LIUC
Università Cattaneo

Innovation Management and New Product Development

Technology intelligence

Agenda of today

- **Short Recap**
- **Technology intelligence tools**

Short Recap

- **Technology Intelligence**
- **Technology intelligence tools**
  - S-Curves

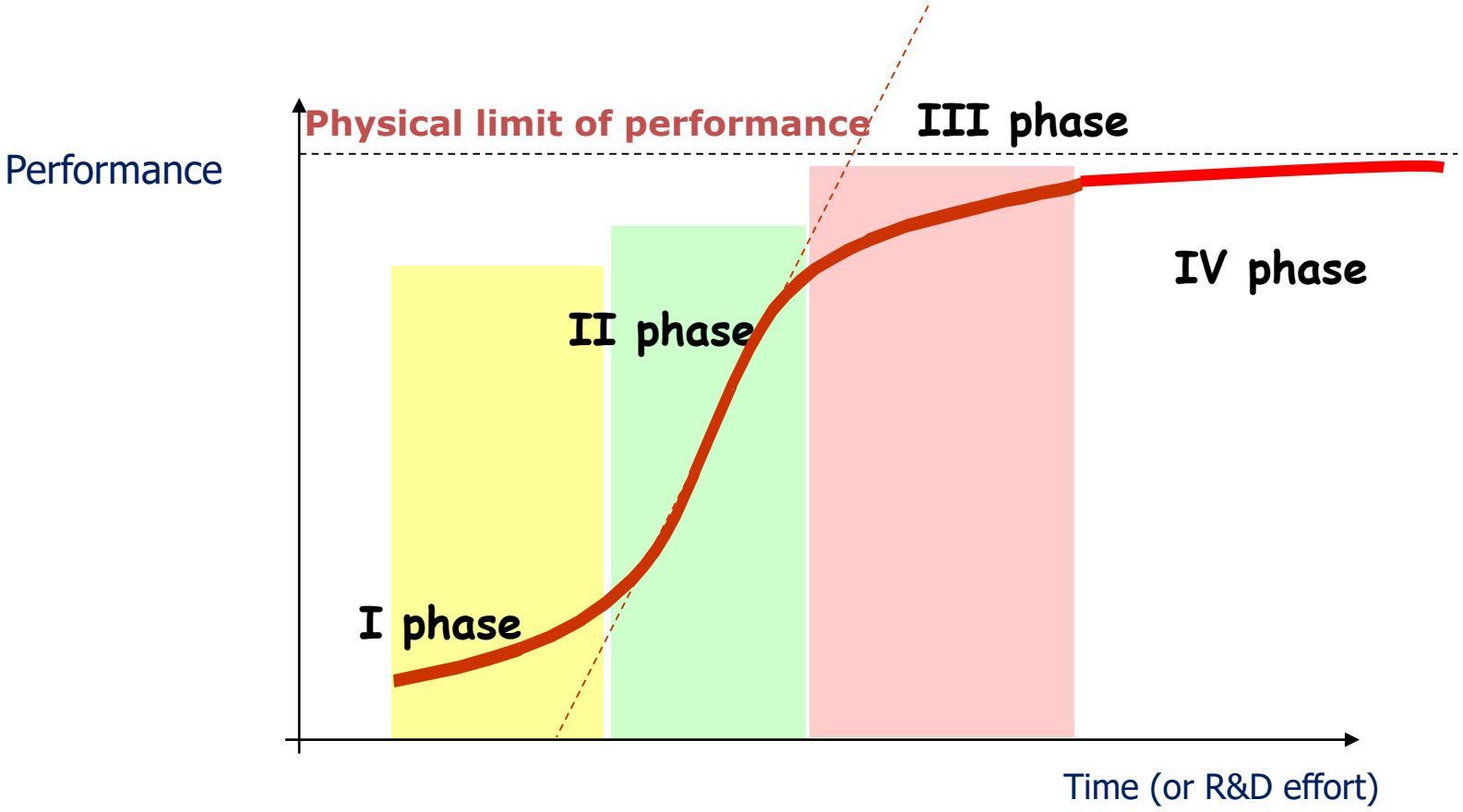
Short Recap

- What Technology Intelligence is
- Main Steps

Technology Intelligence Methods

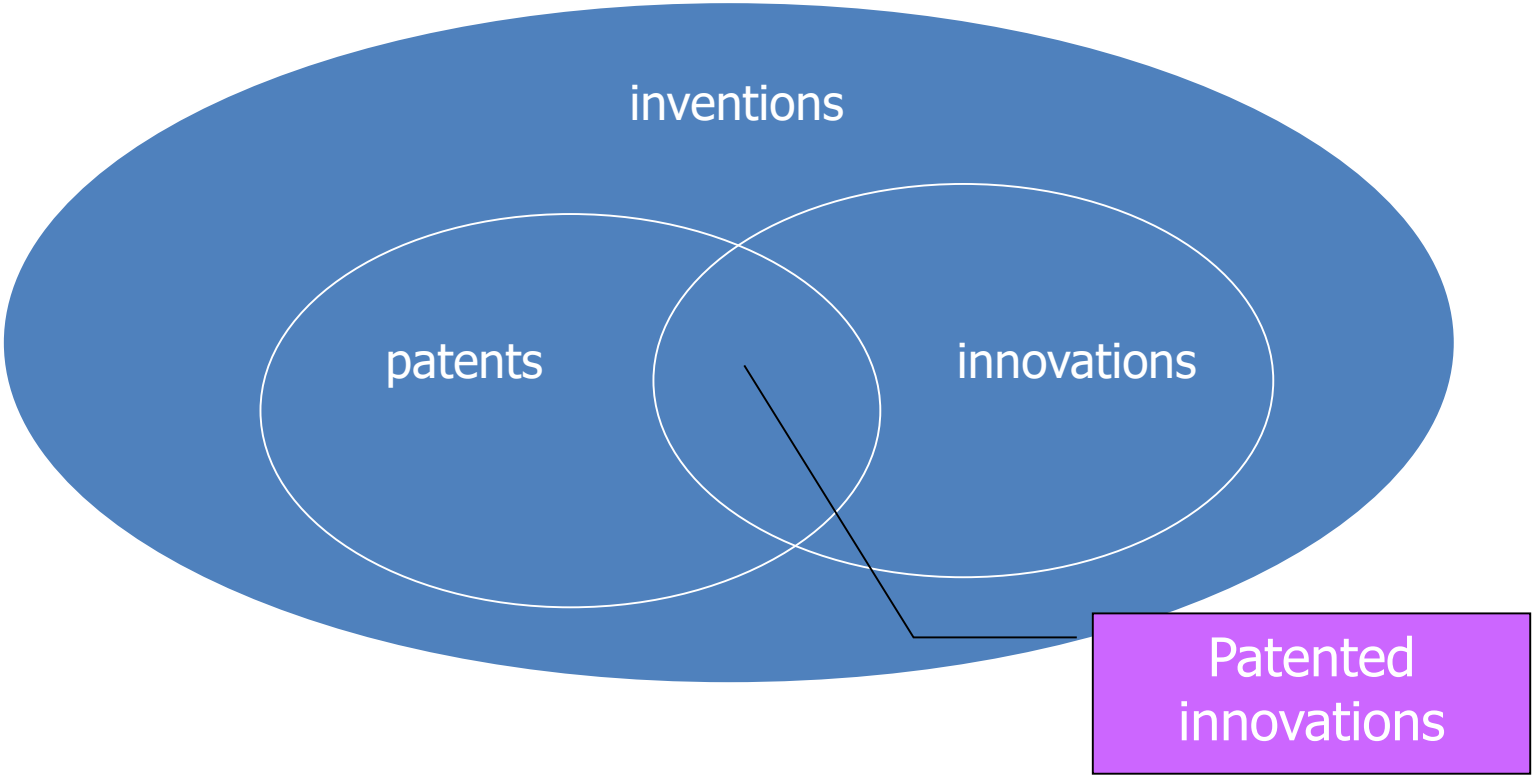
- S-curve
- Patent analysis
- Publication analysis
- Scenario analysis
- Road-mapping
- Relevance trees
- Brainstorming
- Delphi method
- Skill – application matrix
- Benchmarking
- Lead users analysis
- Quality function deployment
- Technical innovation audit
- ……

S-curve


Performance
Physical limit of performance
III phase
IV phase
II phase
I phase
Time (or R&D effort)

Patent analysis

- Patents represent a highly relevant information source, even if:
  - Not all innovations are patented
  - What is patented is not always an innovation



Patent analysis

- Patent analysis can be used to:
  - Understand the positioning of a technology in its lifecycle
  - Identify and monitor major technological competitors
  - Valuate technological positioning with respect to competitors
  - Compare the patent strategy against competitors
  - Communicate the innovation activity

Databases Link

https://poldham.github.io/Patent-Databases/

Publication analysis

- Use of databases of scientific and technical publications to verify:
  - The frequency of occurrence of papers on a specific technology
  - The citations of such papers
    - Indication of quality
    - Indication of correlations among different science – technology areas

Scenario analysis

- Scenario analysis describes «realistic» future states and the different possible patterns towards those future states

- It is based upon:
  - Identification of variables that influence the future state of a system
  - Identification of the trend of the above variables
  - Elaboration of possible future scenarios, corresponding to different patterns of the above variables

- May exploit system dynamics theory

Scenario analysis

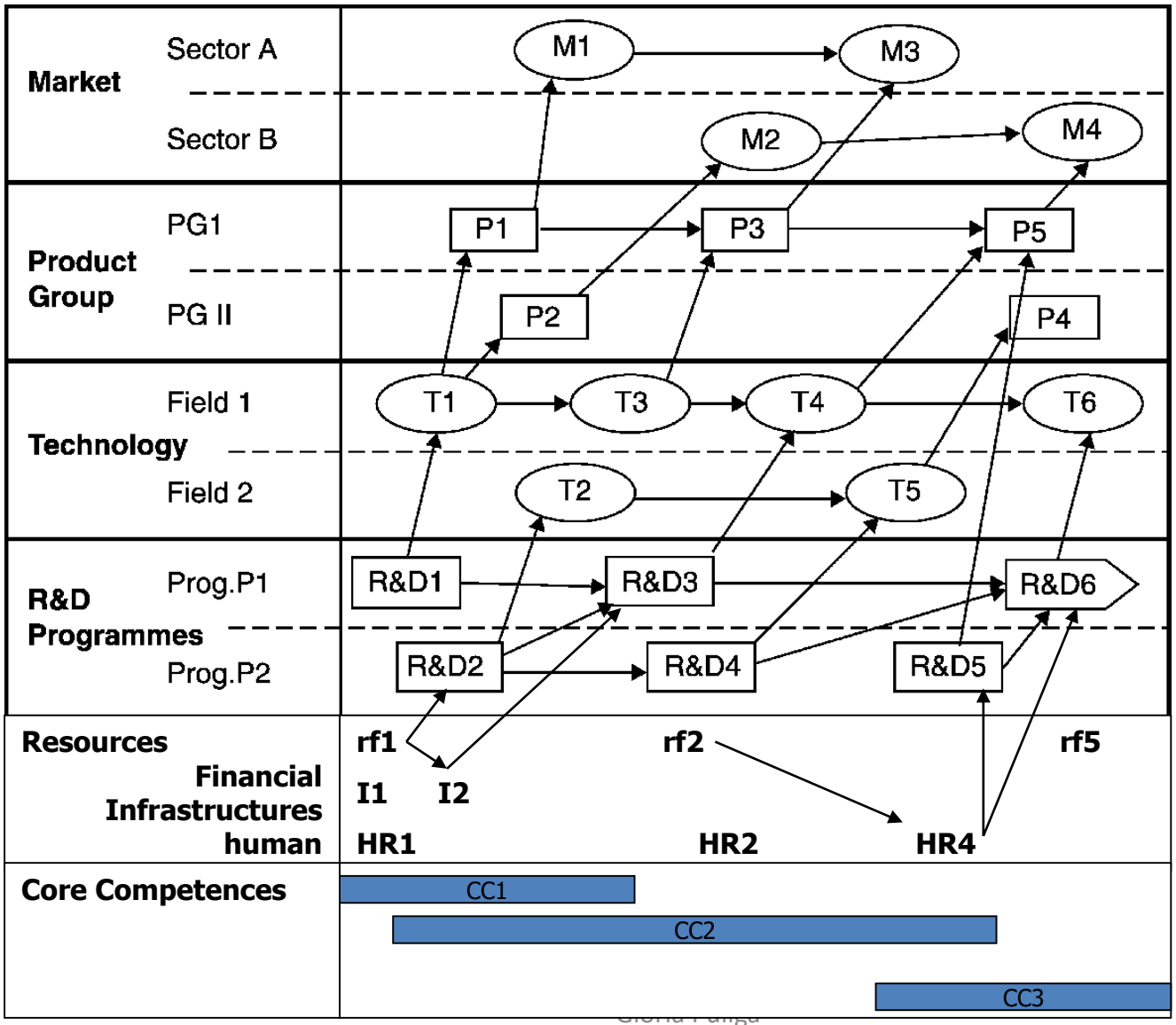
- Advantages:
  - Allows to explicitly consider uncertainty
  - Greatly supports strategic decision making
  - May be used with technological roadmaps

- Limits:
  - Expensive (time and resources)
  - Difficult to consider possible tehcnological discontinuities and breakthrough (i.e. the emerging of new relevant influence variables)

Technology roadmapping

- Technology roadmaps:
  - are tools for strategic forecasting and planning
  - Integrate different organizational perspectives in the intelligence process: R&D, di marketing, manufacturing, finance
  - May evolve following actual events

Technology roadmapping



Adattata da: Lichtenthaler, 2002

Technology roadmapping

- Advantages:
  - Visual, clear and rapid representation
  - Integrates different data and information from different company's functional units
  - Integrates technological, scientific, organizational, marketing, manufacturing elements

- Limits:
  - Hard to consider technology breakthrough
  - Soft, non-technical information are often missed

Relevance trees

- Aimed at understanding the alternative paths for achieving a specific objective
- Starting form the desired objective, it is de-composed in different levels(for example, clean car):
  - (i) alternative solutions (electric cars, hybrid cars etc...)
  - (ii) functions (lithium cells, photovoltaic cells, etc…)
  - (iii) technological solutions for performing desired functions
  - (iv) ….
- Each level should be analysed in terms of feasibility, necessary resources, success probability, timing
- Relevance trees allow to:
  - (i) evaluate the feasibility of a path
  - (ii) identify the optimal path
  - (iii) select and plan projects
  - (iv) define performance goals for each R&D project
  - (v) identify the need for specific forecasting activities, relevant for defining possible paths

Brainstorming

- Expert judgment, critical when:
  - There are no historical data
  - New variables are emerging that influence the evolution of technology
  - Cause-effect relations cannot be understood
  - The focus is on the identification of Technological discontinuities

Brainstorming

- Team definition: need to introduce external competencies as well (even external people)
- Identification of the team coordinator, who stimulates the creative process and avoid not useful parenthesis
- Definition of the focus of the discussion
- Exploration of all possible ideas and opinions with the same commitment
- Exploration of ideas, not solutions
- Inhibition removal

Delphi study

- It is a sort of «structured» brainstorming, allowing to:
  - Reduce or remove psychological influences
  - Consider ideas coming from minority groups
  - Cleanse the expert judgement from subjective, personal, biased factors

- Characteristics:
  - Anonymous: avoids the influence of leaders (either hierarchical of charismatic)
  - Iteration with controlled feedback: judgements and forecasts are elaborated and filtered from the coordinator
  - Synthetic synthesis of answers: make expert judgement less subjective

Delphi method

- The technological focus of the process is identified and the coordinator (or moderator) elaborates the questionnaire
- A panel of experts is defined, each expert does not know others
- The questionnaire is sent to the experts

The sequence is launched

1. Experts answer to the questionnaire; the coordinator pool answers and defines the list of events / relevant items
2. Experts valuate the timing of relevant events / items and the coordinator statistically elaborates the answers (distributions, means, variances, medians…)
3. Statistic results are communicate to the experts, asking to motivate their positioning with respect to the mean and median values; experts may then change their answer
4. Iteration of point 3;

….

- Iterations end when there is a statistically robust convergence of answers and when subsequent iterations do not introduce significant statistic modifications

Delphi method

- Advantages
  - Precision
  - Reliability (higher with a high number of expert)

- Disadvantages
  - The identification of experts is critical
  - The identification of a neutral, unbiased coordinaotr is critical
  - May foster orthodoxy
  - Expert commitment in answering to the questionnaire cannot be verified

Technology – application matrix

applications

Tecnology - skill		*existing*			*new*		
		A1	**A2**	**A3**	**A4**	**A5**	**A6**
existing	**T1**						
	T2						
	T3						
new	**T4**						

Competence – application matrix an example

COMPETENCIES	APPLICATIONS			
	A1	A2	A3	A4
C1	X	X	X	
C2			X	
C3	X			
C4	X			
C5		X	X	
C6		X		X
C7				
C8				X
C9				X
C10				X
C11				X
C12				
C13				X
C14	X			
C15				X

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C4	X			
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C6		X		X
C7				
C8				X
C9				X
C10				X
C11				X
C12				
C13				X
C14	X			
C15				X

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C3	X			
C4	X			
C5		X	X	
C6		X		X
C7				
C8				X
C9				X
C10				X
C11				X
C12				
C13				X
C14	X			
C15				X

Benchmarking:

- Comparison against technology “best in class”

- Phases:
  - Planning:
    - Defining the process / performance investigated
    - Identifying “best in class”
    - Defining the data collection process
  - Analysing:
    - Measuring current performance
    - “cleaning” data
  - Draw conclusions:
    - Positioning against “best in class”

Technology intelligence

- The choice of the intelligence method should take into consideration:
  - Information needs and the type of use expected for results
  - Time, resources, competences available
  - Familiarity with the methods
  - Time horizon
  - Uncertainty
  - Strategic relevance of the TI process