Economic drivers for robotic and remote systems in decommissioning

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Agenda

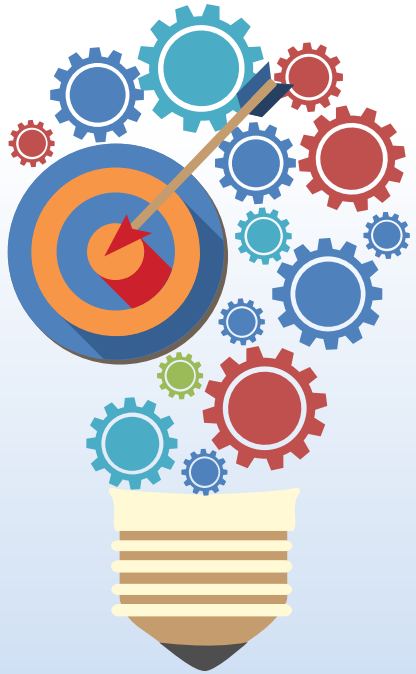
1 Goals of Cost Benefits Analysis Ad-Hoc Group and current status

2 Economic drivers

3 Practical case development - Dessel Experience of FBFC

4 Further steps

MAIN GOALS OF COST BENEFITS AD-HOC GROUP



1

Economic Drivers

What may directly or indirectly influence economic benefits

2

Practical Case

How drivers can be assessed on a real case

3

Global View

Current status of benefits in backend by ISDC

4

Trends

Creativity is the key to success in the great and primary education

5

R&D Prospective

What R&D directions are the most prospective

6

Recommendations

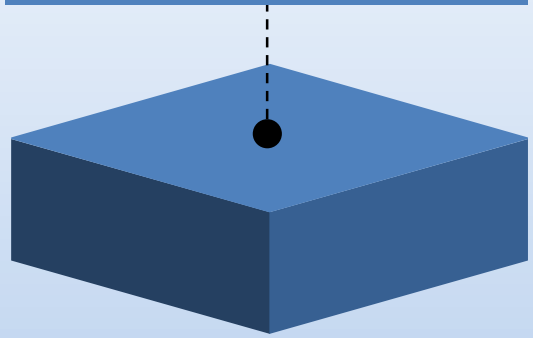
What can be done to support development and implementation of robotics

HYBRID APPROACH – IS THE BEST WAY TO SATISFY DIFFERENT NEEDS

	GENERAL OVERVIEW	CASE DEVELOPMENT	HYBRIDE APPROACH
GLOBAL VISION	✓	✗	✓
TRENDS	✓	✗	✓
PRACTICAL APPROACHES	✗	✓	✓
REFERENCES	✗	✓	✓
CROSS-CUTTING UNDERSTANDING	✗	✗	✓

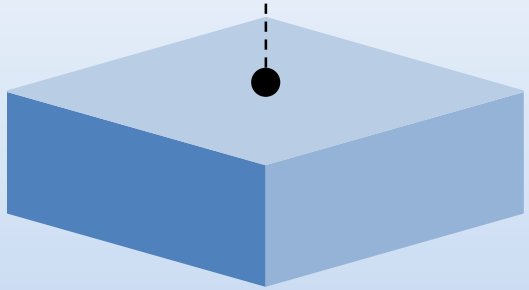
CURRENT STATUS

Determine economic drivers



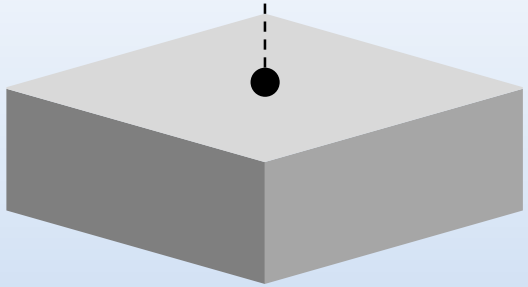
DONE

Develop practical case



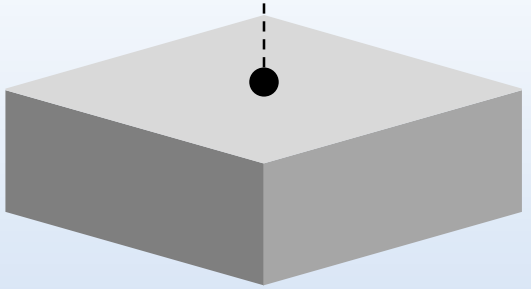
IN PROGRESS

Broad analysis of robotisation based on ISDC structure



TO BE DONE

Vision 2030



TO BE DONE

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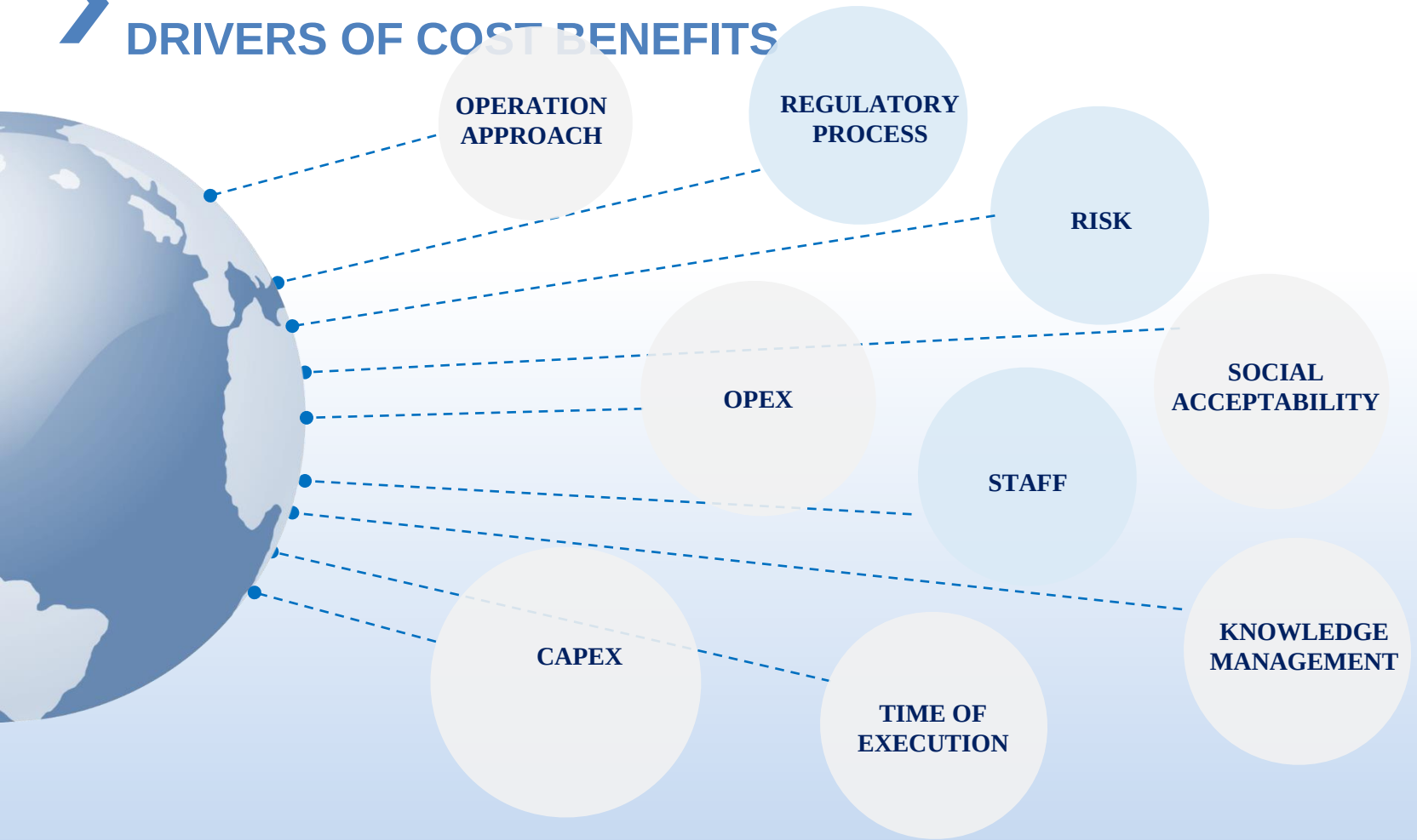
DRIVERS OF COST BENEFITS



Assessment of economic impact of robotics implementation should take into account these drivers in case consider direct and indirect benefits

Describe drivers

OPERATION SCHEME

Operational impact

CAPEX

CAPEX changes

OPEX

OPEX changes

RISKS

Expenses

STAFF

Staff expenses

TIME OF EXECUTION

Execution time

SOCIAL ACCEPTABILITY

Local society to usage robotics and digital AI solutions in D&D

LICENSING & REGULATION

Licensing of robotics and digital solutions

KNOWLEDGE MANAGEMENT

Way of knowledge accumulation

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BELGIAN CASE – FBFC DESSEL (1): ENHANCED RW MANAGMENT

OBJECTIVES

TECHNICAL - SAFETY

Minimimise radioactive waste (in volume) by safe (reliable) sorting

FINANCIAL - COSTS

Minimise radioactive waste management costs

SCHEDULE - TIME

Achieve effectively diversion of materials for timely clearing of site

STARTING SITUATION

Site in advanced decommission state with large amount of site remediation wastes: soil with vegetaion compounds (e.g. roots) and some former building debris

TASK

Safe, effective and efficient radioactive waste management

BELGIAN CASE – FBFC DESSEL (2)

SORTING CRITERIA:

CLEAN	GREY ZONE	RADIOACTIVE WASTE
< 1Bq/g:	**1-10Bq/g:**	**≥10Bq/g:**
unconditional free release.	conditional release. Restricted management – disposal in landfill	Radioactive waste will be diverted according the applicable normative and administrative context

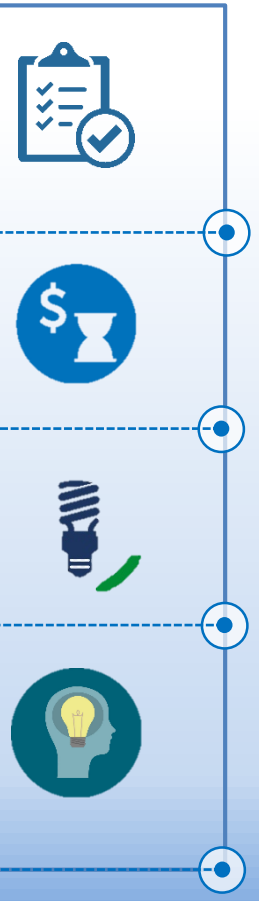
STRATEGY

Maximise unconditional release of materials (unrestricted use). In first instance, this sand was and will be used to refill the excavation on site	With a dedicated license granted by the Belgian authority, this material was transferred in big bags to a conventional landfill for hazardous waste	transferred to the Belgian national radioactive waste management agency (ONDRAF/NIRAS)

BELGIAN CASE – FBFC DESSEL (3)

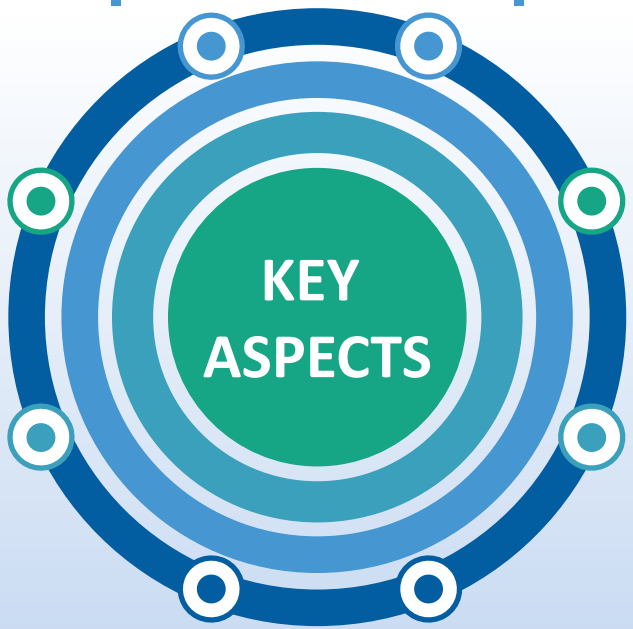
TECHNOLOGY AND ECONOMY ASPECTS:

1. **MUST BE ACCEPTED BY THE REGULATORY AUTHORITY (SAFE)**
2. **MUST BE TECHNICALLY RELIABLE (EFFECTIVE)**
3. **MUST BE PRODUCTIVE (EFFICIENT)**
4. **MUST FOLLOW THE ECONOMIC RATIONALE:**
   - Achieve result with minimal costs
   - Achieve a maximum result with available resources
   - Cost-Benefit-.Analysis (CBA) for justification



BELGIAN CASE – FBFC DESSEL (4)

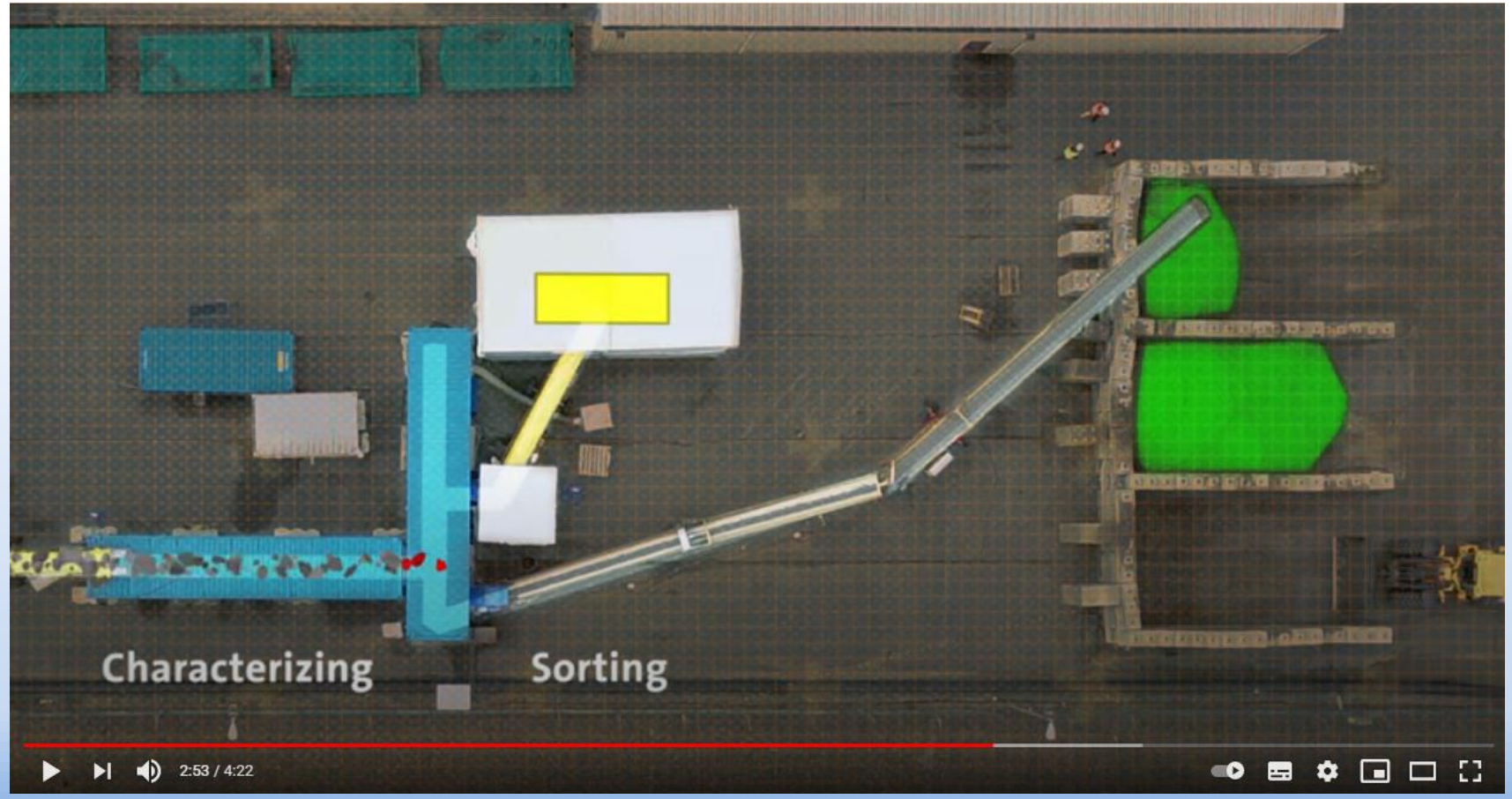
CHOSEN TECHNOLOGY AND APPROACH:



1. CONTINUOUS MEASUREMENT AND SORTING ON RUNNING MATERIAL FLOW
2. HIGH EFFICIENCY DETECTORS (GETL - DETECTORS)
3. OPTIMISED AND RELIABLE ARRANGEMENT OF DETECTORS (SUBSTANTIATION AND REDUNDANCY)
4. AUTOMATED CONTROL (PROGRAMMABLE LOGIC CONTROL - PLC)
5. CLOSE COORDINATION WITH REGULATORY BODY
6. PROOF OF EFFECTIVENESS AND PRODUCTIVITY DURING COMMISSIONING AND NORMAL OPERATION (INCLUDING PROGRAMMED CHECKS AND SPOT CHECKS)
7. RETURN OF EXPERIENCE FROM SIMILAR PROJECT
8. REFERENCE BASIS FOR KEY ELEMENTS (NO SCIENCE FICTION BUT PROVEN ELEMENTS)

BELGIAN CASE – FBFC DESSEL (5) VIDEO

https://www.youtube.com/watch?v=klj6yOl1XZs



OVERVIEW OF DESSEL CHARACTERIZATION CASE:

BELGIAN CASE – FBFC DESSEL (6)

About 38 000 tons of soil have been excavated and sent through the sorting equipment FREMES within 12 months of operation (01-12/2018) with following results:

36 000 TONS

Unconditionally released

~2 000 TONS

Sent in a landfill

~1,3 TONS

Sent to ONDRAF/NIRAS as radioactive waste (> 10 Bq/g)

THE RESULTS MAKES EVIDENT THE MERRIT TO USE AN ENHANCED AUTOMATED TECHNOLOGY

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Timeframe and scale classification of effects

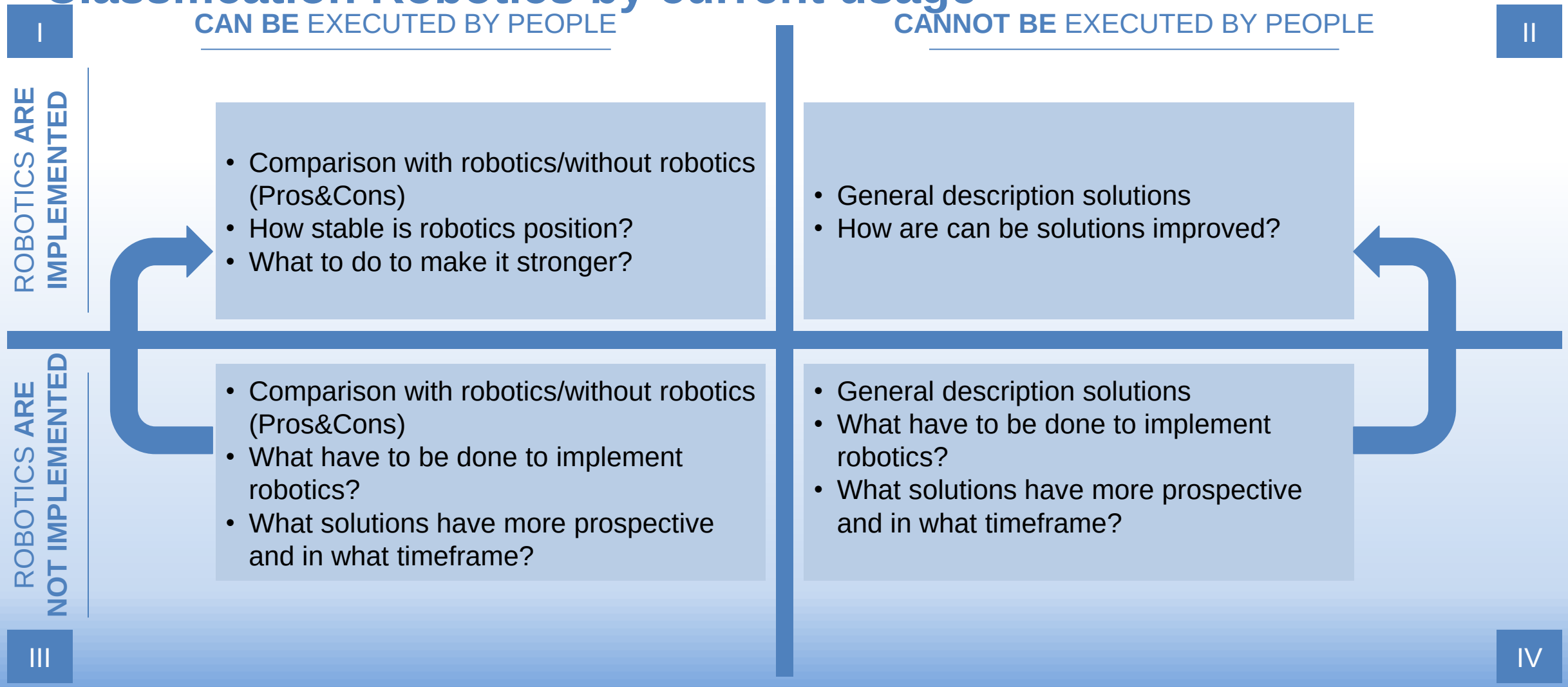
There are 4 timeframes:

1. **Immediate –** cost benefits may be achieved at one step of project
2. **Short-term –** cost benefits may be achieved on one stage of project
3. **Midterm –** cost benefits may be achieved on all stages of project
4. **Long-term –** cost benefits may be achieved at a few projects

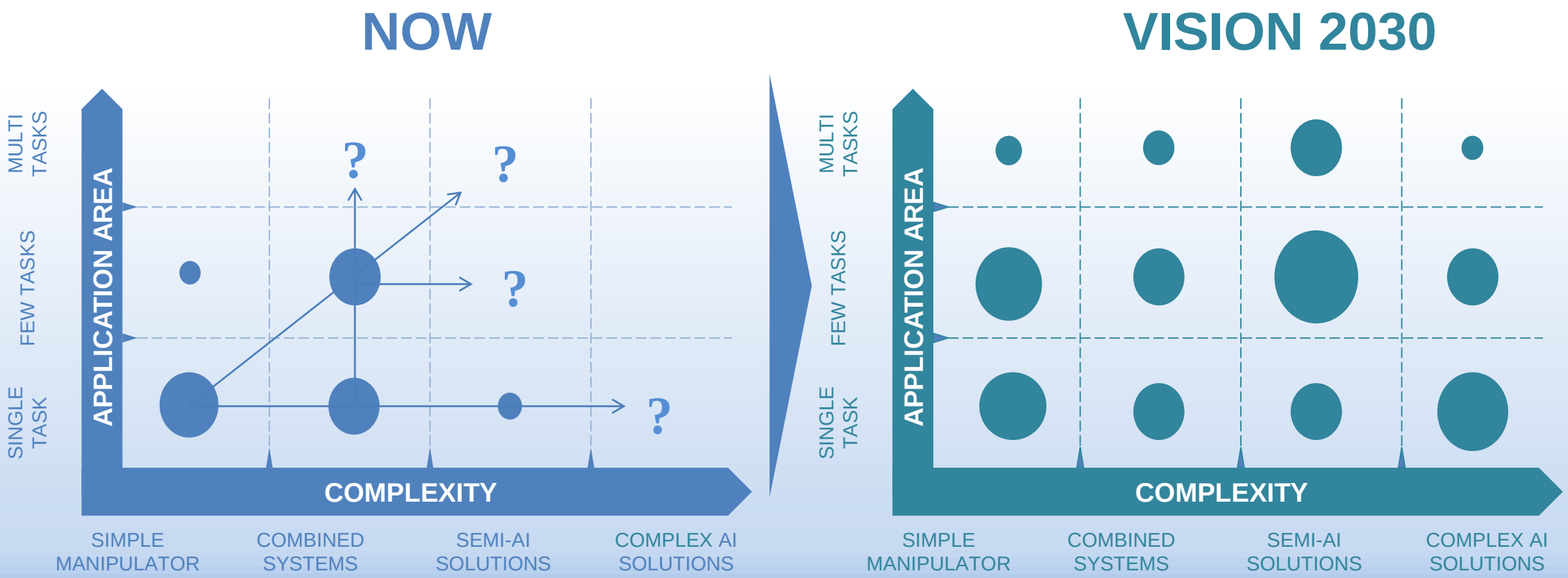
There are 5 scales:

1. **Step –** cost benefits may be achieved at one step of project
2. **Stage –** cost benefits may be achieved on one stage of project
3. **Project –** cost benefits may be achieved in a project
4. **Group of projects –** cost benefits may be achieved in a few projects
5. **Global –** cost benefits may be achieved in case of global implementation

Classification Robotics by current usage



FORECAST OF ROBOTICS, REMOTE AND DIGITAL DEVELOPMENT TRENDS FROM ECONOMIC



THANK YOU