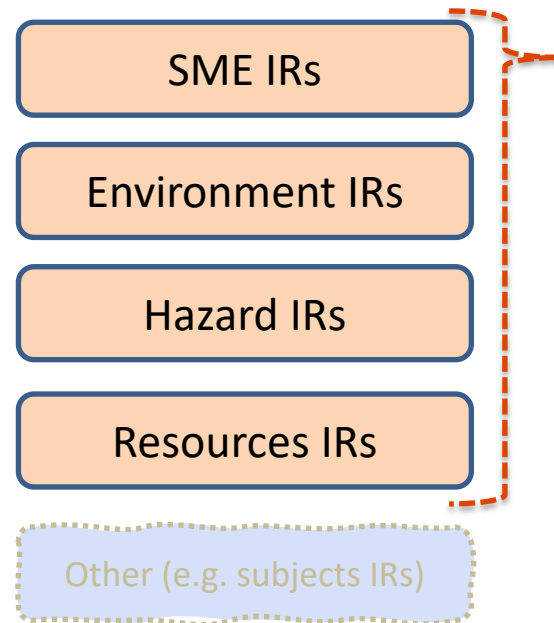
-> Questions -> PA Decision

Hypothesis 1

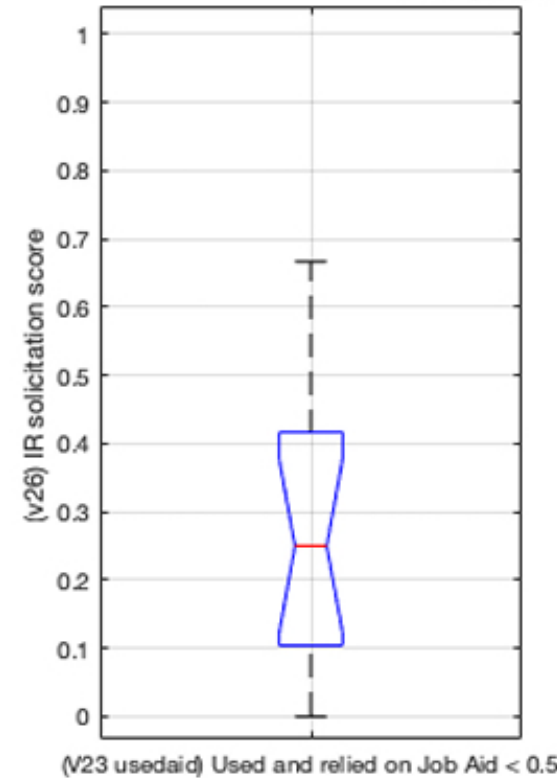
Integrating a decision-making job aid in the Protective Action decision-making process has an effect on soliciting Protective Action Decision-Making Information requirements.



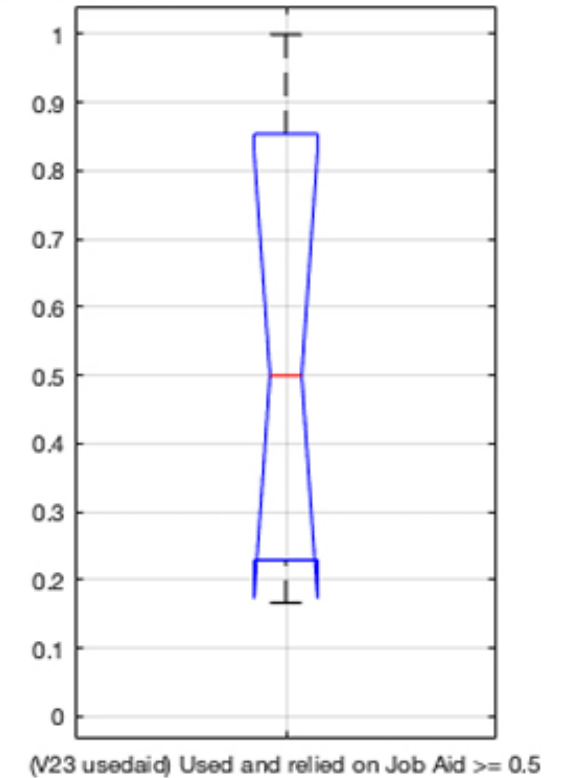
H1



The relationship between (V23 usedaid) Used and relied on Job Aid
and (v26) IR solicitation score



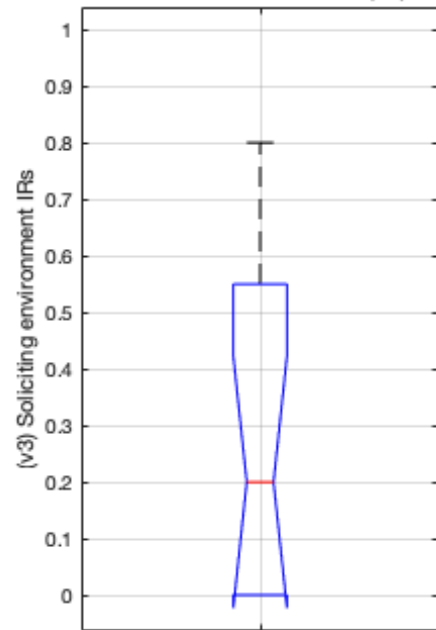
p-value= 0.067 corr= 0.070



experince factor= 0.63
exp. effect: may be larger

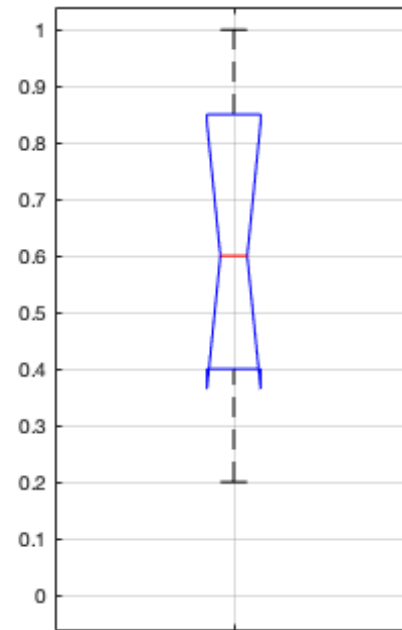


The relationship between (V23 usedaid) Used and relied on Job Aid
and (v3) Soliciting environment IRs



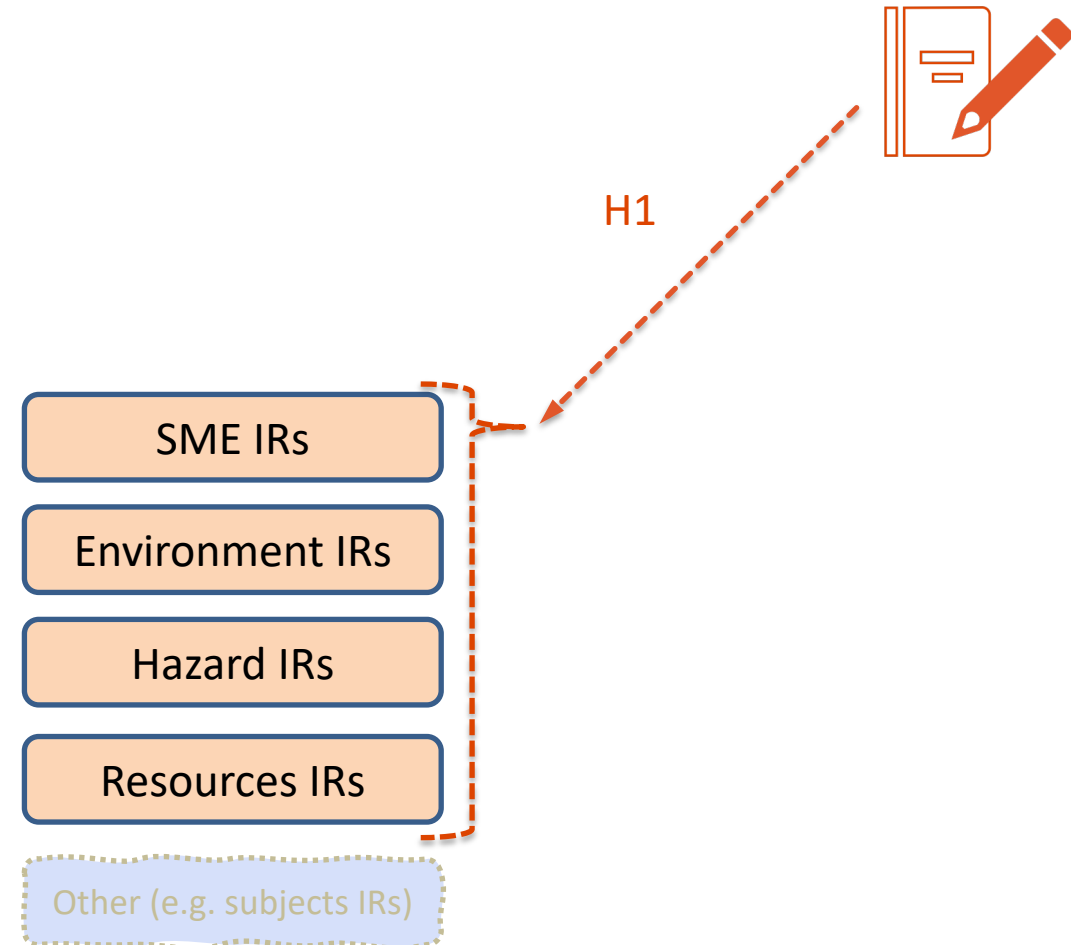
(V23 usedaid) Used and relied on Job Aid < 0.5

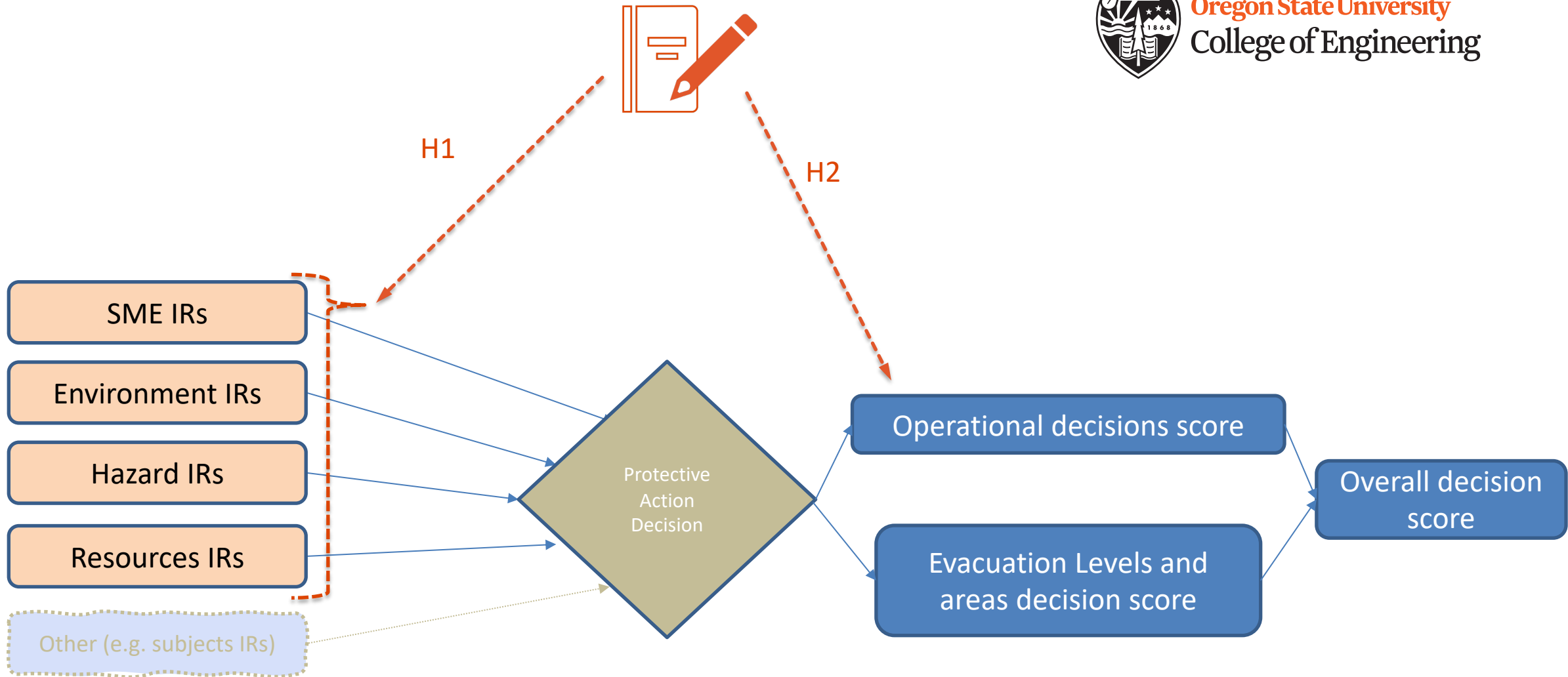
p-value= 0.019 corr= 0.014
Ranksum test rejects null hypothesis of equal medians



(V23 usedaid) Used and relied on Job Aid >= 0.5

experience factor= 0.55
exp. effect: may be larger



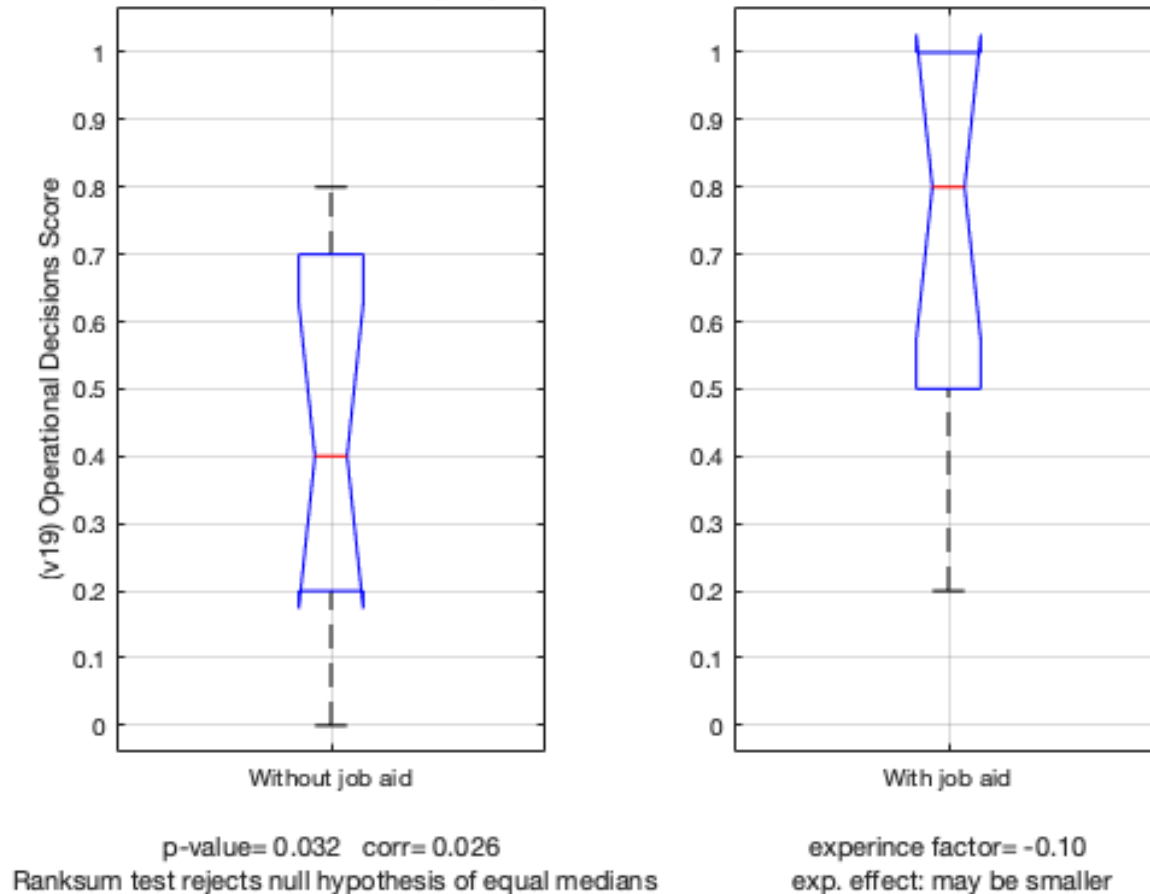


Hypothesis 2

Integrating a decision-making job aid in the Protective Action decision-making process has an effect on decisions makers determining appropriate operational components (Operational components) necessary for a successful protective action.



The relationship between (v23) Control(0)/Treatment(1)
and (v19) Operational Decisions Score



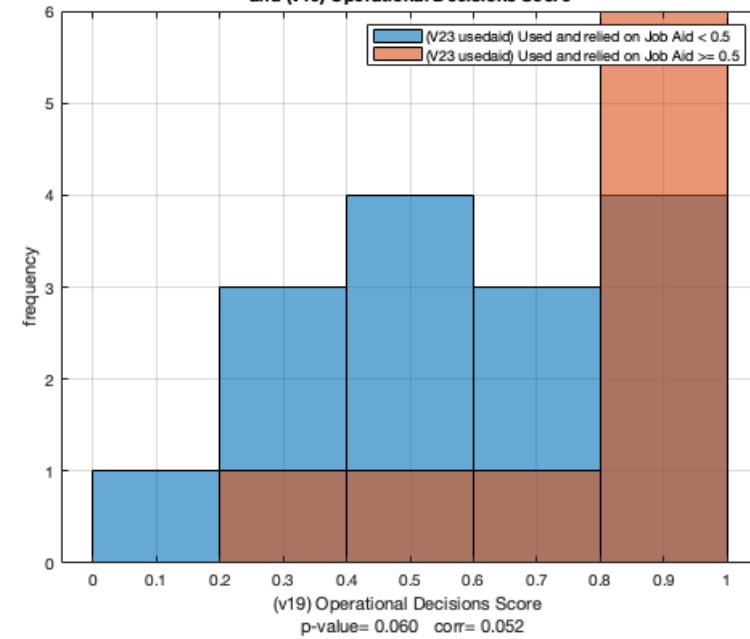
H2

Operational decisions score

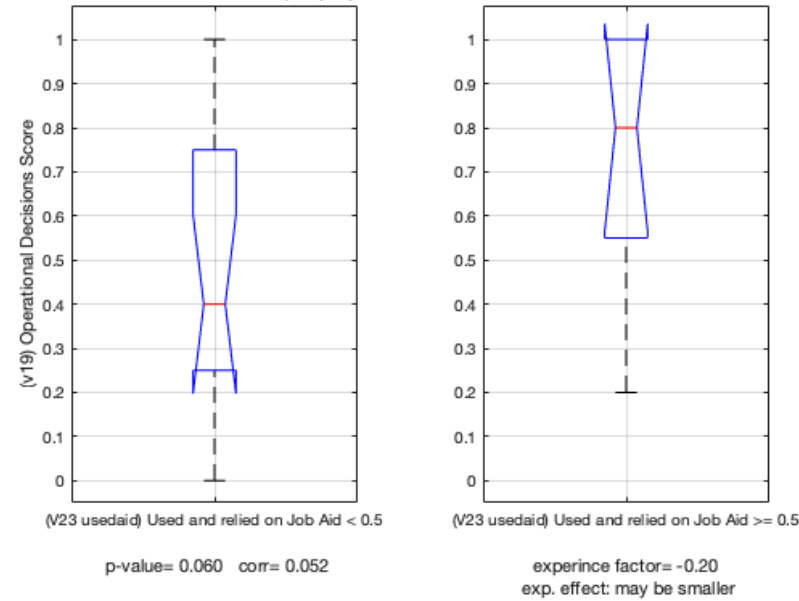
- Activated an Emergency Operating Center
- Activated Public Information Officer
- Ordered an evacuation message to be communicated,
- Identified a safe destination
- Identified a safe route for evacuation.



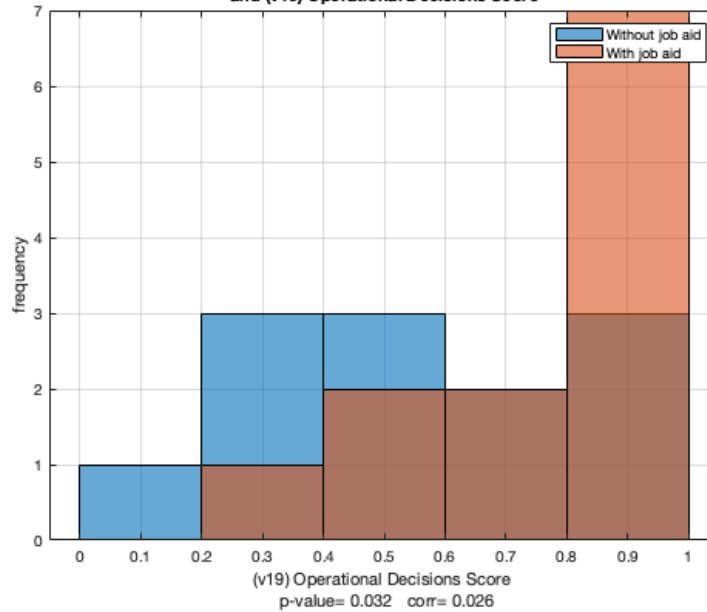
The relationship between (V23 usedaid) Used and relied on Job Aid and (v19) Operational Decisions Score



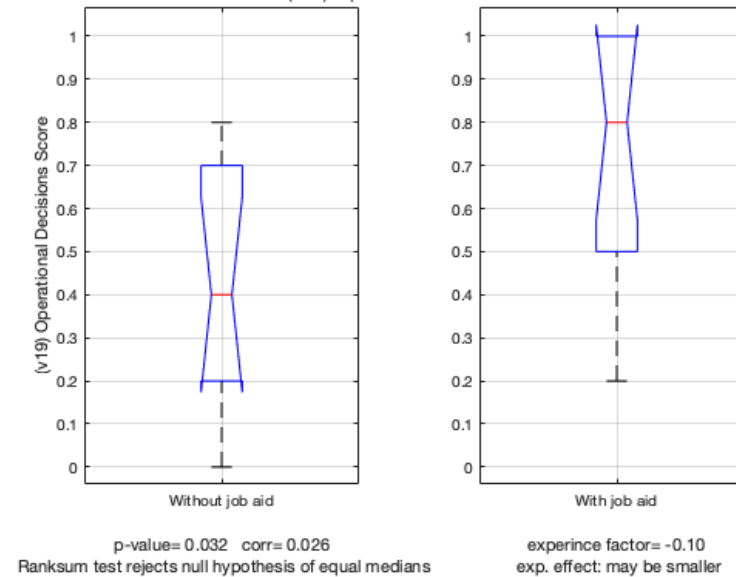
The relationship between (V23 usedaid) Used and relied on Job Aid and (v19) Operational Decisions Score



The relationship between (v23) Control(0)/Treatment(1) and (v19) Operational Decisions Score



The relationship between (v23) Control(0)/Treatment(1) and (v19) Operational Decisions Score



Hypothesis 3

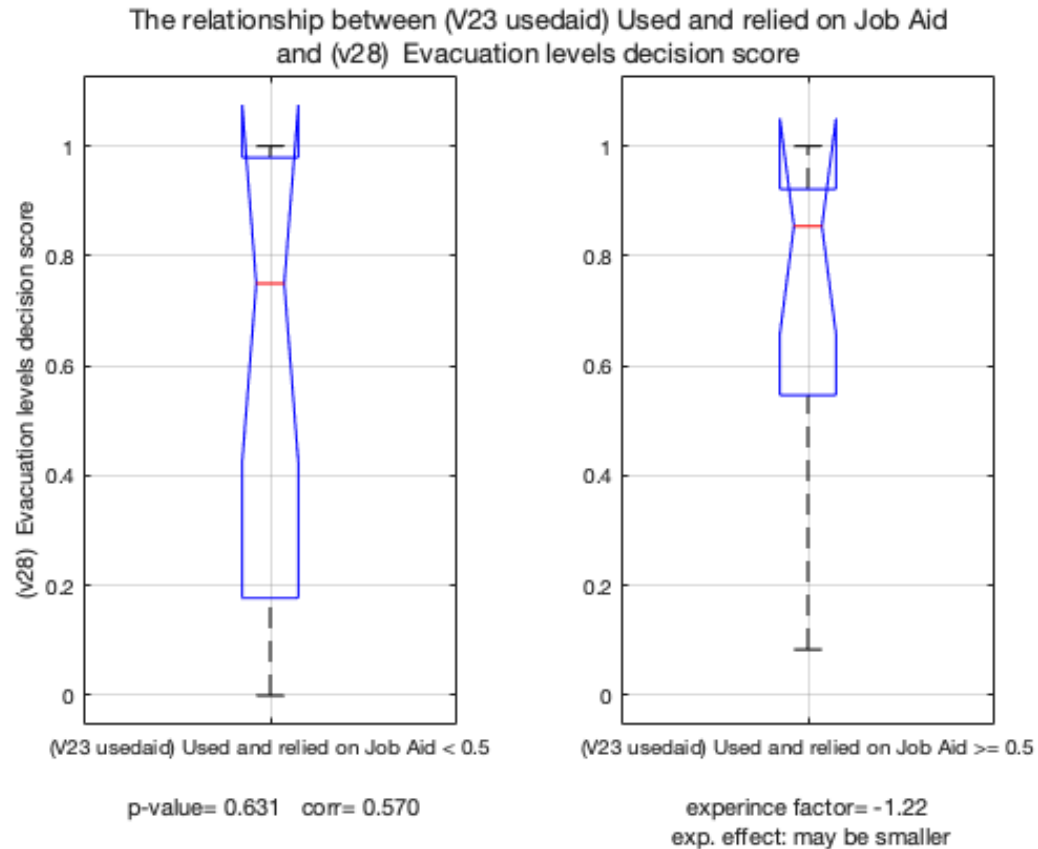


- integrating a decision-making job aid in the Protective Action decision-making process has an effect on decision makers selecting appropriate Protective Action options (Tactical components) necessary for a successful protective action

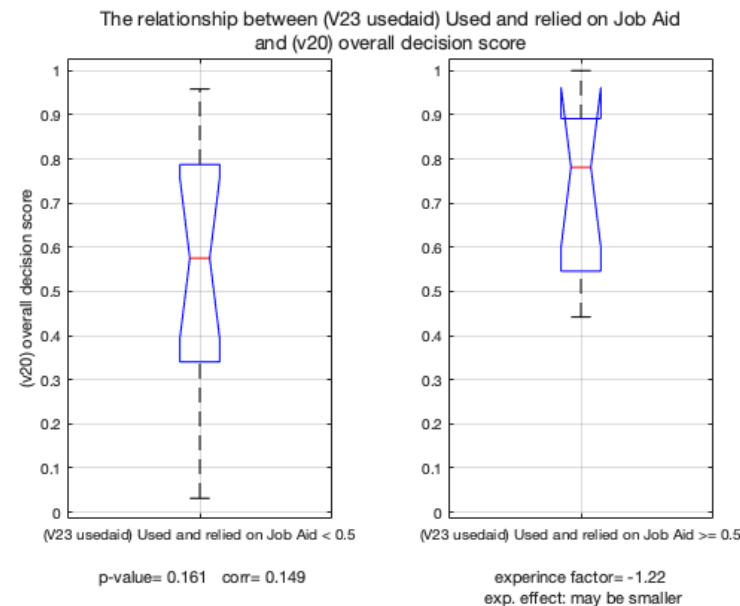
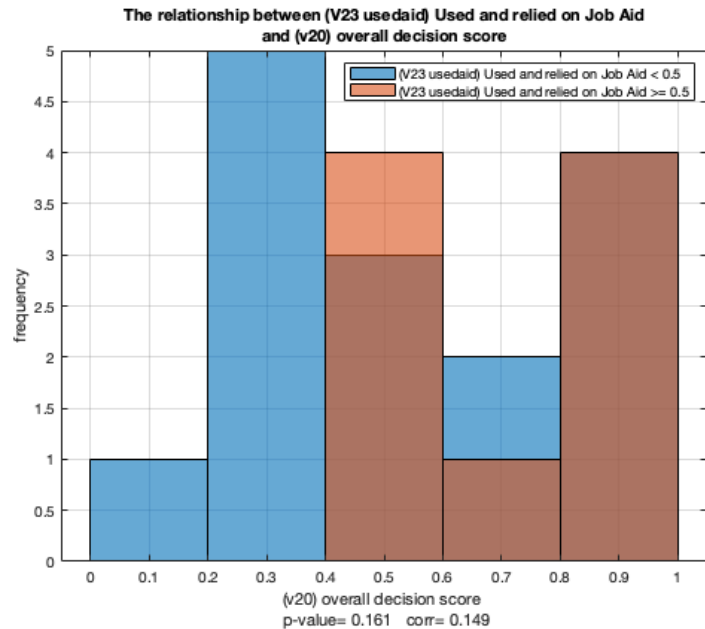
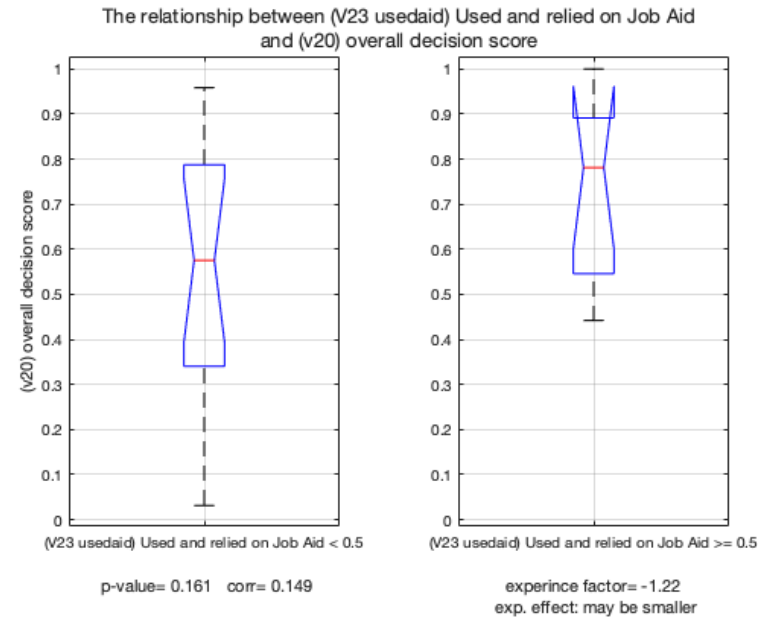
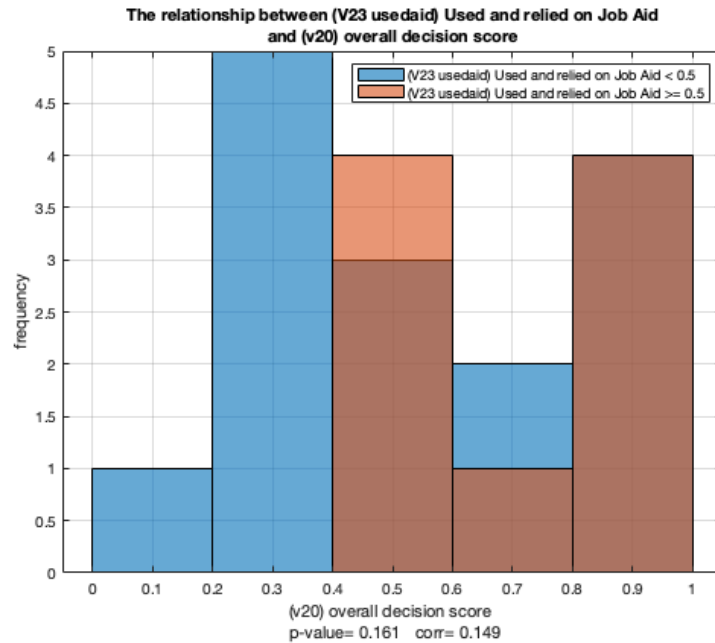
Hypothesis 3

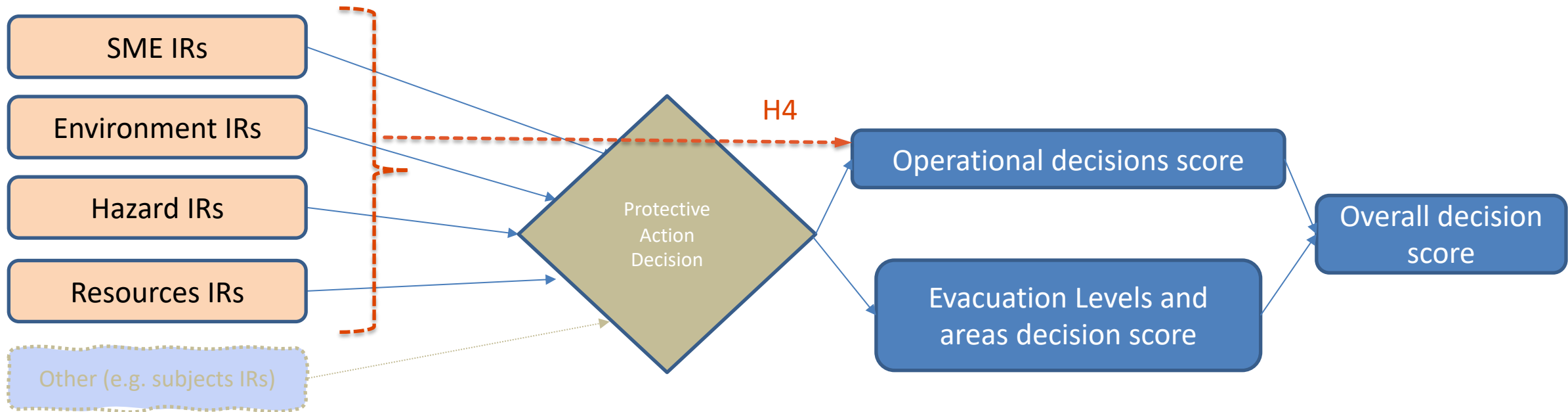


H3



Evacuation Levels and
areas decision score





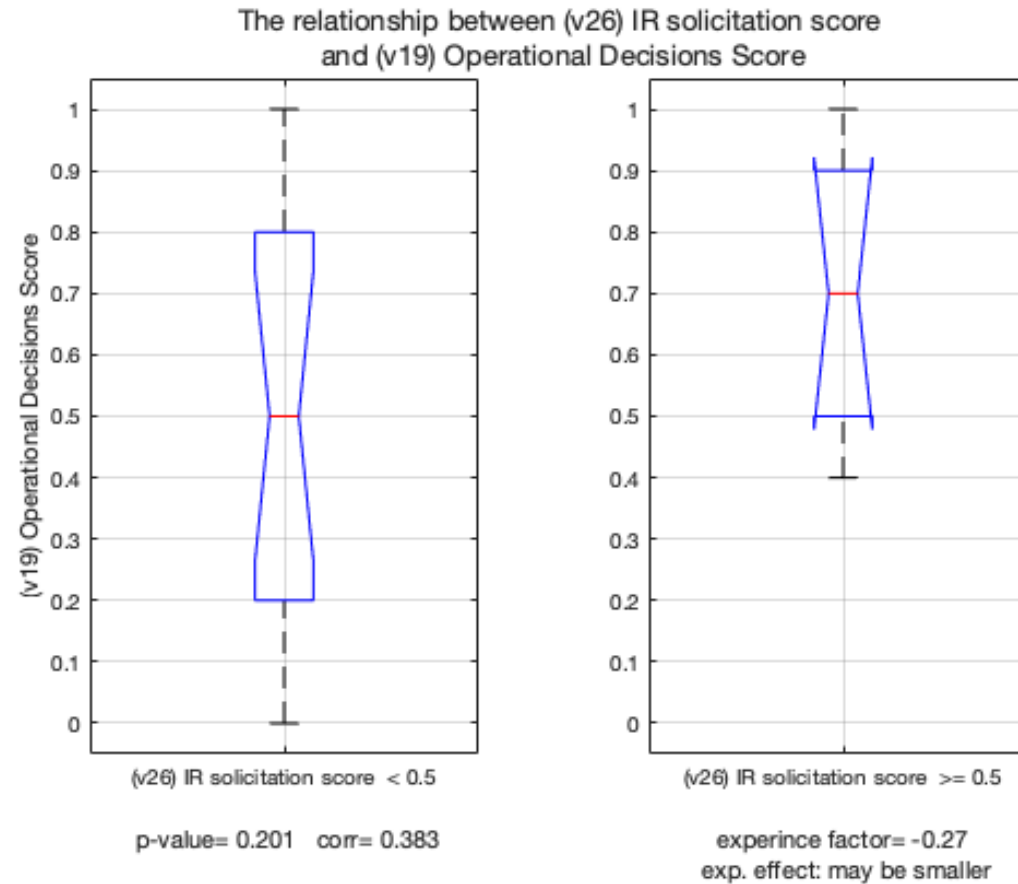
Hypothesis 4



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The number of Information Requirements requested by a decision maker support the decision maker's ability in successfully determining the Operational components of their decision.

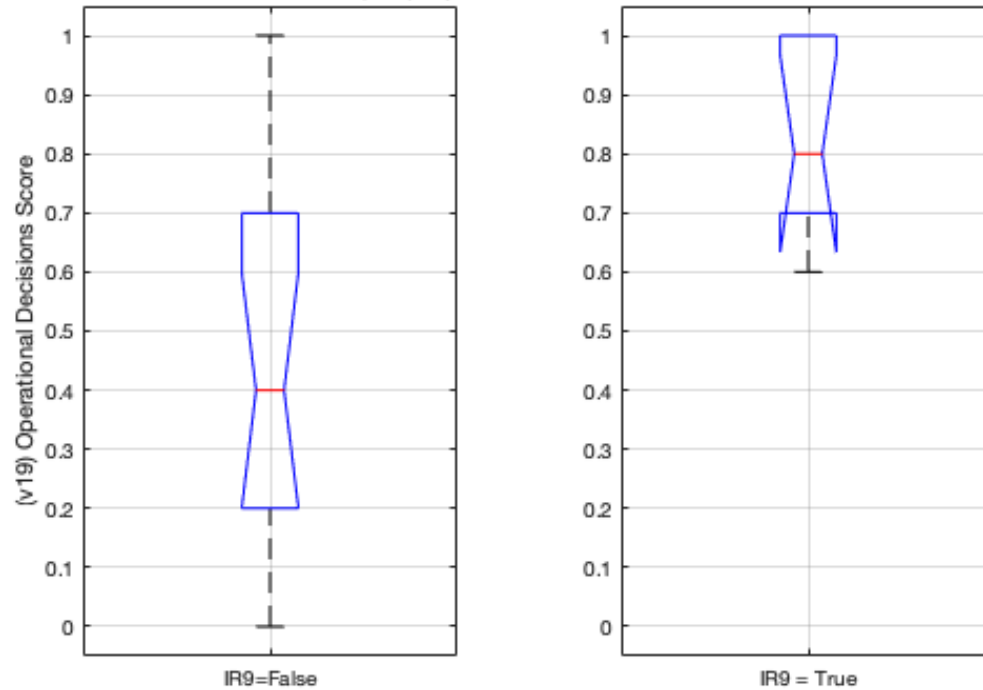
Number of IR solicitation effect on Operational Decisions



Specific IR effect on Operational Decisions Score

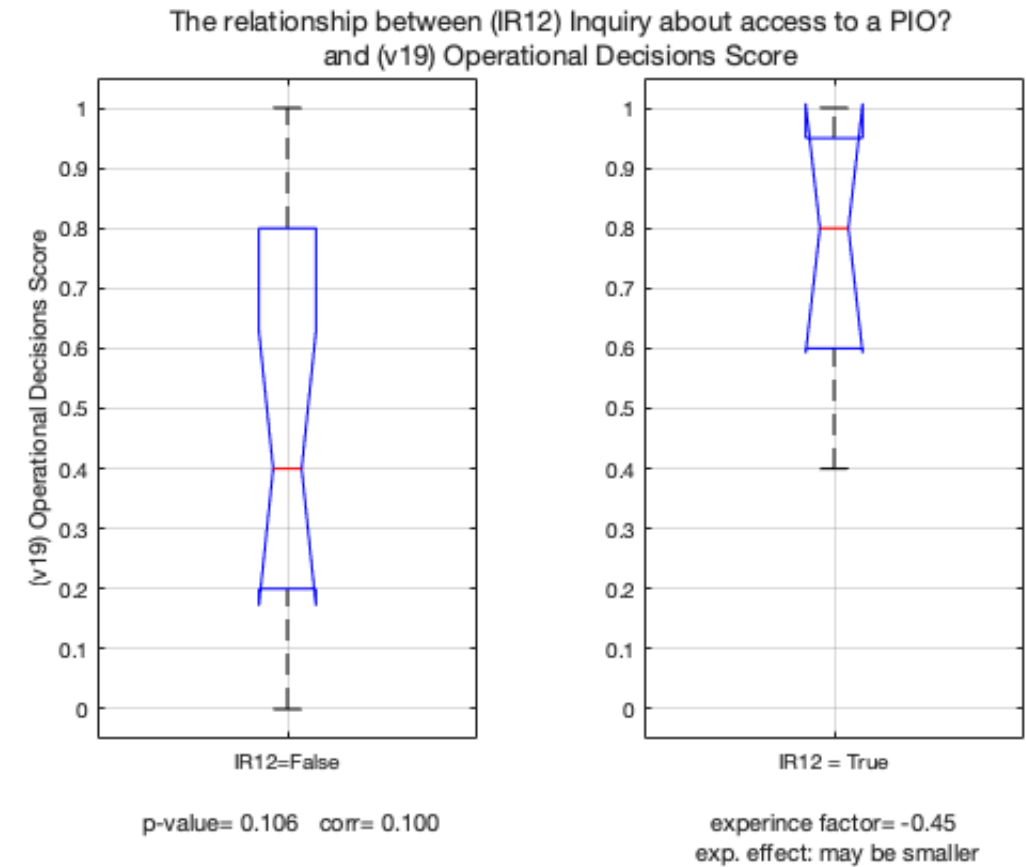
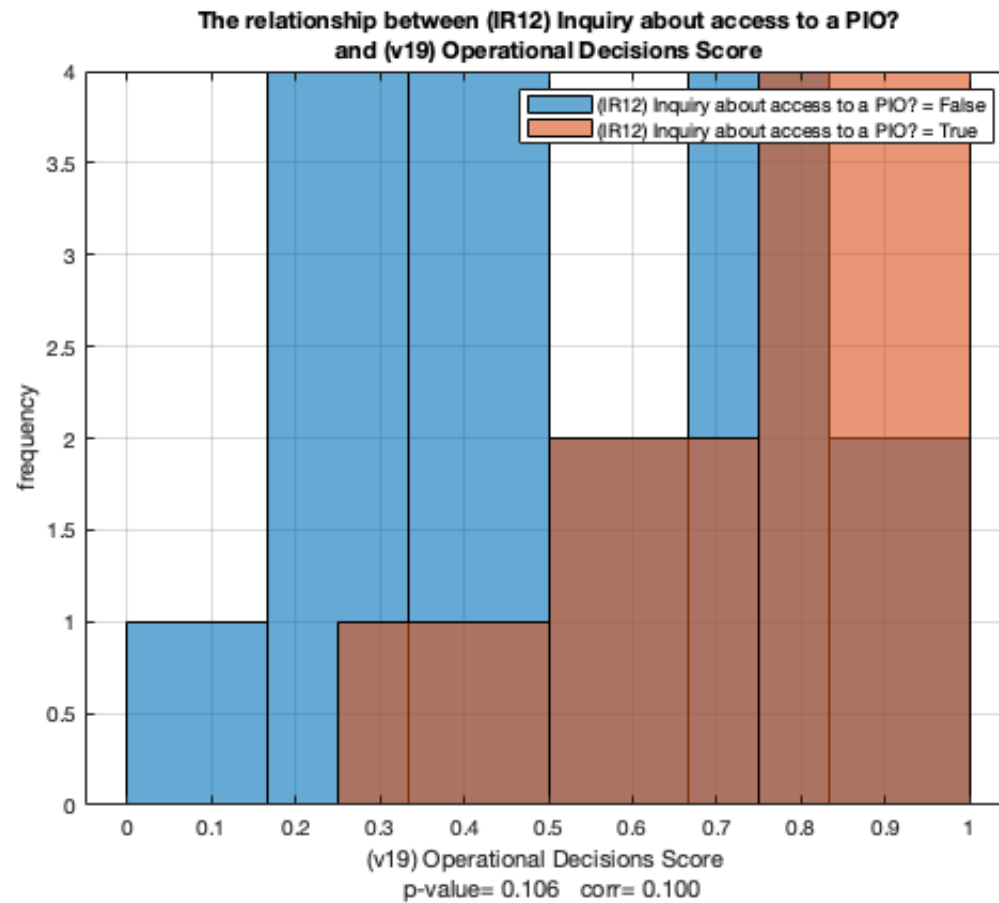


The relationship between (IR9) Inquiry about access to EOC center
and (v19) Operational Decisions Score



p-value= 0.005 corr= 0.003
Ranksum test rejects null hypothesis of equal medians

experince factor= NaN
exp. effect: may be smaller



V26. IR solicitation score = $f(v1, v7, v3, v9)$

SME IRs

V1. Asked for SME recommendation. (1)

(IR1) Inquiry about Fire SME recommendation

Hazard IRs

V7. Asked for Hazard IR. (1)

(IR7) Inquiry about fire Behavior (Crowning effect)

Environment IRs

V3. number of environmental IRs requested (5)

(IR2) Inquiry about wind speed and direction

(IR3) Inquiry about Wind speed and direction forecast

(IR4) Inquiry about weather conditions(temperature, humidity, rainfall)

(IR5) Inquiry about topography of the location

(IR6) Inquiry about history of fires in area

Resources IRs

V9. Number of resources IRs requested (6)

(IR8) Inquiry about pre-identified resource center or shelter center

(IR9) Inquiry about access to EOC center

(IR10) Inquiry about number of engines and battalions are available

(IR11) Inquiry about law enforcement resources

(IR12) Inquiry about access to a PIO?

(IR13) Inquiry about access to people or resources to help with communicating evacuation orders?

Overall decision score

V20. = $f(v19, v28)$

Operational decisions score

V19. Evacuation critical operational decisions

V19e. Established an EOC

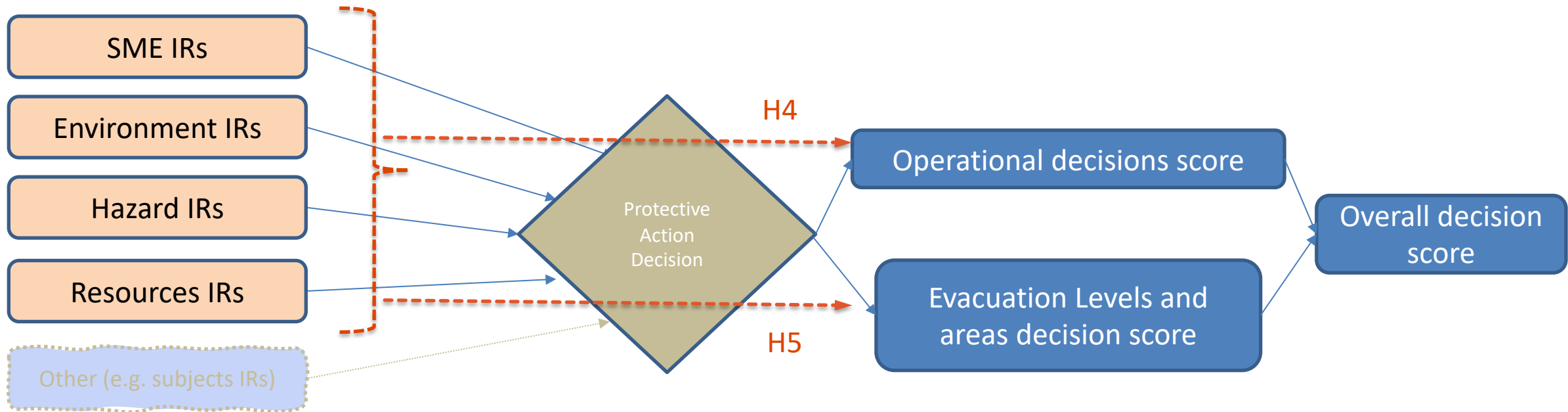
V19r. Identified safe route for evacuation

V19d. Identified safe evacuation destination

V19p. Asked about/appointed a PIO

V19m. Ordered an evacuation messaging to be communicated

Tactical decisions (Evacuation Levels and areas decision) score



Hypothesis 5

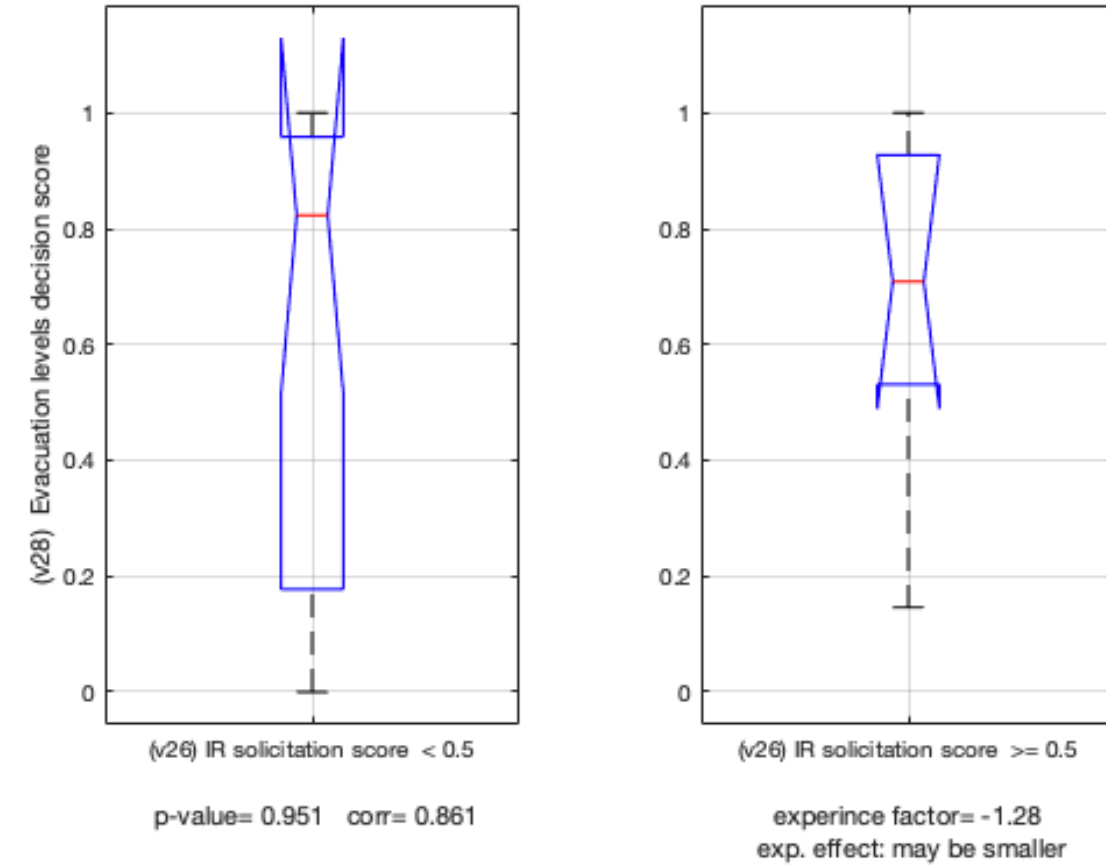


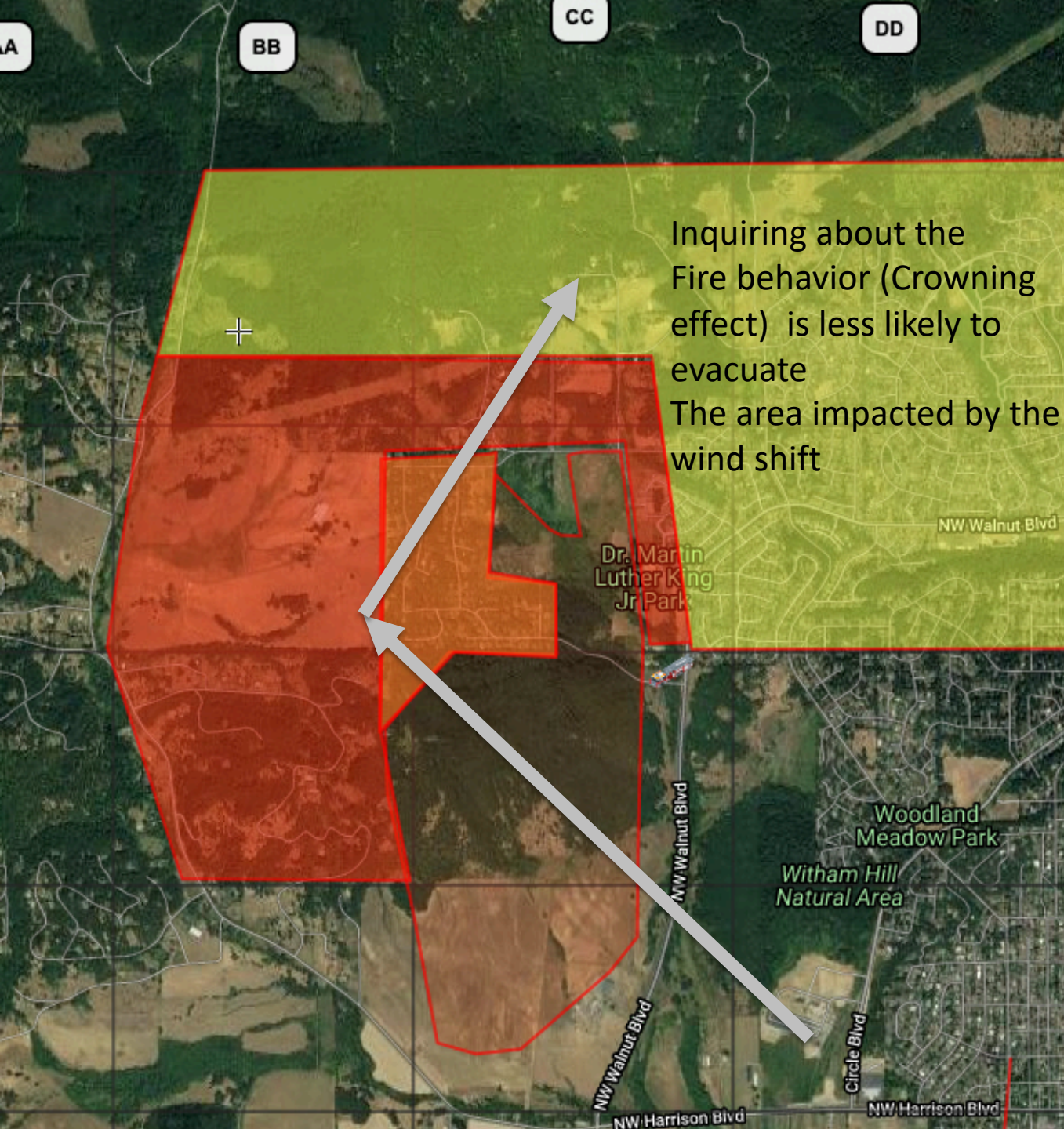
Oregon State University
College of Engineering

The number of Information Requirements requested by a decision maker support the decision maker's ability in successfully determining the Tactical components of their decision



The relationship between (v26) IR solicitation score
and (v28) Evacuation levels decision score





Wind speed and direction forecast

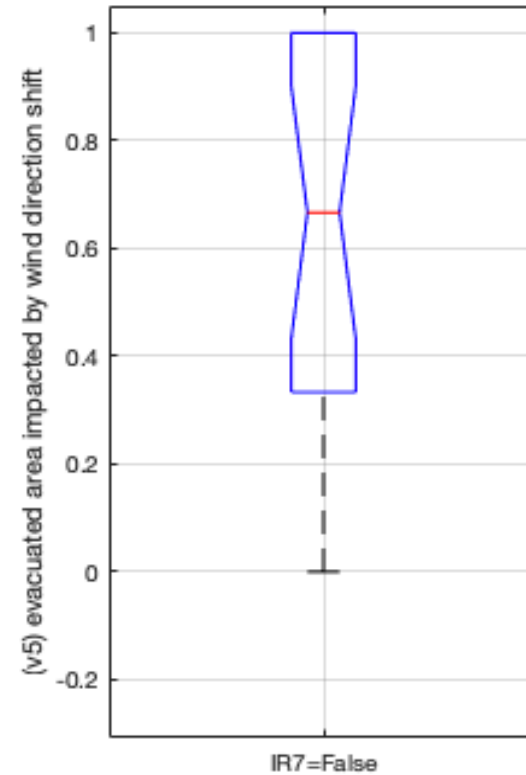
Wind expected to change direction in four hours

Fire behavior

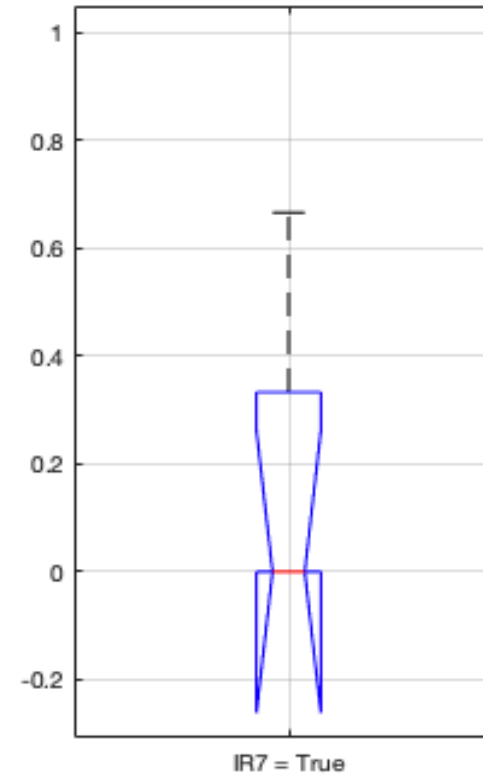




The relationship between (IR7) Inquiry about fire Behavior (Crowning effect)
and (v5) evacuated area impacted by wind direction shift



p-value= 0.045 corr= 0.037
Ranksum test rejects null hypothesis of equal medians



experince factor= -0.10
exp. effect: may be smaller

SME IRs

V1. Asked for SME recommendation. (1)

(IR1) Inquiry about Fire SME recommendation

Hazard IRs

V7. Asked for Hazard IR. (1)

(IR7) Inquiry about fire Behavior (Crowning effect)

Environment IRs

V3. number of environmental IRs requested (5)

(IR2) Inquiry about wind speed and direction

(IR3) Inquiry about Wind speed and direction forecast

(IR4) Inquiry about weather conditions(temperature, humidity, rainfall)

(IR5) Inquiry about topography of the location

(IR6) Inquiry about history of fires in area

Resources IRs

V9. Number of resources IRs requested (6)

(IR8) Inquiry about pre-identified resource center or shelter center

(IR9) Inquiry about access to EOC center

(IR10) Inquiry about number of engines and battalions are available

(IR11) Inquiry about law enforcement resources

(IR12) Inquiry about access to a PIO?

(IR13) Inquiry about access to people or resources to help with communicating evacuation orders?

Overall decision score

V20. =f(v19,v28)

Operational decisions score

V19. Evacuation critical operational decisions

V19e. Established an EOC

V19r. Identified safe route for evacuation

V19d. Identified safe evacuation destination

V19p. Asked about/appointed a PIO

V19m. Ordered an evacuation messaging to be communicated

Tactical decisions (Evacuation Levels and areas decision) score

V28. Participant made appropriate evacuation levels on the map = f(V2,V5,V6,V13)

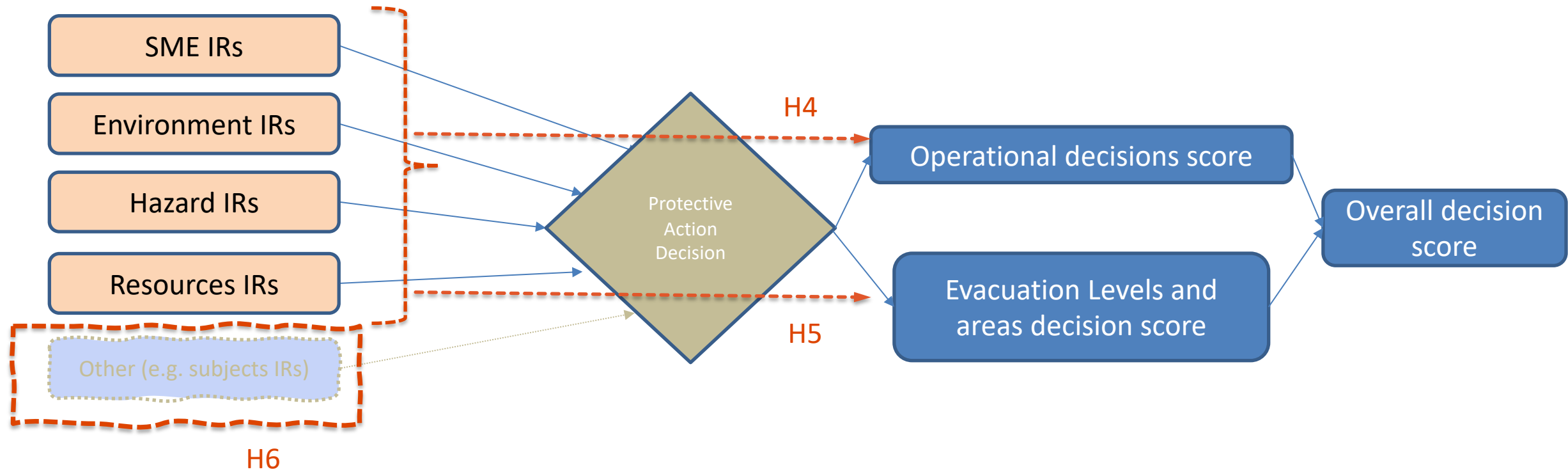
V2. Evacuated Zone D/followed battalion chief? (1/0)

V6. Evacuated Immediate area west and east? (0/0/1/2)

V5. Evacuated north east? (projected impact of wind direction shift) (0/1/3/2)

V13. Used all evacuation levels (Out of 4)

Negative effect



Hypothesis 6



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(part of an exploratory study)

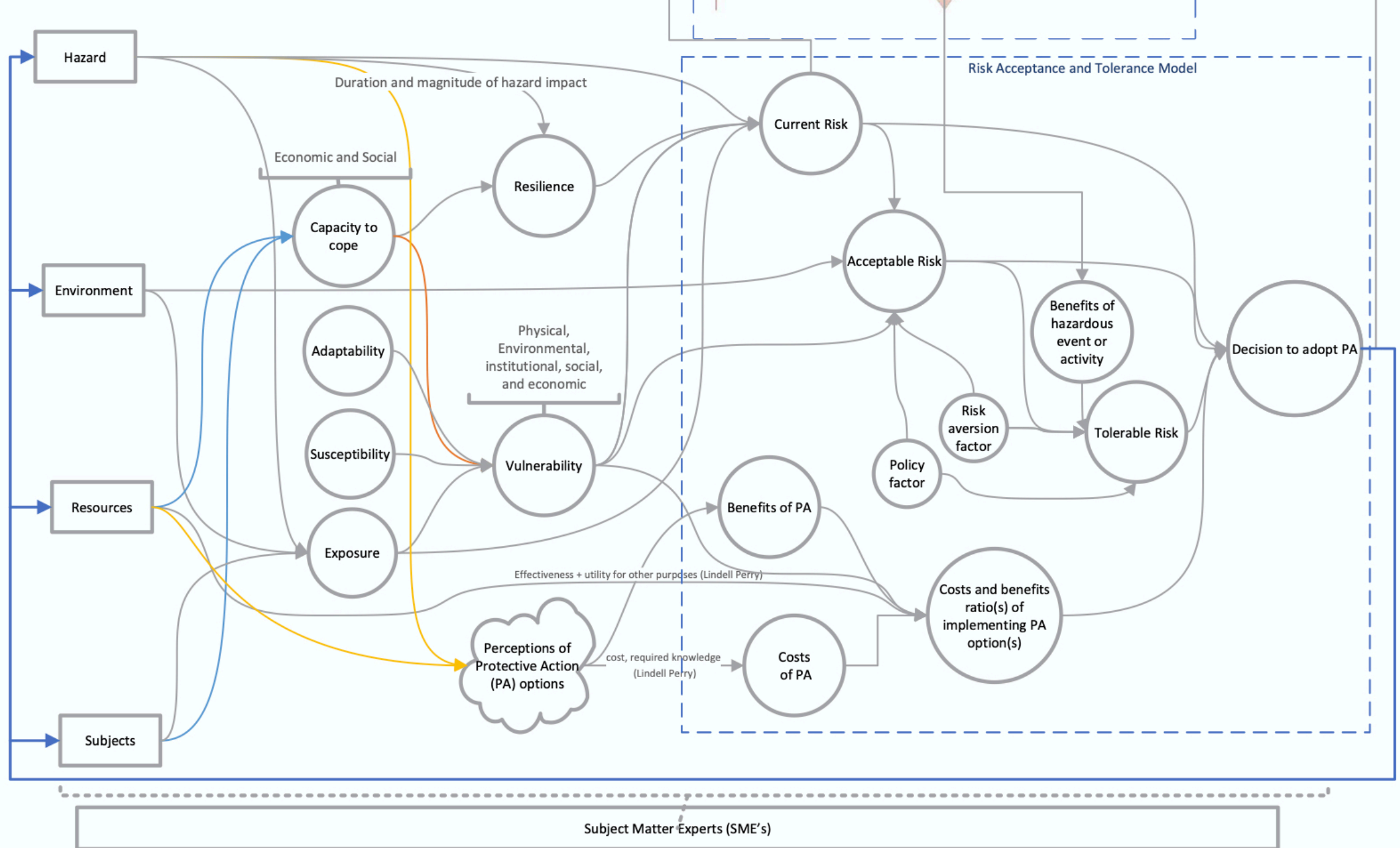
Other categories of PADM Information Requirements exist and are used in decision-making in addition to in Subject Matter Experts recommendations, hazards Information Requirements, environment Information Requirements, and response resources Information Requirements.

Examples of additional Factors Identified

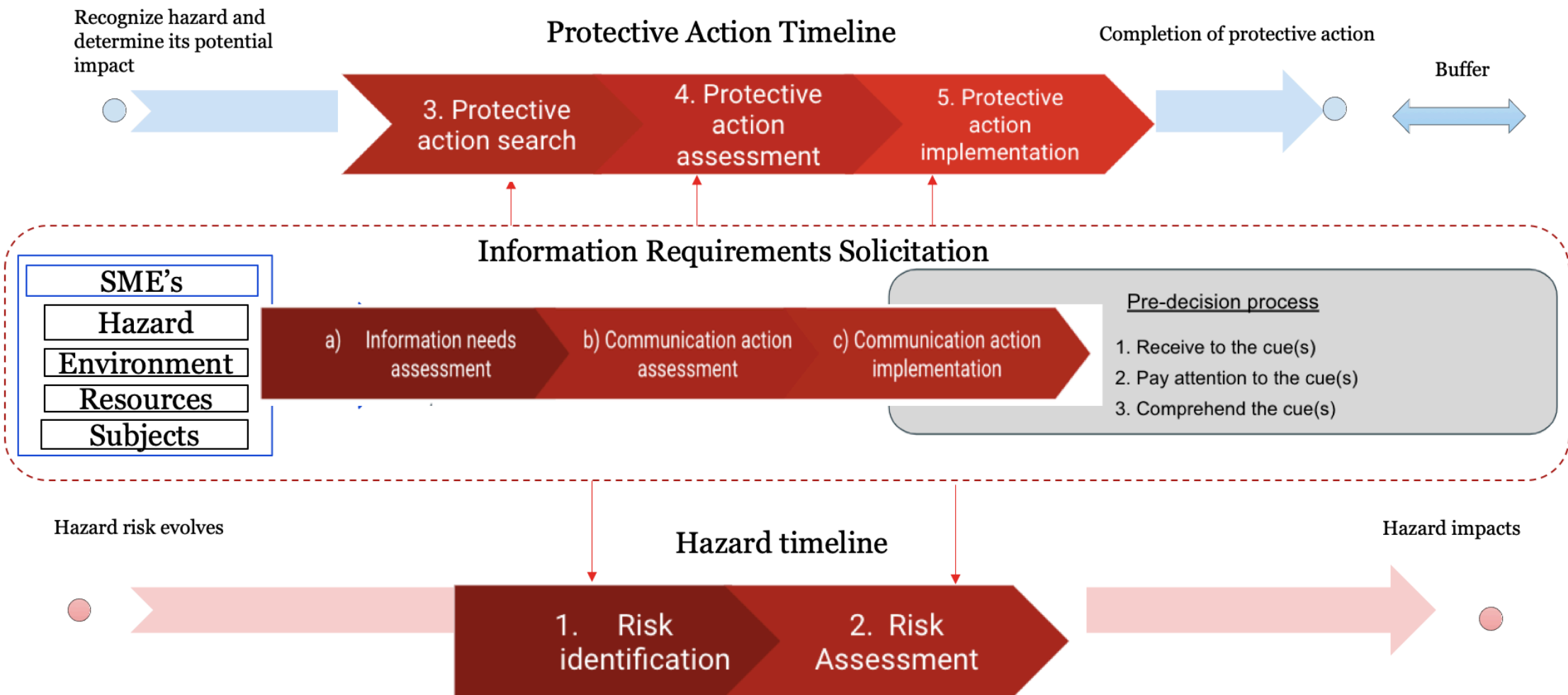
- Subject related factors:
 - Cultural and religious considerations
 - Vulnerabilities
- Hazard related factors:
 - Secondary hazardous material
- Resources related factors
 - Air assets, status of power availability, functionality of fire plugs

General Discussion

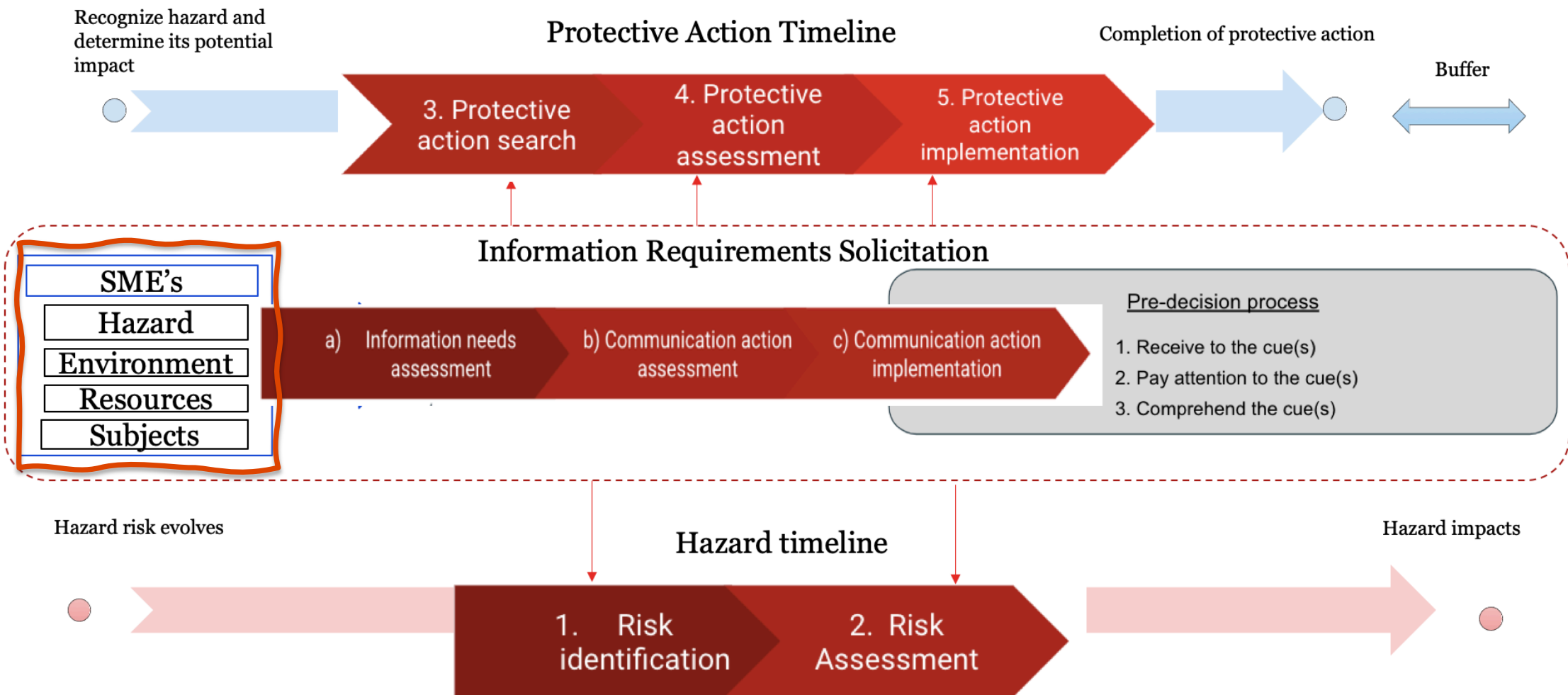
- Provided more clarity on the concepts and behaviors relating to community-level Protective Action Decision-Making.
- Introduced theoretical modification on Protective Action Decision Making theory. Introduced the Dual Timeline Decision Making Model that presents a theory driven and clearer description of the role of information solicitation process which is part of the Protective Action Decision Making pre-decision phase
- Developed, verified, and partially validated a holistic ontology of Information Requirement solicited by a Protective Action Decision Maker



Dual Timeline Protective Action Decision Making (DT-PADM)



Dual Timeline Protective Action Decision Making (DT-PADM)



General Discussion

- Demonstrated that some information requirements have different effects on the decision making tactical and operational outcomes in wildland-urban fire protective action decision making
- Found a promising evidence that presenting a job aid to a decision maker can positively impact decision makers to solicit specific information requirements and do better in terms of the operational outcomes.

V26. IR solicitation score = $f(v1, v7, v3, v9)$

SME IRs

V1. Asked for SME recommendation. (1)

(IR1) Inquiry about Fire SME recommendation

Hazard IRs

V7. Asked for Hazard IR. (1)

(IR7) Inquiry about fire Behavior (Crowning effect)

Environment IRs

V3. number of environmental IRs requested (5)

(IR2) Inquiry about wind speed and direction

(IR3) Inquiry about Wind speed and direction forecast

(IR4) Inquiry about weather conditions(temperature, humidity, rainfall)

(IR5) Inquiry about topography of the location

(IR6) Inquiry about history of fires in area

Resources IRs

V9. Number of resources IRs requested (6)

(IR8) Inquiry about pre-identified resource center or shelter center

(IR9) Inquiry about access to EOC center

(IR10) Inquiry about number of engines and battalions are available

(IR11) Inquiry about law enforcement resources

(IR12) Inquiry about access to a PIO?

(IR13) Inquiry about access to people or resources to help with communicating evacuation orders?



Overall decision score

V20. $=f(v19, v28)$

Operational decisions score

V19. Evacuation critical operational decisions

V19e. Established an EOC

V19r. Identified safe route for evacuation

V19d. Identified safe evacuation destination

V19p. Asked about/appointed a PIO

V19m. Ordered an evacuation messaging to be communicated

Tactical decisions (Evacuation Levels and areas decision) score

V28. Participant made appropriate evacuation levels on the map = $f(V2, V5, V6, V13)$

V2. Evacuated Zone D/followed battalion chief? (1/0)

V6. Evacuated Immediate area west and east? (0/0/1/2)

V5. Evacuated north east? (projected impact of wind direction shift) (0/1/3/2)

V13. Used all evacuation levels (Out of 4)

V26. IR solicitation score = $f(v1,v7,v3,v9)$

SME IRs

V1. Asked for SME recommendation. (1)

(IR1) Inquiry about Fire SME recommendation

Hazard IRs

V7. Asked for Hazard IR. (1)

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(IR6) Inquiry about history of fires in area

Resources IRs

V9. Number of resources IRs requested (6)

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(IR9) Inquiry about access to EOC center

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(IR11) Inquiry about law enforcement resources

(IR12) Inquiry about access to a PIO?

(IR13) Inquiry about access to people or resources to help with communicating evacuation orders?



Overall decision score

V20. $=f(v19,v28)$

Operational decisions score

V19. Evacuation critical operational decisions

V19e. Established an EOC

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V19d. Identified safe evacuation destination

V19p. Asked about/appointed a PIO

V19m. Ordered an evacuation messaging to be communicated

Tactical decisions (Evacuation Levels and areas decision) score

V28. Participant made appropriate evacuation levels on the map = $f(V2,V5,V6,V13)$

V2. Evacuated Zone D/followed battalion chief? (1/0)

V6. Evacuated Immediate area west and east? (0/0/1/2)

V5. Evacuated north east? (projected impact of wind direction shift) (0/1/3/2)

V13. Used all evacuation levels (Out of 4)

V26. IR solicitation score = $f(v1, v7, v3, v9)$

SME IRs

V1. Asked for SME recommendation. (1)

(IR1) Inquiry about Fire SME recommendation

Hazard IRs

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Environment IRs

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(IR4) Inquiry about weather conditions(temperature, humidity, rainfall)

(IR5) Inquiry about topography of the location

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Resources IRs

V9. Number of resources IRs requested (6)

(IR8) Inquiry about pre-identified resource center or shelter center

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(IR12) Inquiry about access to a PIO?

(IR13) Inquiry about access to people or resources to help with communicating evacuation orders?



Overall decision score

V20. = $f(v19, v28)$

Operational decisions score

V19. Evacuation critical operational decisions

V19e. Established an EOC

V19r. Identified safe route for evacuation

V19d. Identified safe evacuation destination

V19p. Asked about/appointed a PIO

V19m. Ordered an evacuation messaging to be communicated

Tactical decisions (Evacuation Levels and areas decision) score

V28. Participant made appropriate evacuation levels on the map = $f(V2, V5, V6, V13)$

V2. Evacuated Zone D/followed battalion chief? (1/0)

V6. Evacuated Immediate area west and east? (0/0/1/2)

V5. Evacuated north east? (projected impact of wind direction shift) (0/1/3/2)

V13. Used all evacuation levels (Out of 4)

(-)

Limitations

- Conclusions of this study are provided with relatively small sample size.
- The scenario in the research study examined specific information requirements and only one type of hazards (Wildland-Urban Fire)
- Focus on information solicitation process. Did not examine all stages of DT-PADM such as situational awareness.

Conclusions

- Provided a systemic method to examine information requirements with stronger effect on Protective Action Decision Makers performance.
- Provided theoretical modifications that better reflect community-level protective action decision making.
- Verified and partially validated the SHERS ontology of information requirements solicited in emergency management protective actions.

Future work



- Regional studies may provide different results. Specific geographical regions may have specific attitudes and outcomes.
- Control for or fully assess the extent of experience and training on decision making.
- Assess the stages of situational awareness.

Thank you

- Advisors Dr. Ken Funk and Dr. Javier Calvo-Amodio
- Committee members Dr. Anthony Veltri, Dr. Sunil Khanna, and Dr. Martin Storksdieck,
- Parents, grandmother, brothers, and extended family
- Participants and Emergency Management SMEs Dave Busby and Mike Bamberger
- Mamta

Thank you

- Destry Jensen, Cassidy Boyle, and Cheryl Upshaw
- Friends and colleagues
- The People of Corvallis and Oregon State University
- To the EMT and medical staff at St. Joseph Hospital who one day saved me when I was a child and relieved my pain, dedicating this work to you is the least I can do to return the favor,
- To you for your support and listening to my presentation



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Questions?