Futuribles

INTERMIN WP2 – BRGM
Foresight process and system definition

Madrid, January 30th, 2019

Part I : Foresight

Philosophy and Definitions

Foresight vs Forecasting

- Foresight
  - Global approach
  - Quantification and qualification
  - Considering discontinuities and ruptures
  - The risk: CHAOS effect (lost in the « if… then »s)

- Forecasting
  - Partial and sectoral approach
  - Built through numbers
  - Continuity principle
  - The risk: GIGO effect (garbage in, garbage out)

The simulation tools

- Foresight : scenarios
  - The base and its relevance ?
  - The path and the complexity of the routes ?
  - The final pictures

- Forecasting : models (comes from hard sciences)
  - The logic of the formulas and their perenity ?
  - The components of the system and their autonomy ?
  - The input data

But a complementary use of methods
Numbers about the future are not more « true » than words

The Foresight Process

Three essential features:

- The systemic approach
- The long-term dimension
- Discontinuities and changes

« see large, in depth , with a long view and keep humankind in mind » G. Berger

BASIC IDEAS BEHIND FORESIGHT

➢ The Future, a Realm of Freedom

- ➢ It is open to many possible futures (futur-ibles)
- ➢ Just useful signs : heavy trends, emerging trends and weak signals

➢ The Future, a Realm of Power

- ➢ Urgent = already too late

➢ The Future, a Realm of Will

- ➢ Opportunities and threats make sense only if one has a goal

Foresight not to guess exactly the future but to explore :
what may happen ? Then, what can we do (strategy) ?
Exploratory, then Normative foresight (values)

Exploratory scenarios : what may happen ?

- **the possible futures : issues, range of action**
  - from the possible futures (of mining and raw material) to issues revealed term of required skills

Strategy : process to perform a specified goal though time. Detailed in planning. Bound to a decided goal/vision in the future

Glossary

- **Foresight:** *A systematic, participatory and multi-disciplinary approach to explore mid- to long-term futures and drivers of change.*

- **Prospective:** *Refers to the French foresight method "La Prospective" which is based on the principle foresight is meant to lead to provoke strategic action.*

- **Driver**: *Factors causing change, affecting or shaping the future (drivers are a mix of factor and actor)*

- **Trend:** *General (factor) tendency or direction of a movement/change over time. A trend may be strong or weak, increasing, decreasing or stable. There is no guarantee that a trend observed in the past will continue in the future.*
- **Heavy trend:** *a trend that cannot be reversed at a specific horizon, lead to one hypothesis.*
- ***Main (tendencial) trend :*** *continuing trend from the past to the future. Not always the most probable : things change*

- **Weak Signal:** *An early indication of a potentially important new event or emerging phenomenon that could become an emerging pattern, a major driver or the source of a new hypothesis.*

- **Hypothesis:** *assumption about a specific driver for at a time horizon*

- **Scenario:** *A description of how the future may unfold according to an explicit, coherent and internally consistent set of assumptions about key relationships and driving forces*

Part II
SCENARIO METHOD
STEP BY STEP

Why the scenario method

- An assembly of engineering tools specific to foresight (not the base tools)
  - A rationale process
  - A common language

- Creativity limited by logic and rationale :
  - *Pertinent* driver describing the system
  - *Possible* hypothesis for each driver
  - *Consistent* links between drivers (scenarios)

The Foresight Process

1. **Define** the problem/topic, boundaries, and horizon
2. **Identify** key variables and their relationship
3. **Build** different hypotheses variable by variable
4. **Explore** possible evolutions by assembling hypotheses
5. **List** possible futures and their paths
6. (**Construct** strategic options)

IN EACH CASE

- Do not confuse possible, probable and main trend future

- Identify drivers influencing demand and offer mining and raw material sector

PHASE 1 – TOPIC AND HORIZON

TOPIC DEFINITION

The future of mining and raw material sector to deduce future competencies

→ Geographical scope : EU inc. Russia, Turkey ; Australia, Canada, Japan, South Africa, USA, Brazil, Chile, Mexico…..

→ Typology proposal for mining countries : OECD/rich countries and emerging countries

HORIZON

→ 15 years ; 2035 and deployment to 2050 ;

WORKING PROCESS

→ Expert foresight (researchers)

PHASE 2 – BUILDING THE DRIVERS SYSTEM

- **IDENTIFY KEY DRIVERS OR VARIABLES** (ACTORS/FACTORS)
  → Internal /External to the foresight topic

(functional analysis)

- **GRADE/SORT THE DRIVERS** (DRIVING FORCE ; INFLUENCE ; UNCERTAINTY)

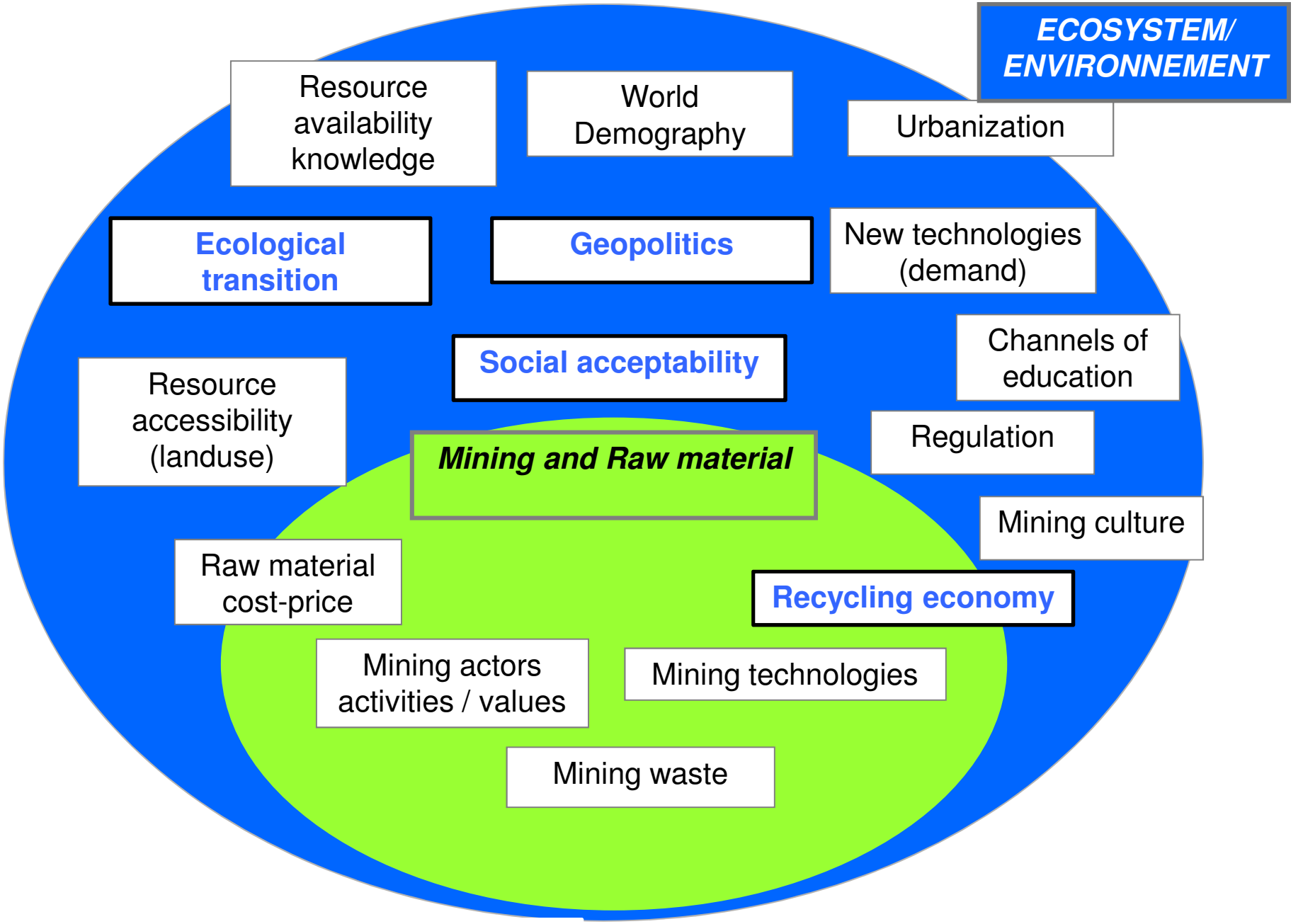
No foresight in vitro

PHASE 2 : THE DRIVERS

- **DRIVERS = FACTORS + ACTORS**
- **IDENTIFY THE DRIVERS**
- **HOW TO (Delphi, creativity/Metaplan)**
  - **EXPERTS**
  - **ACTORS/STAKEHOLDERS**
  - **LITERATURE**
  - **SURVEYS**
  - **BRAIN STORMING**

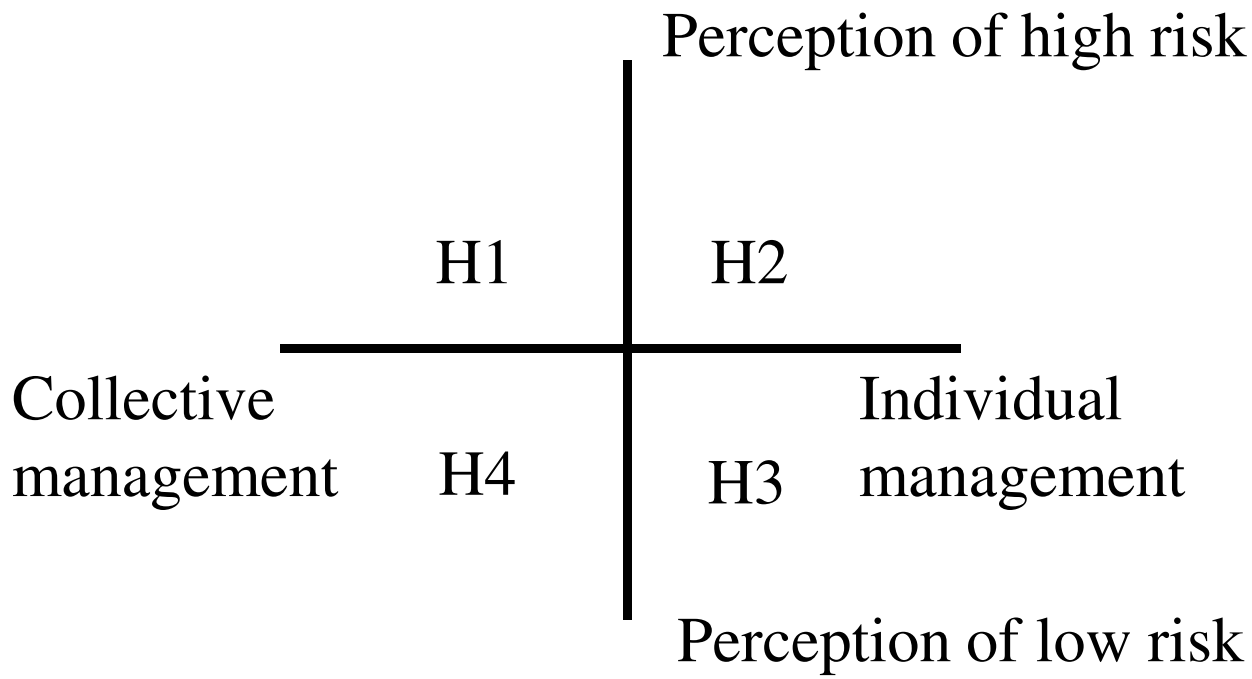
Study duration is bound to the number of drivers thus limited to 6 to 8 drivers for the INTERMIN Project

Goal : drivers shaping the future of mining and raw material sector (BRGM 1/25th)



- max : 5 possible hypotheses
- max : 2 uncertainty level by driver

Example : Perception of risk and management



BUILDING THE HYPOTHESIS

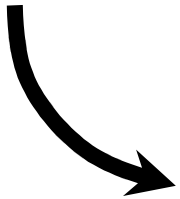
FOR THE KEY-VARIABLES

1. THE PAST EVOLUTION

2. THE CONTINUOUS TREND

3. PRECISE THE POSSIBLE WILD CARDS, FACTORS OF DISCONTINUITIES

5 MAJOR PROBLEMS
1. INDICATORS
2. DATA
3. TIME SERIES
4. CAUSES
5. IDEAS



CLEARLY INDEPENDANT HYPOTHESIS ABOUT THE KEY-VARIABLES FUTURE STATE

DRIVER FILE

A template to fill for each key variable :

Driver name

1. Definition
2. Indicators : numbers or facts
3. Past evolution : what ?, how and by who's influence
   - ↗ Weak signals - uncertainties
4. **Hypotheses 2035 (and evolution to 2050)** : a name and definition for each hypothesis
5. (Actors involved)

A watch system if maintained to organize knowledge

Questions to find contrasted foresight hypotheses :

- **Is there a threshold ? ,**
- **A change of actors ruling ? ,**
- **of geographical scale ? ,**
- **similarities with other activities … : ideas !**

Driver file documentation :
- arguments about the possible hypotheses
- The “scientific base”

Phase 3 FROM DRIVERS TO HYPOTHESES

- **NO FORESIGHT WITHOUT WATCH**

But dynamic watch (trends)
The purpose of the driver file : arguments about hypotheses

- **FORESIGHT BUILTS A WATCH SYSTEM**

Drivers documentation files : a watch system if updated

- **Each hypothese covers the all range of the driver**

  - **Hypotheses are mutually exclusives**

For drivers related to mining countries :
possibly 2 sets of hypotheses
-OECD countries
-Emerging countries

Key drivers

1. Sterility rate
2. Age for first child
3. Infant and motherood care an services
4. Dwelling
5. Female employment (first job age)
6. Child wish
7. …

Hypotheses

H1	H2	**H3**	
H1	**H2**	H3	
H1	H2	H3	**H4**
H1	**H2**	H3	
H1	**H2**	H3	H4
H1	H2	**H3**	H4

System « fertility » scenarios

A 1	A 2	A 3

PHASE 5 – USE AND LIMITS OF SCENARIOS

- **THE BASIS** : is our scanning of the « system » correct ?
- **THE PATHS : IF, THEN ?**
  Taking dynamic evolution and drivers links into account
- **THE FINAL PICTURES**

Watch time horizon and levels of magnitude

In practice:

- « main trend scenario » (if possible)

- Find different « engine » for each scenario

- scenario consistency : ability to tell credible different stories (hypotheses) with the same ingredients (key drivers)

- Possible and contrasted scenarios : the black, le white, the grey versus rue choices to raise debate

- Scenario writing
  - Who, what format (beware of PowerPoint) ?
  - technical writing/communicational writing

Study impacts of scenarios on

- activities,
- **human resources,**
- regulation,
- research topic,
- Etc.

General : Risk and opportunities for different actors (range of action) or SWOT analysis for a specific organization or territory

- Our case : impact of each scenario on skills and competencies
- Importance of skills/competencies bound to their occurrence in several scenarios

Workshop 1 : Topic and horizon

• Future of mining and raw material sector by 2035 (and evolution 2050)

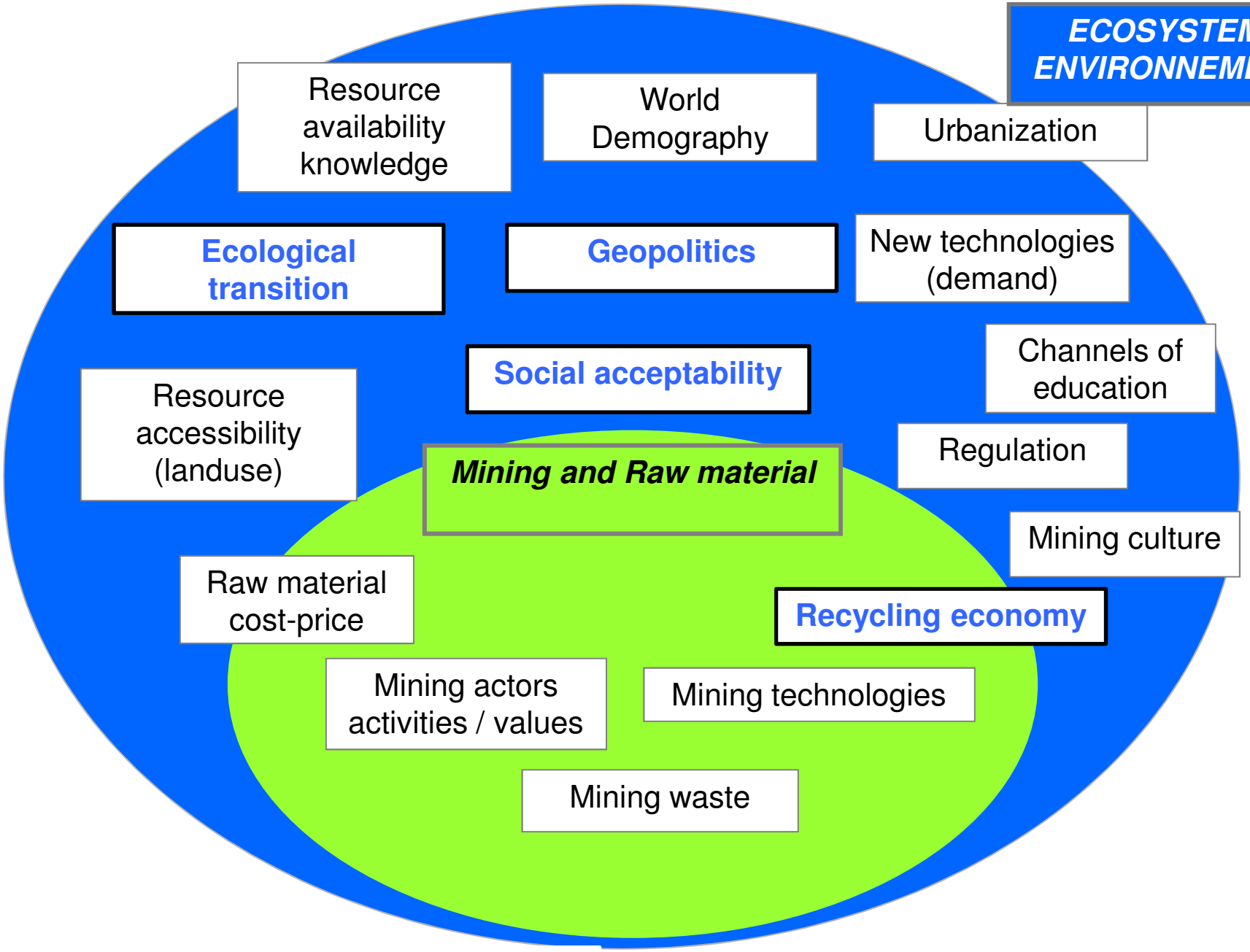
➢ to deduce skills required in each scenario

Workshop 1: Drivers (performed January 25th in Orleans)

What are the factors (actors) impacting/influencing the development of mining and raw material sector ?

➢ list **5 main influencing factors** /actors influencing mining ad raw materal sector
➢collective collecting of ideas / mapping drivers

Goal : drivers shaping the future of mining and raw material sector



Workshop 2 : Sorting the drivers

- Place the collected drivers in a graph importance/uncertainty (driver comparison)
- We keep only 6 to 8 most important and uncertain drivers
- Other possible drivers : heavy trends (one hypothesis) or secondary drivers (disregarded)

Workshop 3: Definition /documentation

- Clear definition of each driver
- Possible indicators : to measure evolution through time (incl. facts)
- Documentation sources to gather dynamic evolutions (indicators) of each driver

Workshop 2 : Sorting the drivers

Demand drivers	Definition/rationale
World demography	Raw material consumption is bound to the number of people and individual consumption for quarries materials and equipment (cell phones….)
Urbanization	World Urbanization lead to an increase in building (quarries) material which is less true for rural population using more local materials
Resource accessibility	Land use conflicts due to urbanization or biodiversity protection (protected areas) may limit raw material accessibility and lead to raw material mining in new places: ocean grounds, Arctic or Antarctic areas, space.
Resource availability and knowledge	Resource availability and knowledge including depth of the resource for the geographical scope of Intermin project (Europe, Australia, USA, Chile…)
Geopolitics	Geopolitical context of countries with resources, condition of access (from bribery, quotas, to sustainable label ?)
Regulation /legislation	Environmental impact regulation, taxation, exploitation permits

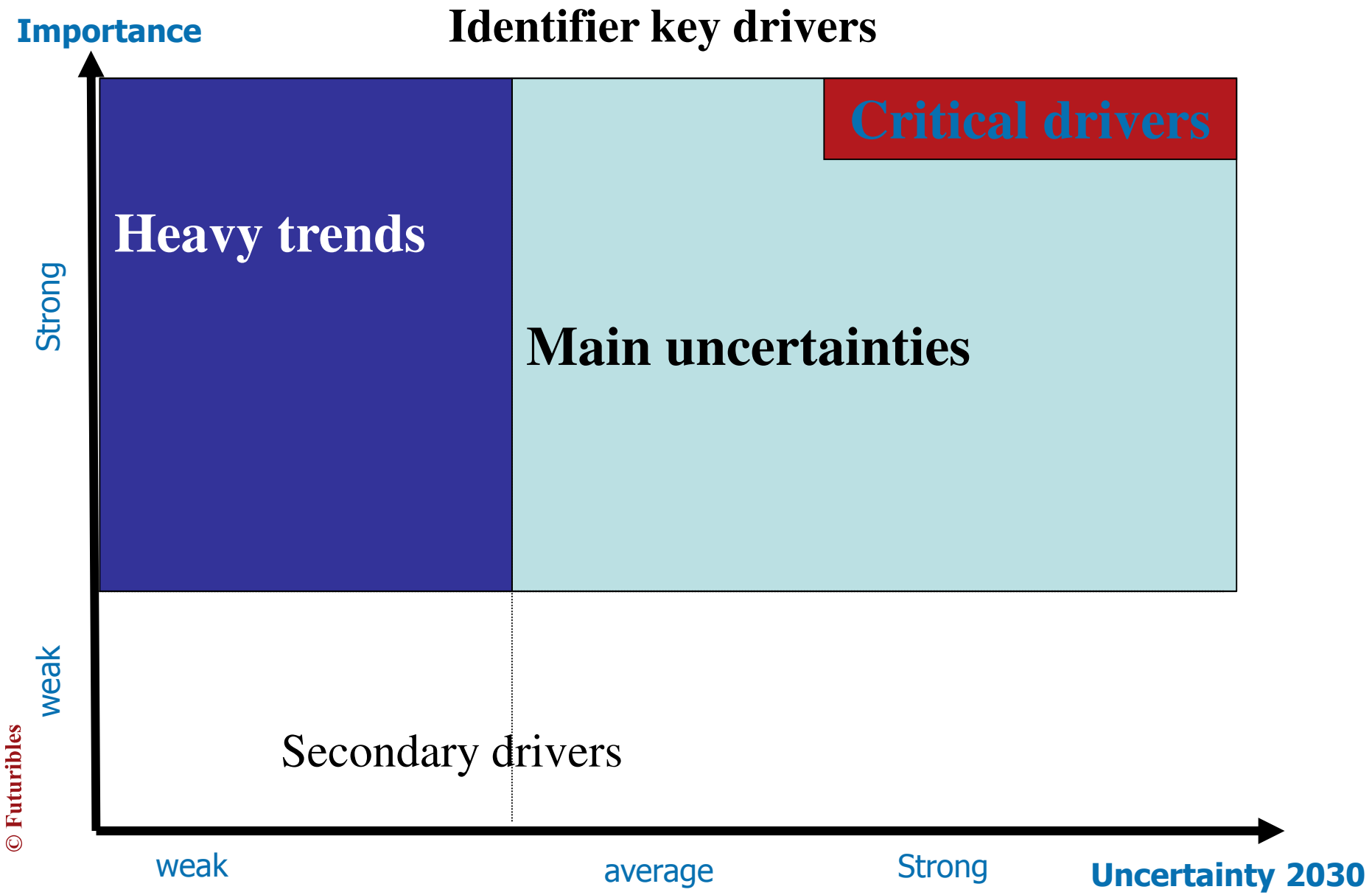
Workshop 2 : Sorting the drivers

Demand drivers	Definition/rationale
Social acceptability	Environmental consciousness and acceptability bound to mining and material processing ("not in my backyard", acceptability of impact transfer to other countries….)
Mining culture	Mining history and culture/view of mining
Ecological (energy and digital) transition	As a proxy of mineral and specific material demand, pace of the energy and digital transition
New technologies	New technologies (digital, batteries…) requiring new materials
Channels of education including field experience	Channel to access knowledge and competencies especially about field experience (enhanced or virtual reality ?)

Workshop 2 : Sorting the drivers

Mining or offer drivers	Definition /rationale
Recycling and circular economy	Waste treatment, recycling technologies or business models like service economy (rent a product instead of selling it)
Mining and processing actors and activities	Number of actors and strategy on the value chain (mining, processing, recycling) ; corporate social responsibility
Price and production cost of raw material	The profitability of raw material production is driving mining choices of companies
Companies technologies to find, access and process materials	Technological improvement in finding, accessing and processing raw material, including artificial intelligence
Mining waste	Mining waste use /valorization

Workshop 2 : sorting drivers (max 8 drivers)



Driver name /definition	Indicators	Documentation sources
Driver 1		
Driver 2		
Driver 3		
Driver 4		
Driver 5		
Driver 6		
…		

- This part can be done by remote work
- Driver files shared among researchers WP2.2 ?
- **Time series**

DRIVER FILE

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NEXT STEPS

- Drivers files and hypotheses per driver to discuss (February to April 2/3 half day remote meeting)

- Scenario meeting in May/June