



Høgskulen
på Vestlandet

Contingency planning

Norwegian Tunnel Safety Conference 2018

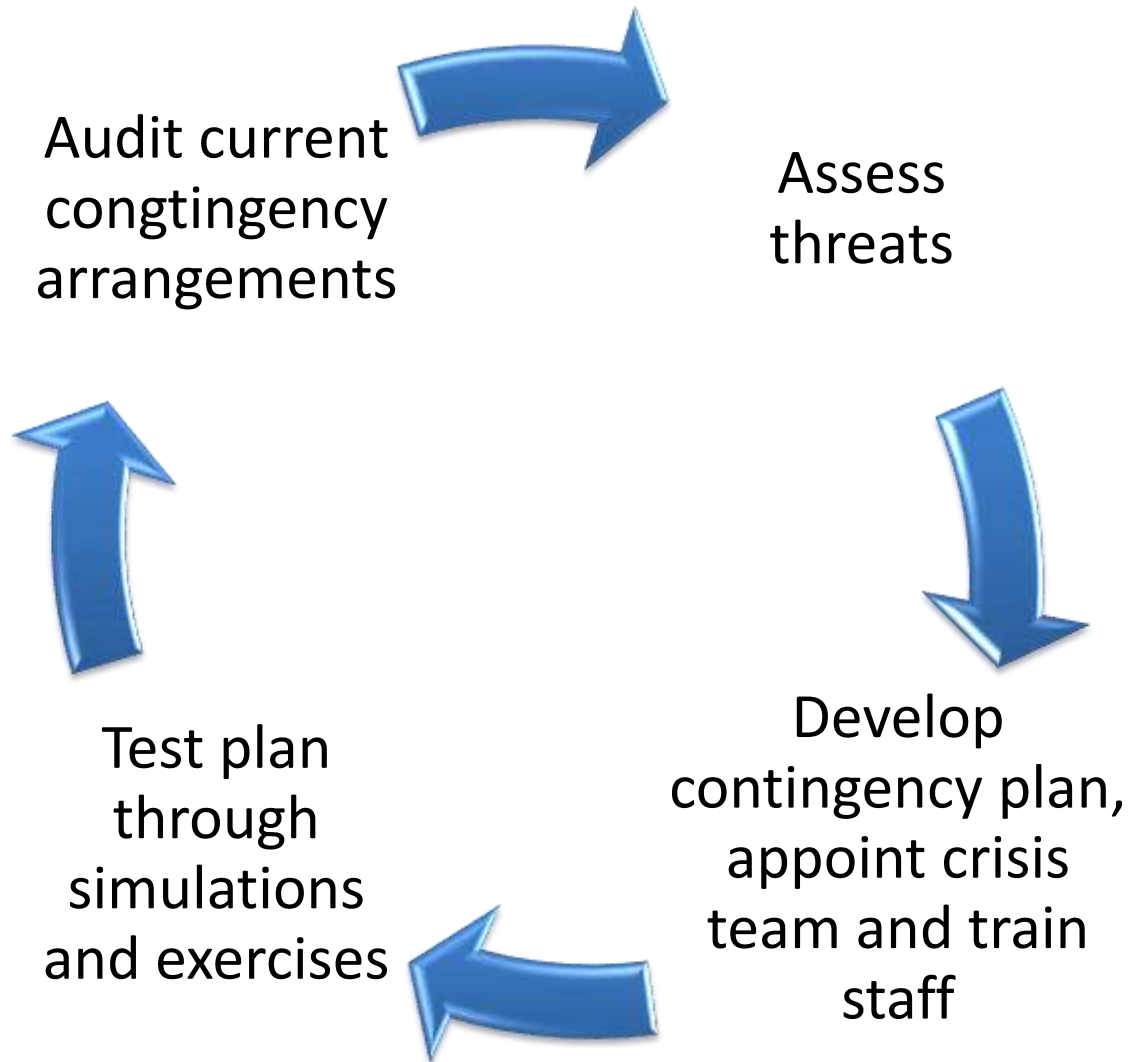
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19.06.2018

“Ideal” rules for contingency planning and preparedness (Perry & Lindell, 2003)

1. Be based on accurate knowledge of threats and likely human responses
2. Encourage appropriate action by crisis managers
3. Encourage flexibility in responses
4. Promote inter-organizational coordination
5. Integrate plans for each hazard into a multi-hazard approach
6. Involve the training of relevant personnel
7. Provide for testing of proposed response through drills and exercises
8. Be a continuing process to accommodate changes in the threat environment and with the introduction of new or improved equipment
9. Be a strong advocate for resources to low probability events
10. Recognize the differences between crisis planning and crisis management



Main stages in pre-crisis contingency planning (Drennan & McConnel, 2007)



The emergency preparedness process

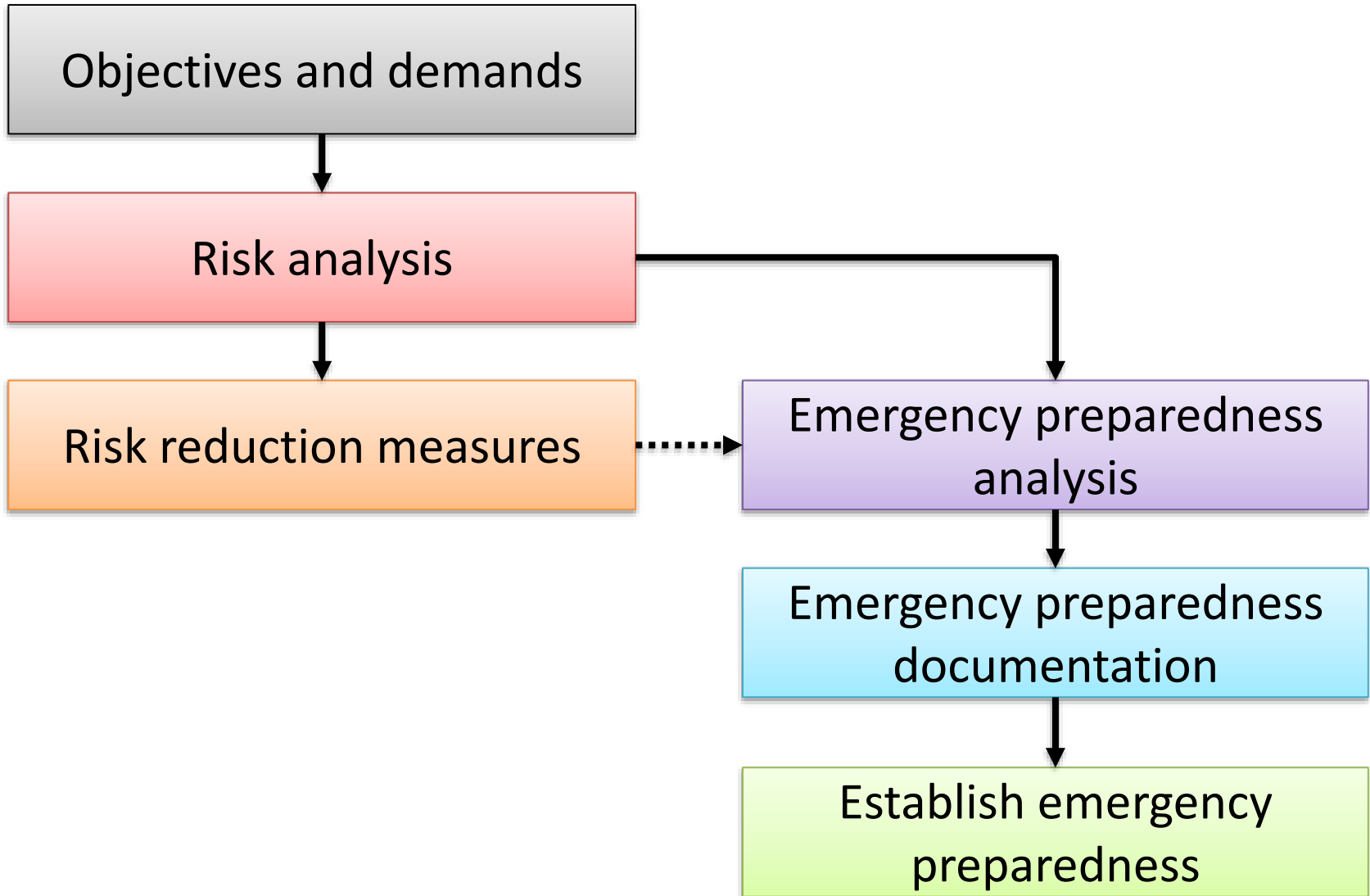


Example of risk analysis for tunnel

	K1: Lettere skade	K2: Hardt skadd	K3: 1 - 4 drepte	K4: 5 - 20 drepte	K5: Mer enn 20 drepte
S5: Svært ofte (minst en gang i året)					
S4: Ofte (en gang per 2 -10 år)	Påkjørsel bakfra Feltskifteulykke	Brann i lett kjøretøy			
S3: Sjelden (en gang per 11 - 100 år)	Kryssulykke utenfor tunnel	Velt- lite kjøretøy	Utforkjøring Møteulykke		
S2: Svært sjelden (en gang per 101 - 1 000 år)	Kryssulykke i tunnel		Påkjørsel myke trafikanter	Brann i lange kjøretøy (20 - 100 MW)	
S1: Ekstremt sjelden (sjeldnere enn hvert 1 000. år)	Nedfall Stormflo	Lekkasje av farlig gods	Velt - buss		Brann i buss (30MW) Brann farlig gods



Contingency planning in tunnels



Example of emergency preparedness analysis (1)

	K1: Lettere skade	K2: Hardt skadd	K3: 1 - 4 drepte	K4: 5 - 20 drepte	K5: Mer enn 20 drepte
S5: Svært ofte (minst en gang i året)					
S4: Ofte (en gang per 2 -10 år)	Påkørsel bakfra Feltskifteulykke	Brann i lett kjøretøy			
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Nr.	Definerte beredskapssituasjoner
I	Trafikkulykke med personskade (inntil 5 skadde)
II	Trafikkulykke med masseskade (mer enn 5 skadde)
III	Brann i personbil
IV	Brann i buss
V	Brann i vogntog
VI	Lekkasje av farlig gods
VII	Brann i farlig gods
VIII	Driftsstans og feil på teknisk utstyr

Nr.	Dimensjonerende hendelser	Beskrivelse av hendelsen som skal håndteres	Dekker definerte beredskapssituasjoner
A	Stor trafikkulykke	Trafikkulykke med buss og/eller flere personbiler, med inntil 20 personer alvorlig skadd	I, II,
B	Brann i vogntog (100 MW)	Brann i vogntog lokalisert nært midten av tunnelen, med kø av biler bak vogntoget i naturlig ventilasjonsretning	III, IV, V, VII
C	Langvarig driftsstans	Hendelse uten personskade, men som vil medføre behov for stengning i flere dager	VI, VIII



Example of emergency preparedness analysis (2)

Dimensioning scenario: *Fire in a heavy goods vehicle (100 MW)*

Response fase	Needs (challenges)	Measures	Time to execution	Resources	Competence/ Quality
<i>Alarm</i>	Information about the incident; what and where in the tunnel	Observation and questioning of emergency telephone caller	Answer within 10 seconds and achieve situation awareness within 2 minutes	Emergency telephone every 100 m., and camera surveillance	Training in questioning people in distress Training in assessing fire development Telephones and cameras resisting xx minutes of fire
<i>Mobilisation</i>	Get to the tunnel	Emergency response from fire service and ambulance	Arrive within 15 minutes from alarm	2 fire trucks with 10 fire-fighters 4 ambulances	Tunnel fire truck, water tank truck Able to treat smoke injuries
<i>Rescue</i>	Prevent people from getting captured in smoke	Start fire ventilation in the direction away from people	Within xx minutes	xx ventilation system	Capacity to remove smoke from a 100 MW heavy goods vehicle fire, with a natural wind flow of xx m/s Possible to change ventilation direction
<i>Evacuation</i>	People needing assistance to evacuate	Transport of 100 people	Within 20 minutes	Transport units for minimum 100 people	Cars with over pressured cabins and IR-cameras
<i>Normalisation</i>					

Example of emergency preparedness analysis (3)

- Performance requirements
 - Answer the emergency telephone within 10 seconds
 - Achieve situation awareness within 2 minutes
 - 2 fire trucks and 4 ambulances arrive at the tunnel within 15 minutes
 - Start the fire ventilation within xx minutes
 - ...
 - ...
- Dimensioning requirements
 - Emergency telephones every 100 meters
 - Camera surveillance equipment, with specification xx
 - Fire and ambulance station located xx km from the tunnel
 - Fire ventilation system with a capacity to remove smoke from a 100 MW heavy goods vehicle fire, against a natural wind flow of xx m/s
 - ...
 - ...

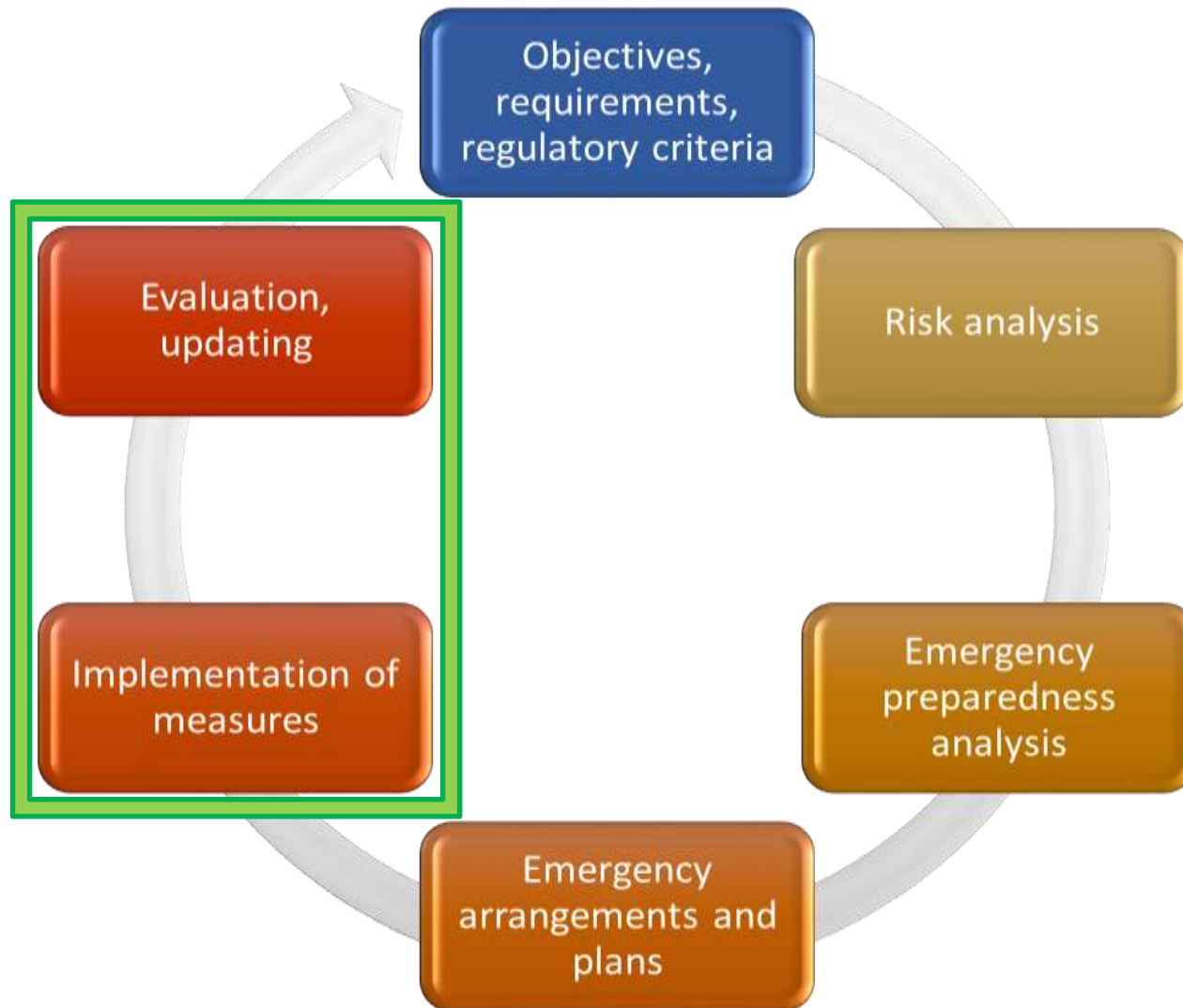


Emergency preparedness documentaion

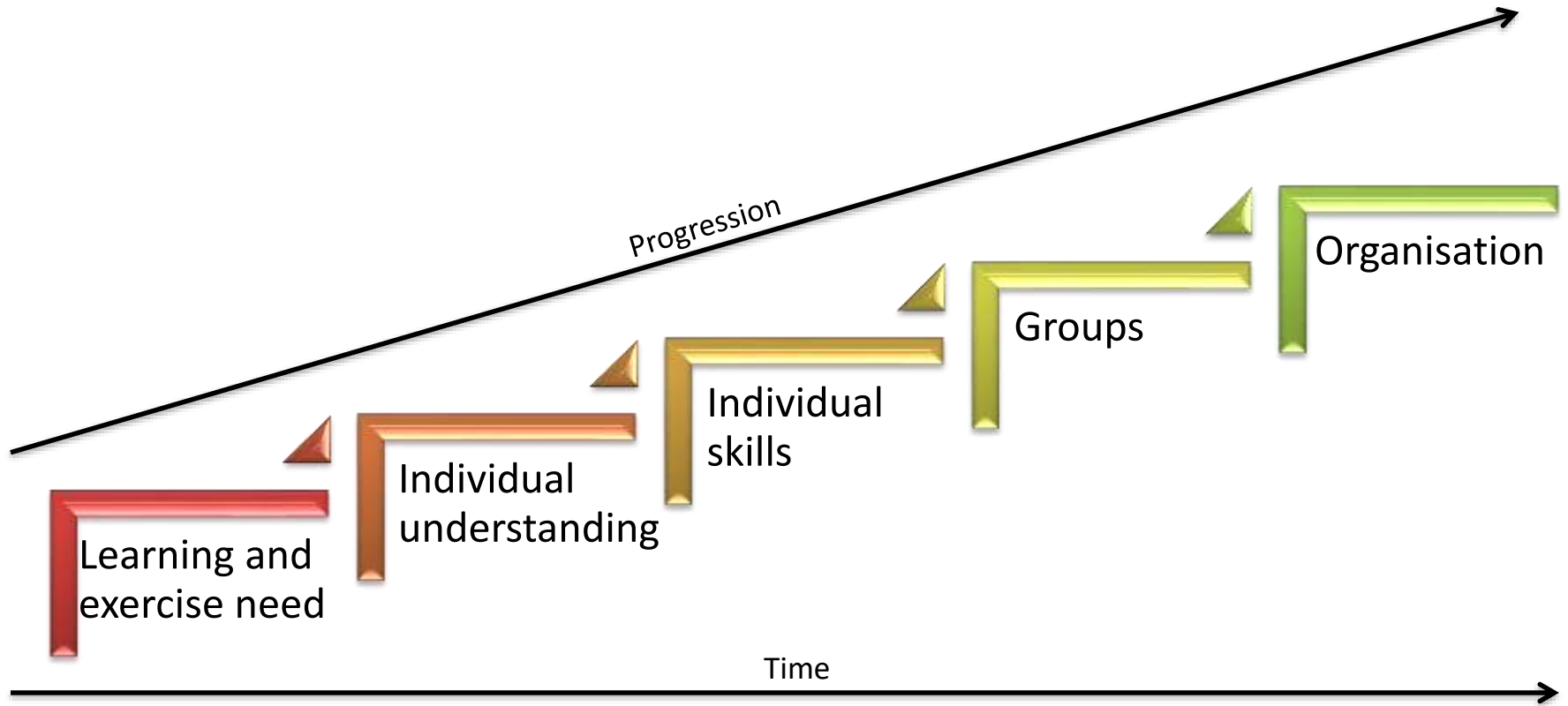
- Emergency response plans
- Plans for training and exercises
- Plan for investment and procurement
- Routines for operation and maintenance



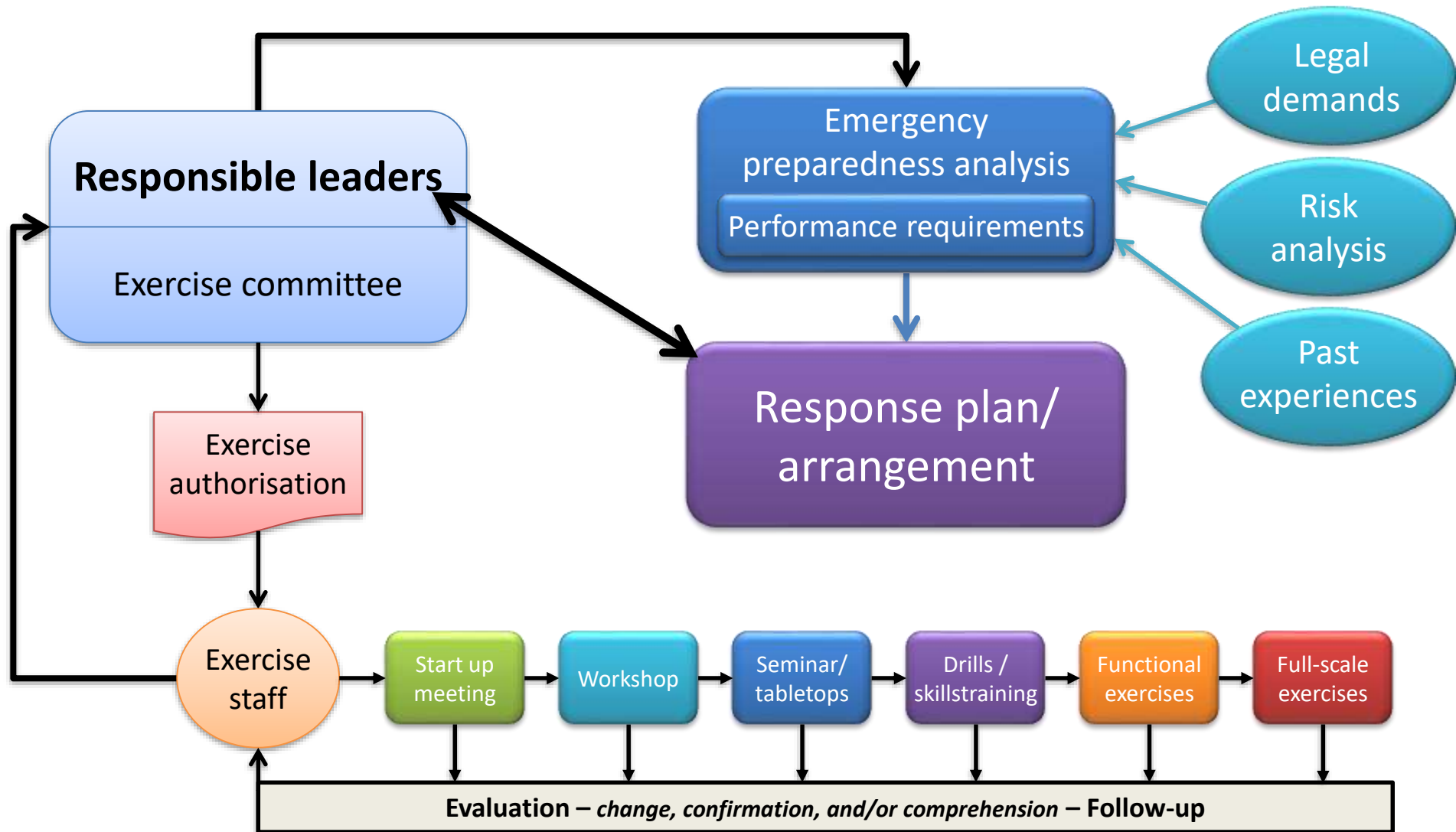
The emergency preparedness process



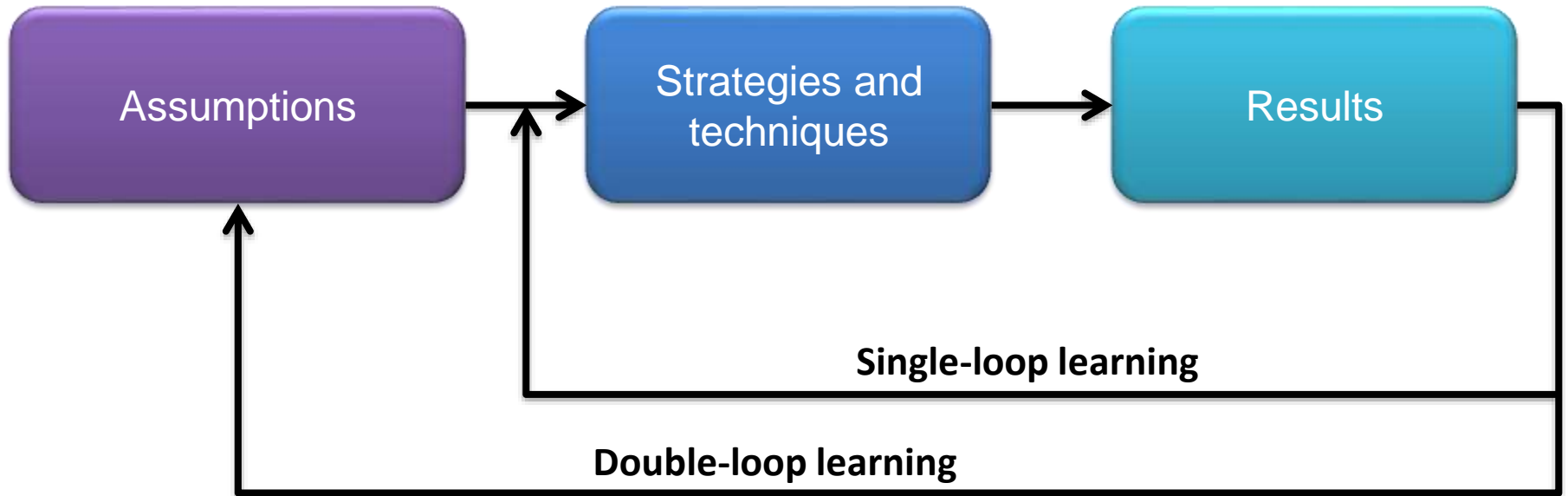
“The learning staircase”



Systematic exercising and learning



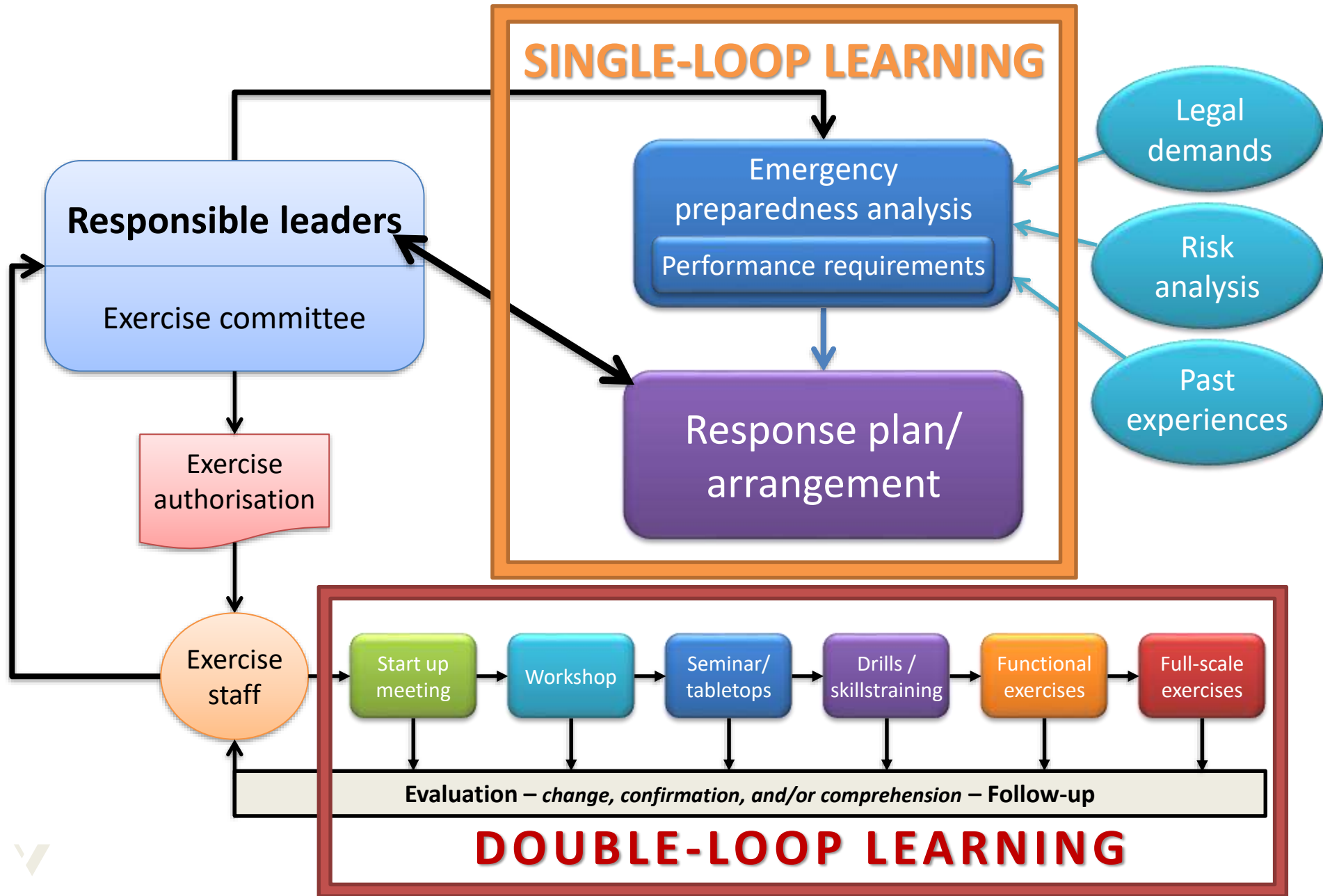
Single-loop and double-loop learning



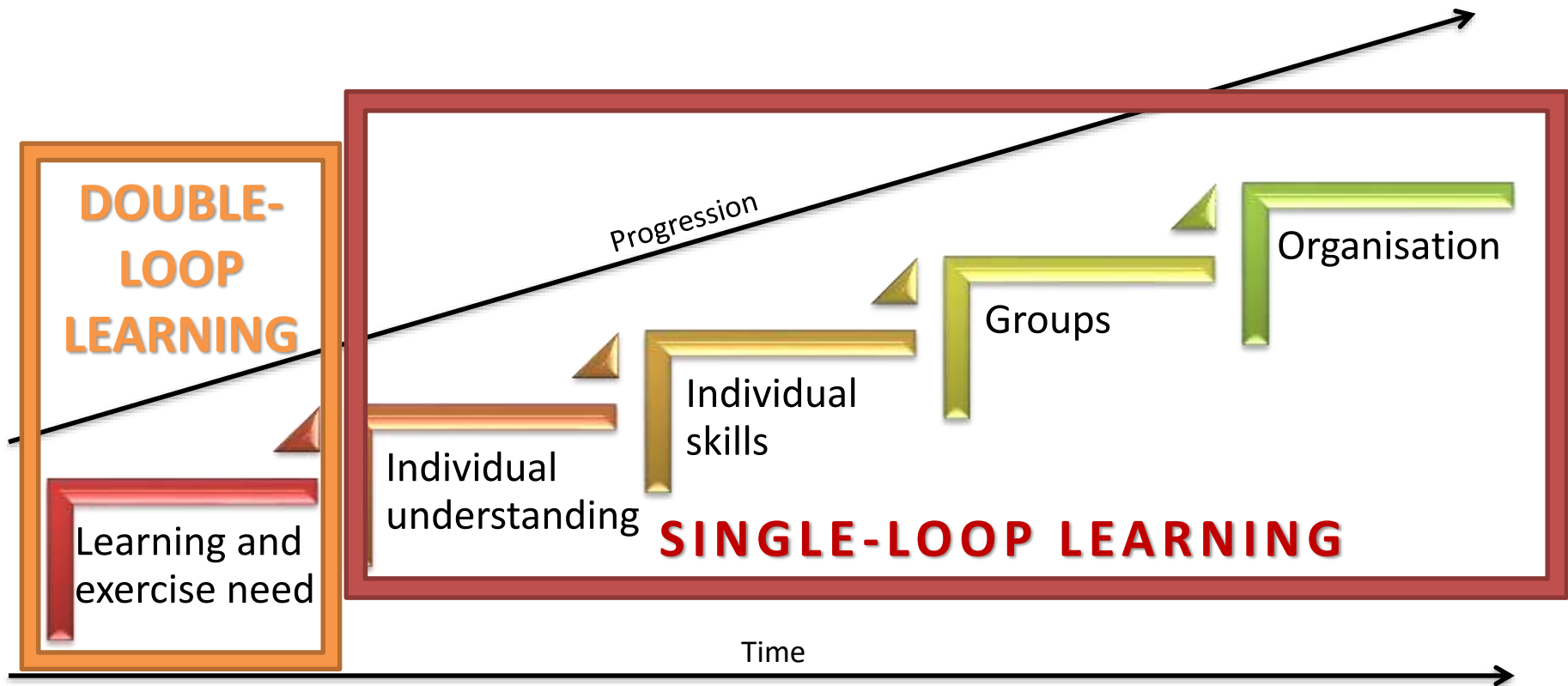
(Basert på Argyris & Schön, 1978, 1996)



Systematic exercising and learning vs. s/d-learning



“The learning staircase” vs. s/d-learning



Emergency Management

