IAEA
International Atomic Energy Agency

Nuclear Reactors Group

A CHARACTERIZATION OF THE FINANCIAL RISK PROFILE OF FAST SMRs

Comparison with SMRs of the PWR type

"Technical Meeting on the Benefits and Challenges of Fast Reactors of the SMR Type"

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Nuclear investment risk

Traditional NPPs

- Invested capital amount
- Pay Back Time (PBT)
- construction delay and cost overruns (size/complexity)
- price-taker technology
- public opinion and public opposition

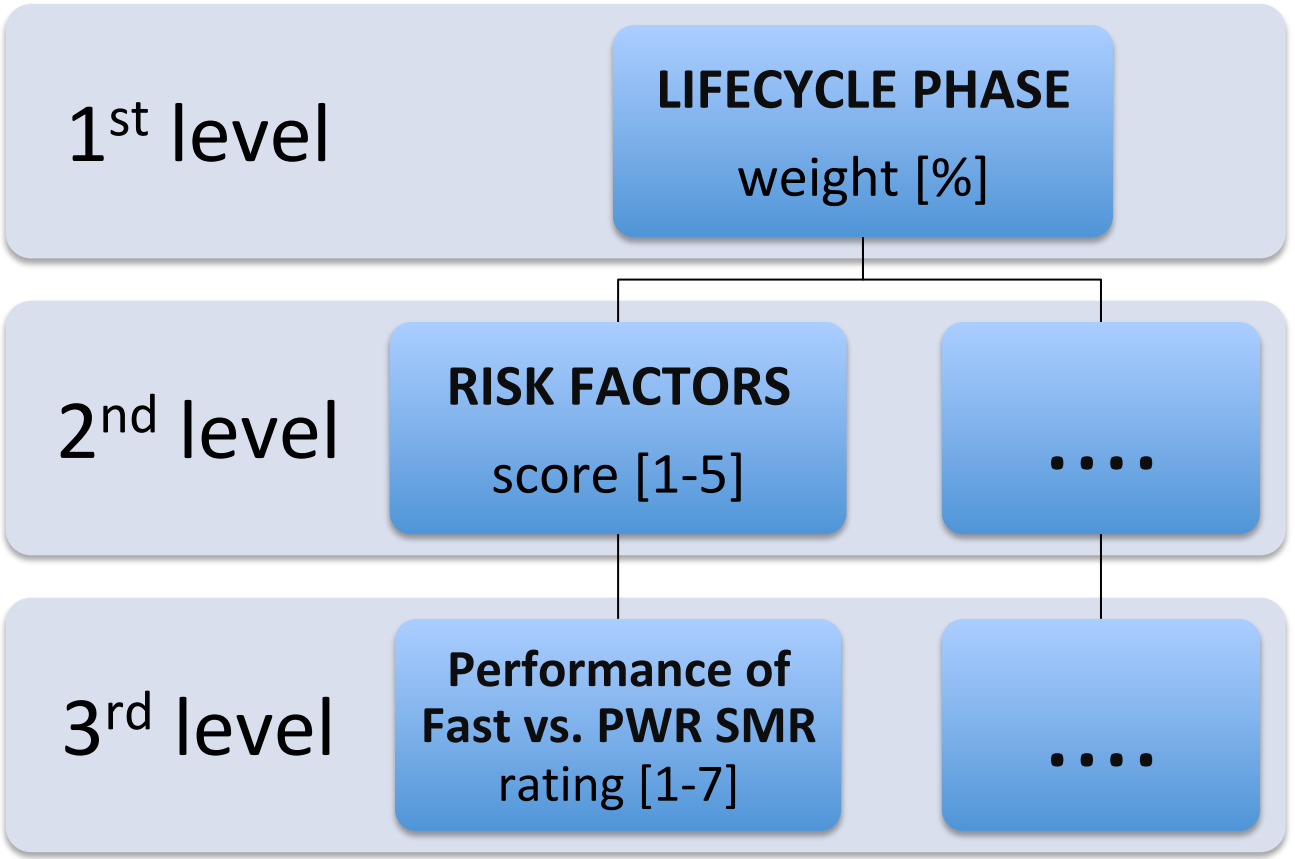
SMRs

- reduced investment amount (higher €/kWe ?)
- lower PBT and self-financing of fleets
- smaller size of components
  + simplification
  + modularity
  + standardisation
  + factory fabrication

  = higher control on construction costs and time
- increased passive safety
  - ➔ better public acceptance
  - ➔ less active components (availability)

Basics of the method

1. "Measurement" of qualitative factors
2. Risk break-down
3. Expert elicitation
4. Pairwise comparison of Fast SMRs with PWR SMRs



Financial risk break-down

1st level

Licensing	Construction	Operation	D&D

2nd level

Licensing	Construction	Operation	D&D
Regulatory activity	Regulatory activity	Regulatory activity	Regulatory activity
Political support	Political support	Political support	Political support
Public acceptance	Public acceptance	Public acceptance	Public acceptance
	Supply chain mgt	Plant maneuverability	Project mgt.
	Project mgt	Fit with cogen. opt.	On site work
	On site work	Fit with energy storage	Security
	Factory fabrication	Exposure to fuel price	Plant layout pro dismantling
		Unplanned outages freq.	HLW management
		Planned outages freq.	Special D&D techniques
		Outages duration	
		Robustness to natural events	
		Security	

Financial risk measurement

1st level

weight	%

2nd level

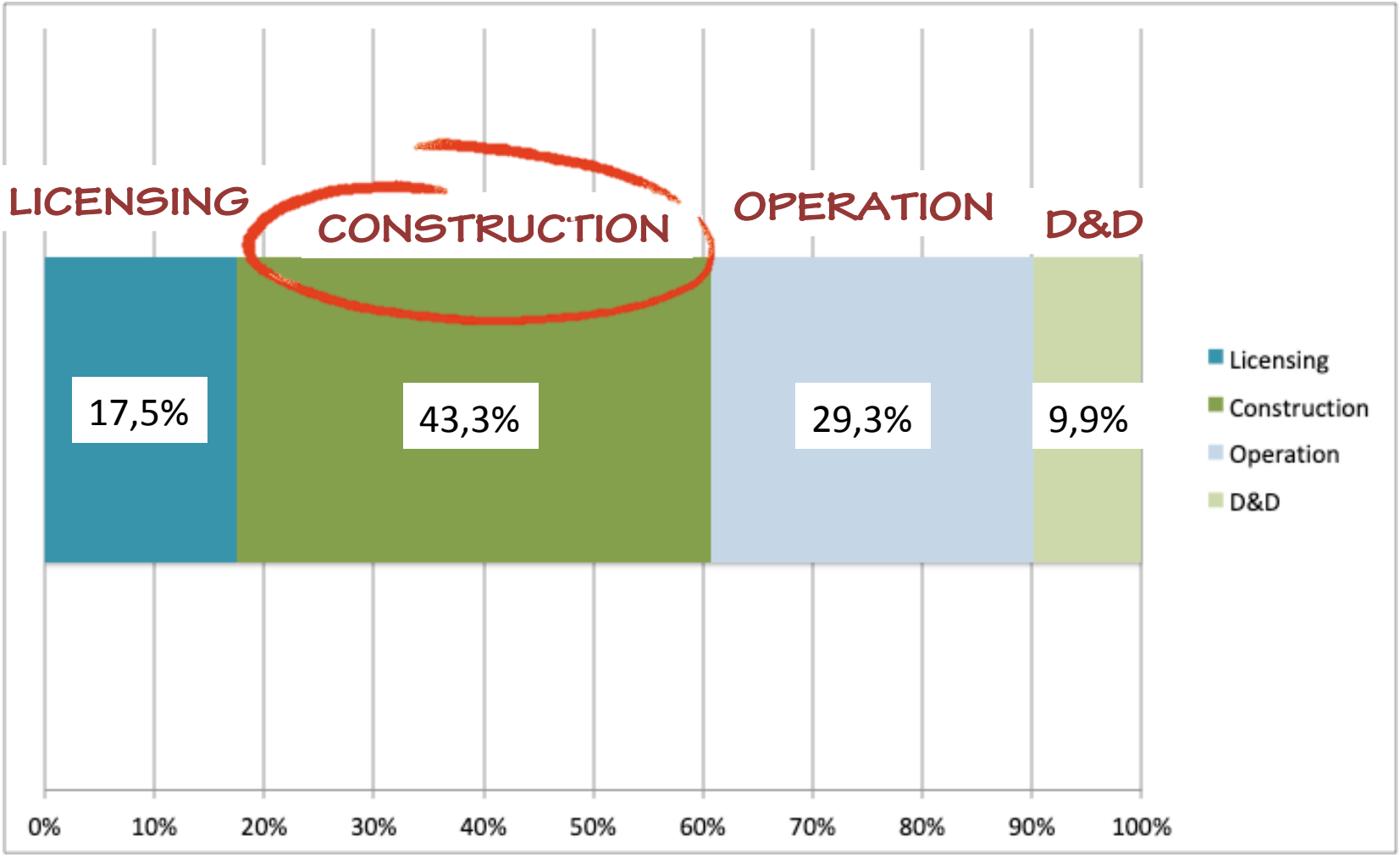
Score	Meaning
1	Not at all important
2	Slightly Important
3	Important
4	Fairly Important
5	Very Important

Expert elicitation

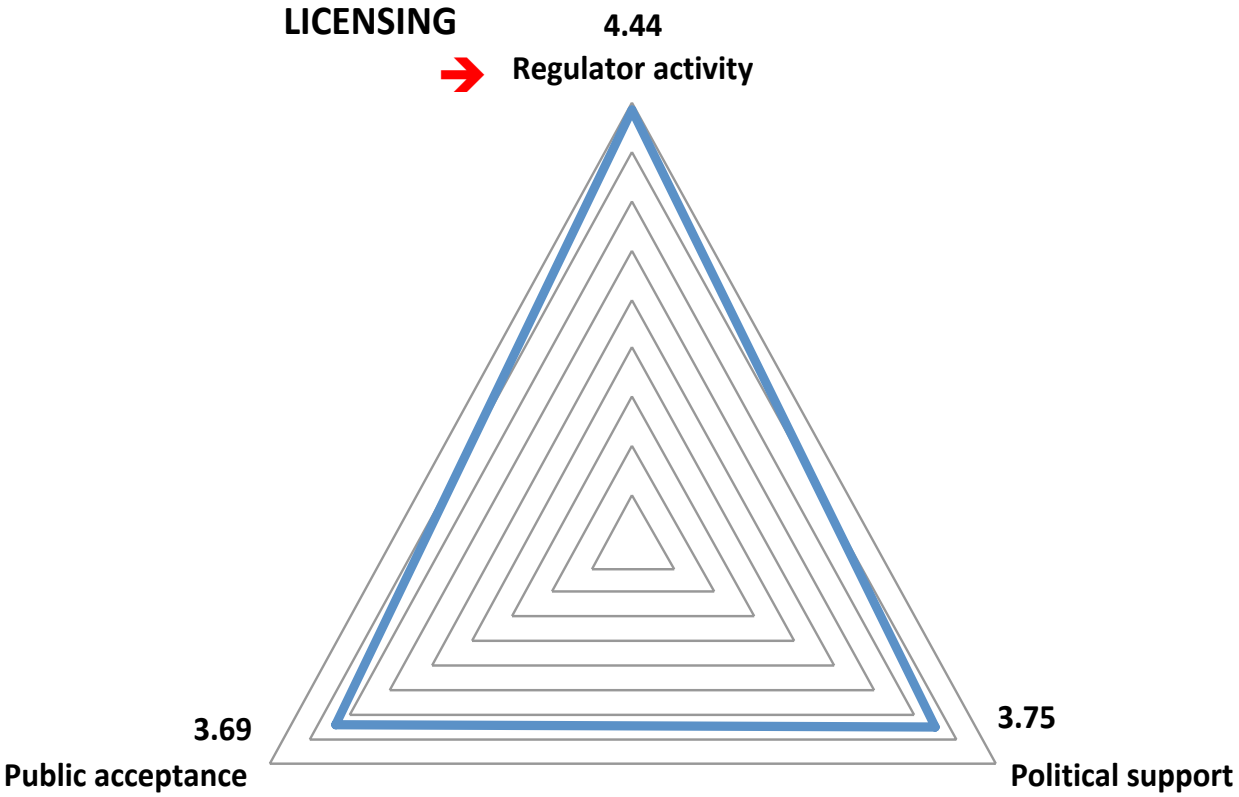
3rd level

Rating	Meaning for Fast SMR	Complementary meaning for PWR SMR
1	PWR SMR much better	Fast SMR much worse
2	PWR SMR fairly better	Fast SMR fairly worse
3	PWR SMR slightly better	Fast SMR slightly worse
4	Equal	Equal
5	Fast SMR slightly better	PWR SMR slightly worse
6	Fast SMR fairly better	PWR SMR fairly worse
7	Fast SMR much better	PWR SMR much worse

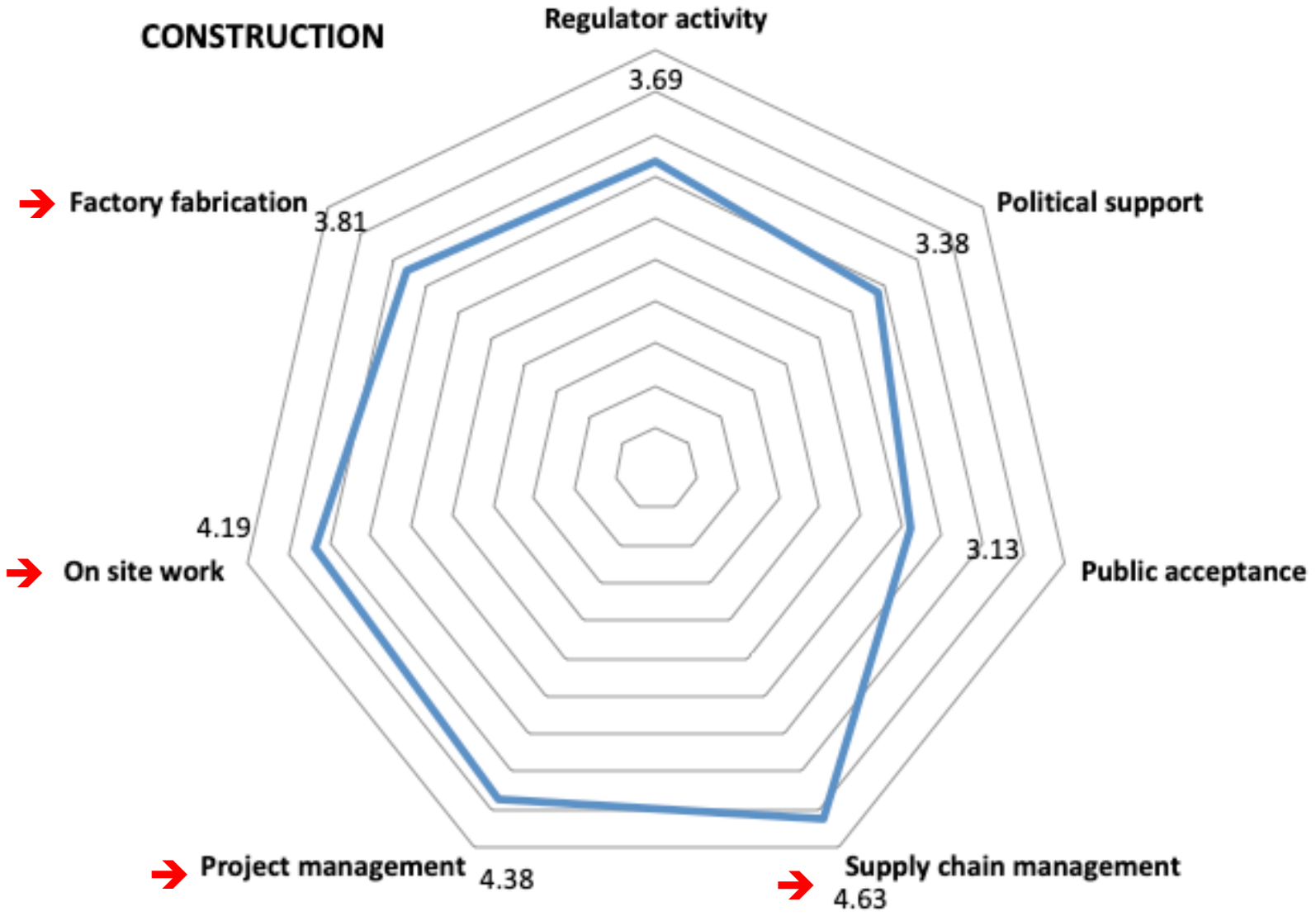
1st level: the risk in lifecycle phases



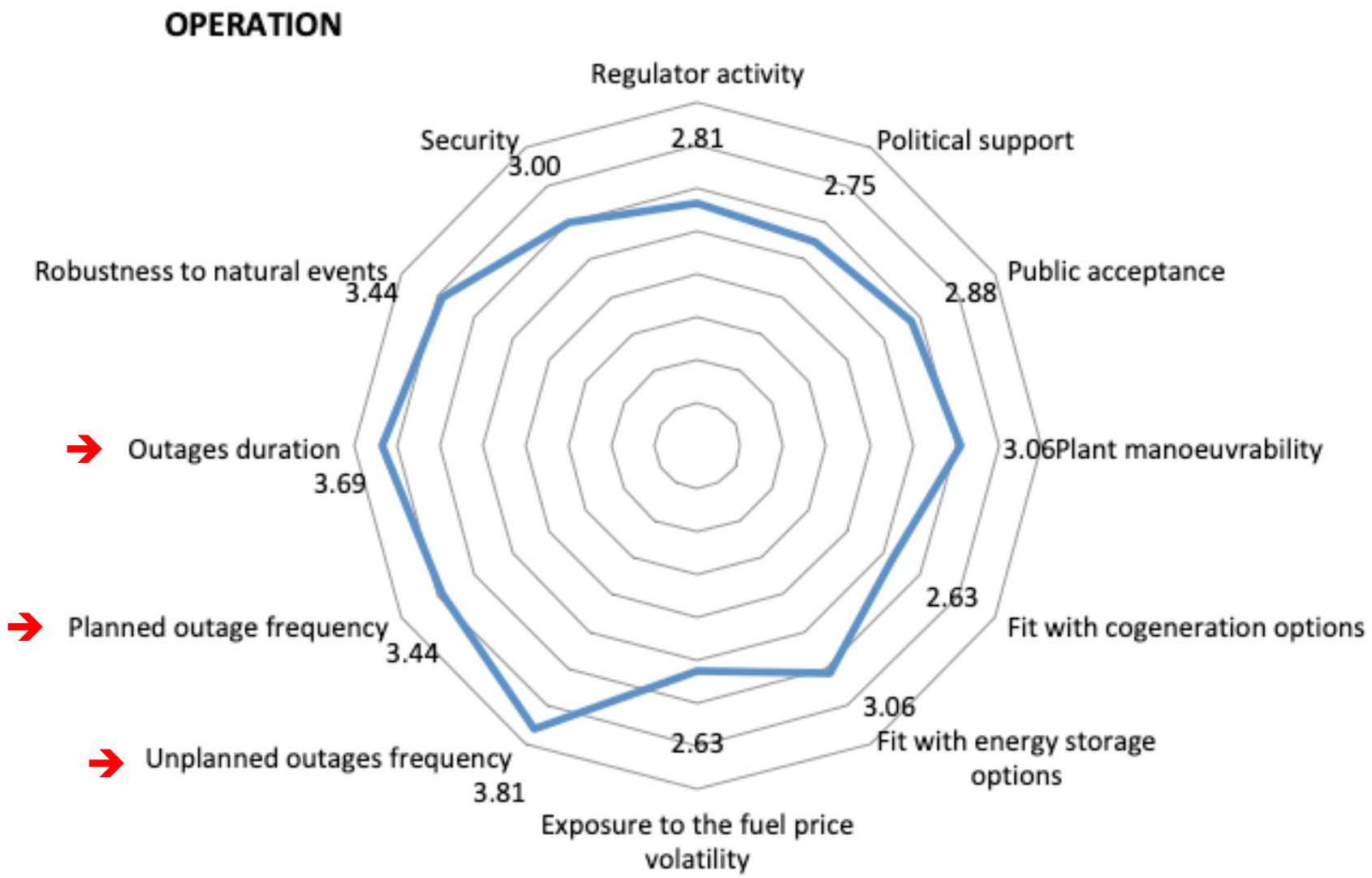
2nd level: risk factors in LICENSING



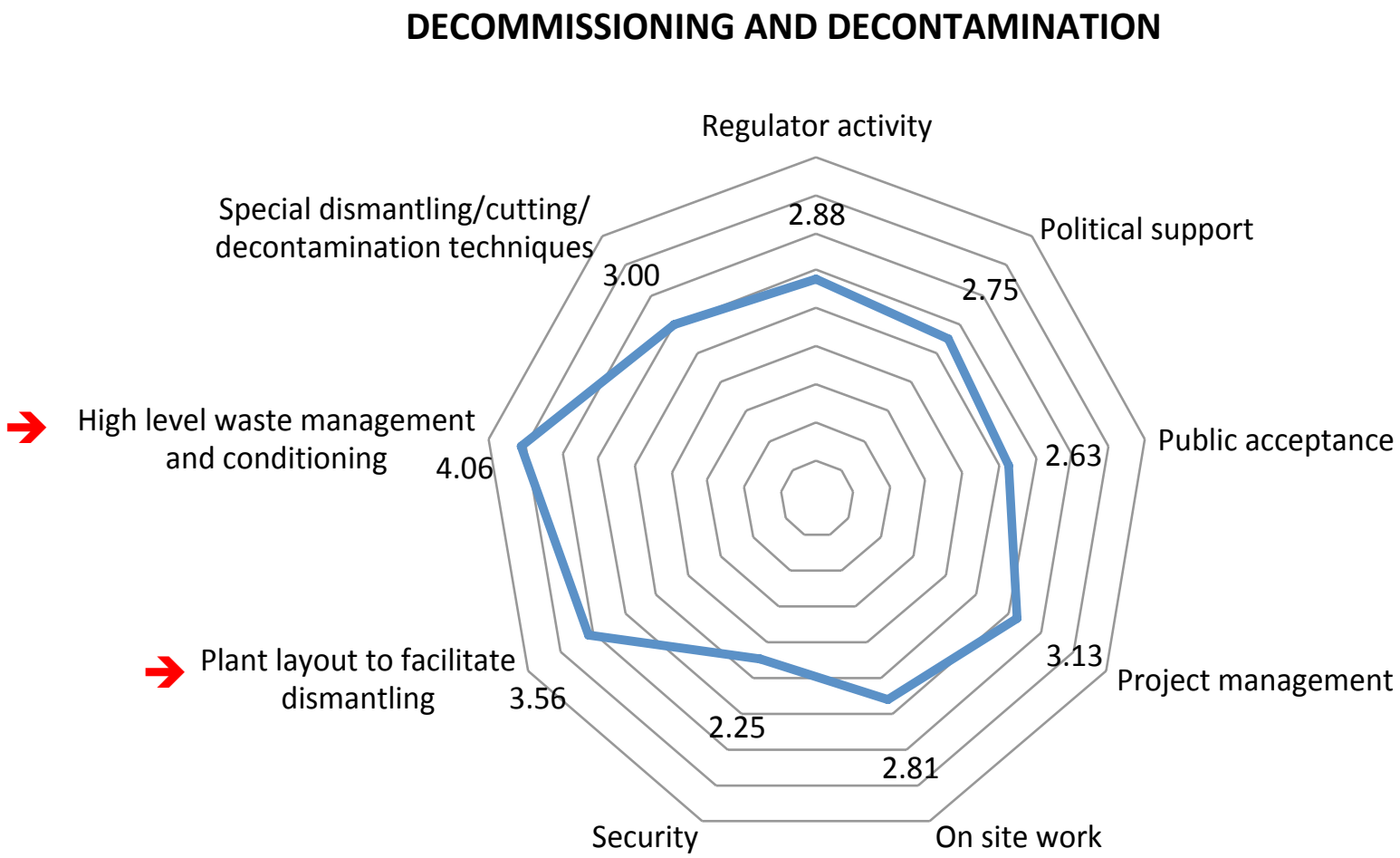
2nd level: risk factors in CONSTRUCTION



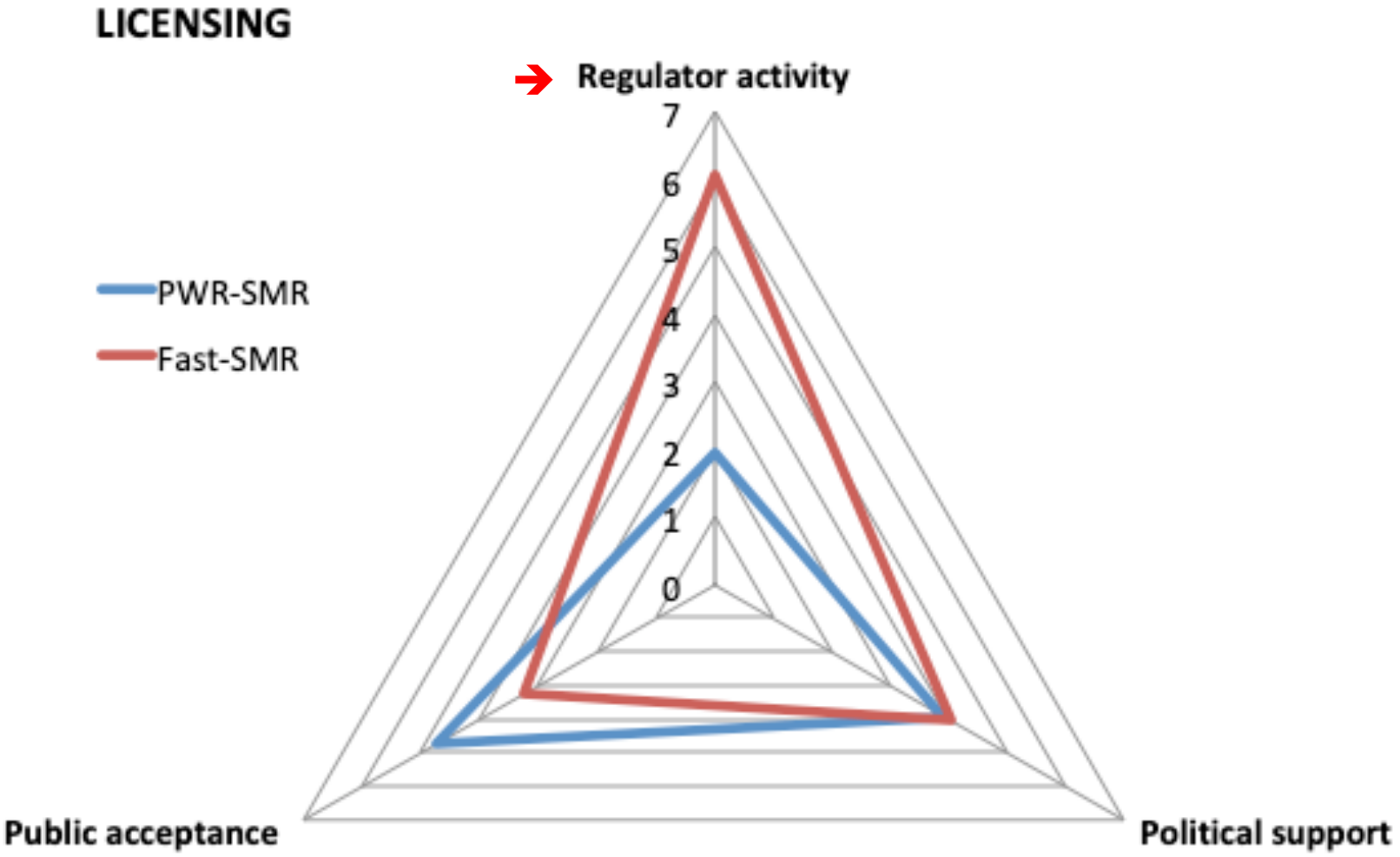
2nd level: risk factors in OPERATION



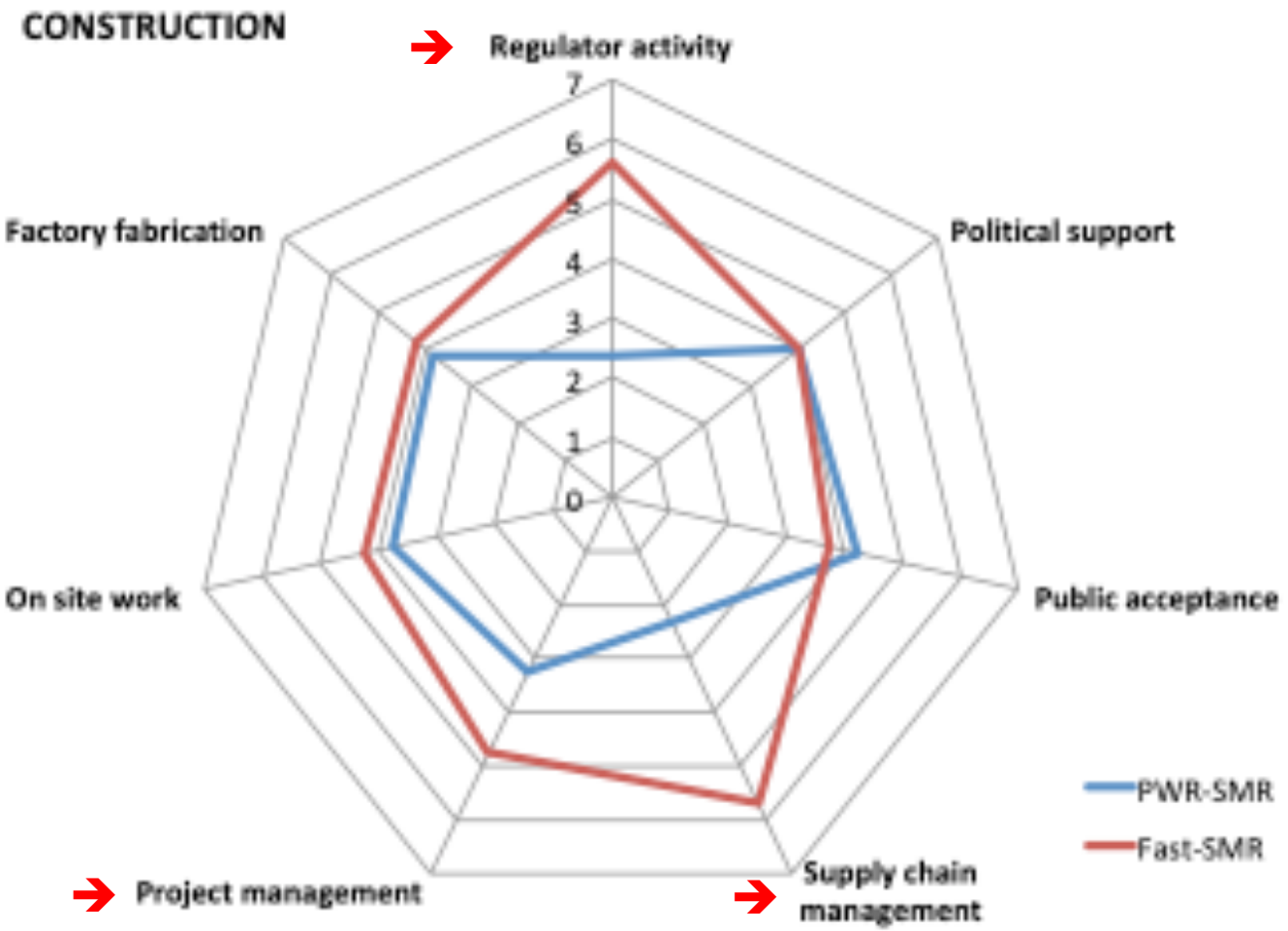
2nd level: risk factors in D&D



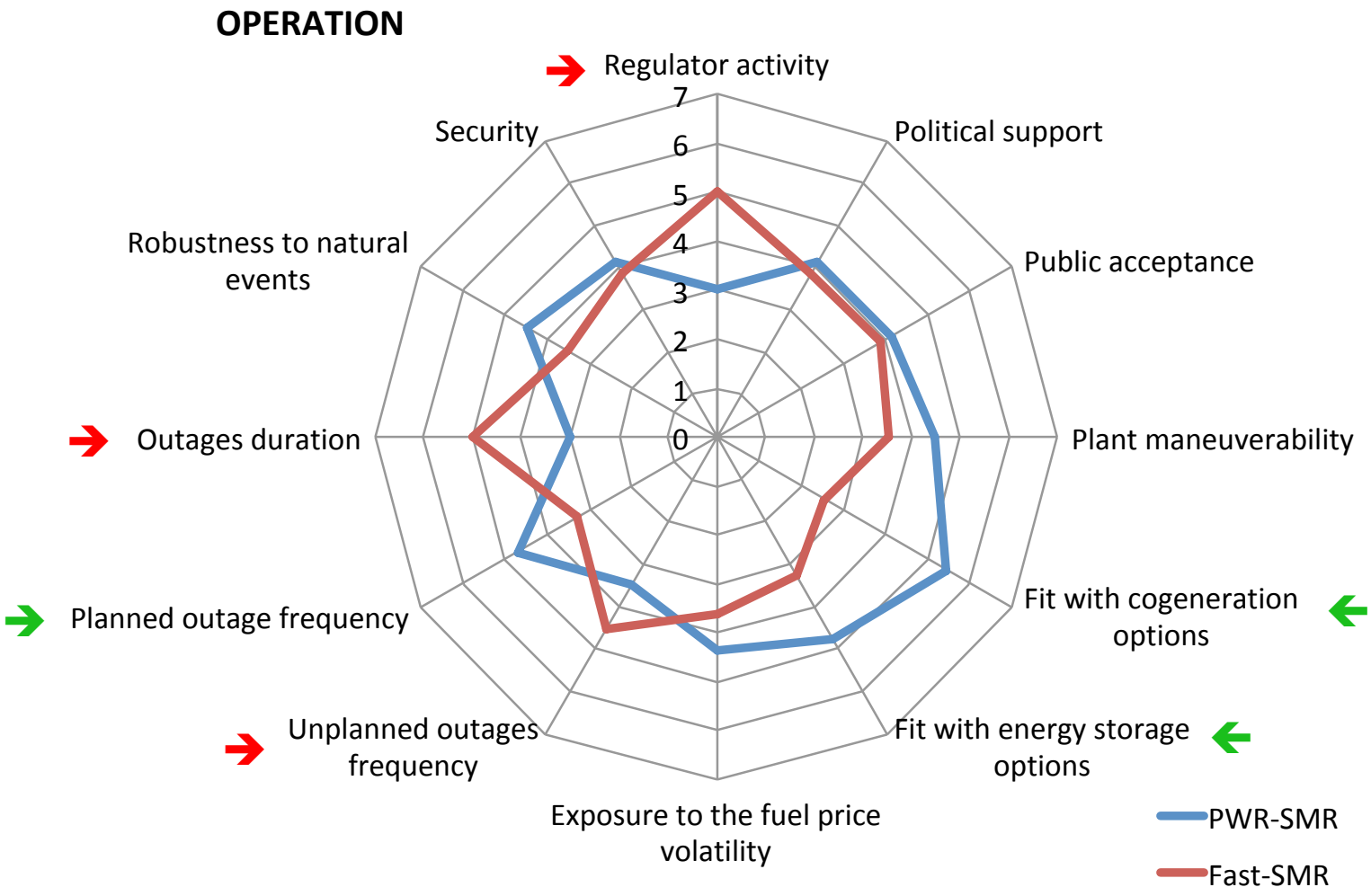
3rd level: comparative risk performance in LICENSING



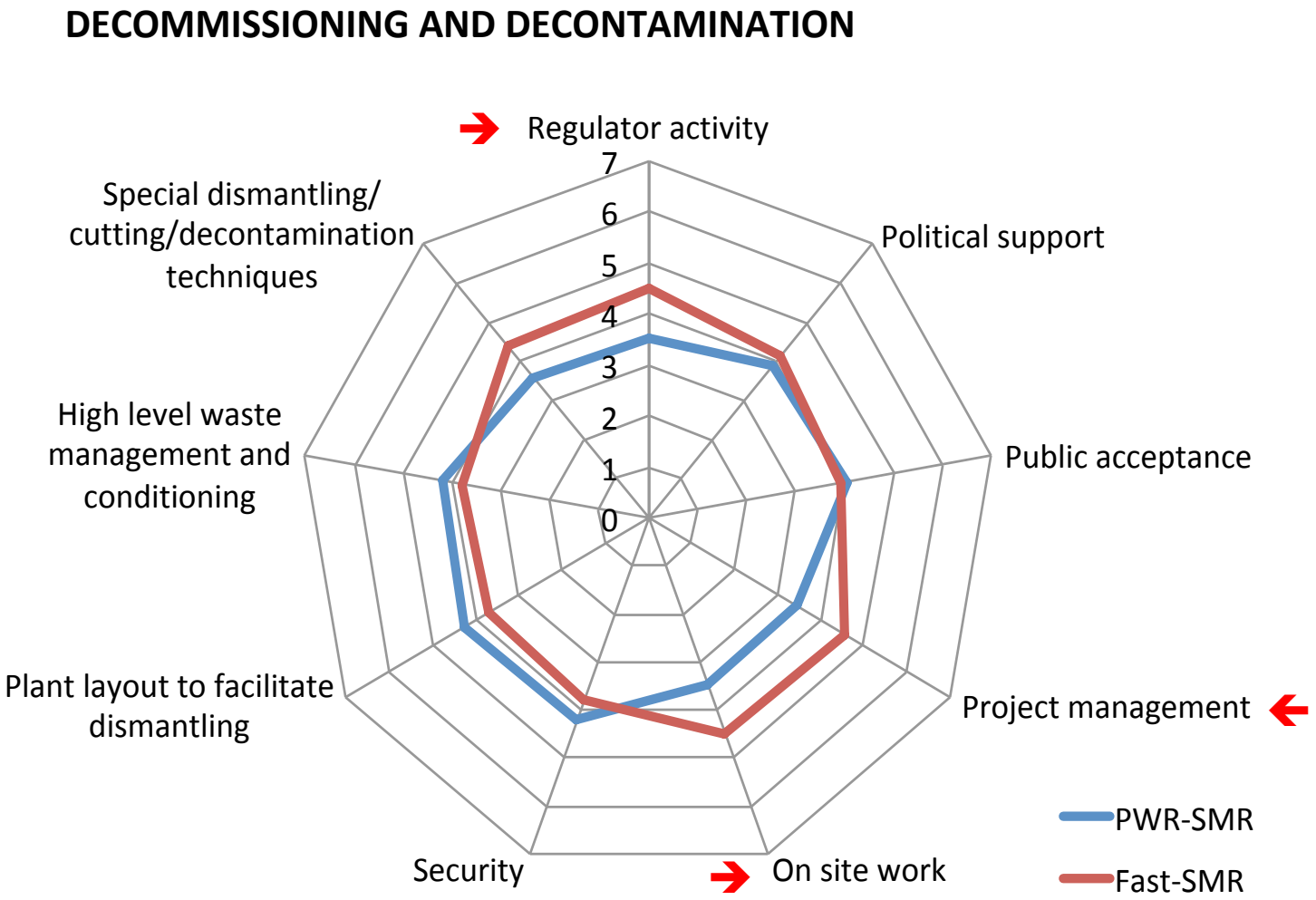
3rd level: comparative risk performance in CONSTRUCTION



3rd level: comparative risk performance in OPERATION



3rd level: comparative risk performance in D&D



Concluding remarks

- **Overall:**
  - Fast SMRs pay for the **novelty of their concept** with higher financial risk perception
  - **PWR SMRs rely on the experience of PWR technology** and keep a competitive advantage in terms of risk perception over Fast SMRs
- **Operation:**
  - Fast SMRs should ensure higher efficiency, flexibility and lower exposure to fuel price, with lower financial risk than PWR technology
  - **higher expected risks of unplanned outages and outage duration** (no track record on operating performance)
- **Construction:** uncertainty on the **supply chain planning, scarce knowledge/trust and lack of experience in project management** of Fast SMRs.

Concluding remarks

- Information and communication effort, the technology demonstration program to increase the knowledge of Fast SMR performance
- **Risk-compensation measures to fill the gap with traditional nuclear plants**
  - New business models such as Contract for Difference, Regulated Asset Base (RAB), the Mankala approach implemented at Olkiluoto-3, etc.
- Government backing to support the technology transition and overcome the free market inefficiency in allocating the resources to long-term, strategic projects with high innovation content.