Evaluating *ex ante* the technological impact of Ris – ELI's experience

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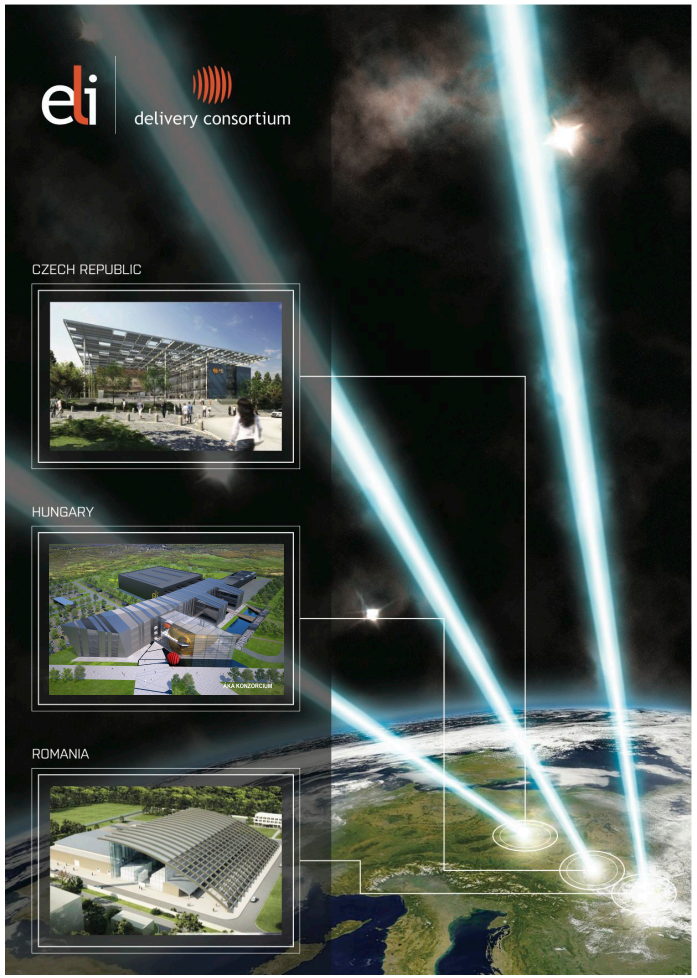
OP Research and Development for Innovation

ELI in brief



- ELI will be the world's **first international laser research infrastructure**, pursuing unique science and research applications for international users
- ELI will be implemented as **a distributed research infrastructure** based initially on 3 specialised and complementary facilities located in CZ, HU and RO
- ELI is the first ESFRI project to be **fully implemented in the newer EU Member States**
- ELI is **pioneering a novel funding model combining the use of structural funds** (ERDF) for the implementation and **contributions to an ERIC** for the operation

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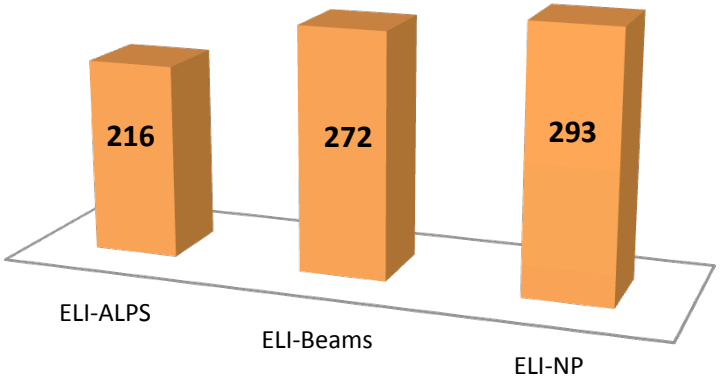
Structural funds – characteristics and benefits

- Structural funds allocated **at the national level** through 3 separate processes and grant agreements
- Project needs to be approved by the European Commission
- Grant beneficiaries (ELI-Hu, IoP, IFIN-HH) **individually responsible for the implementation** of the 3 ELI facilities
- ERDF: **objectives of socio-economic development** for the hosting regions (besides RI objectives)



The demonstration of the socio-economic relevance of the project is a key condition to the approval of the project

Are *ex ante* evaluations useful? Are they reliable?

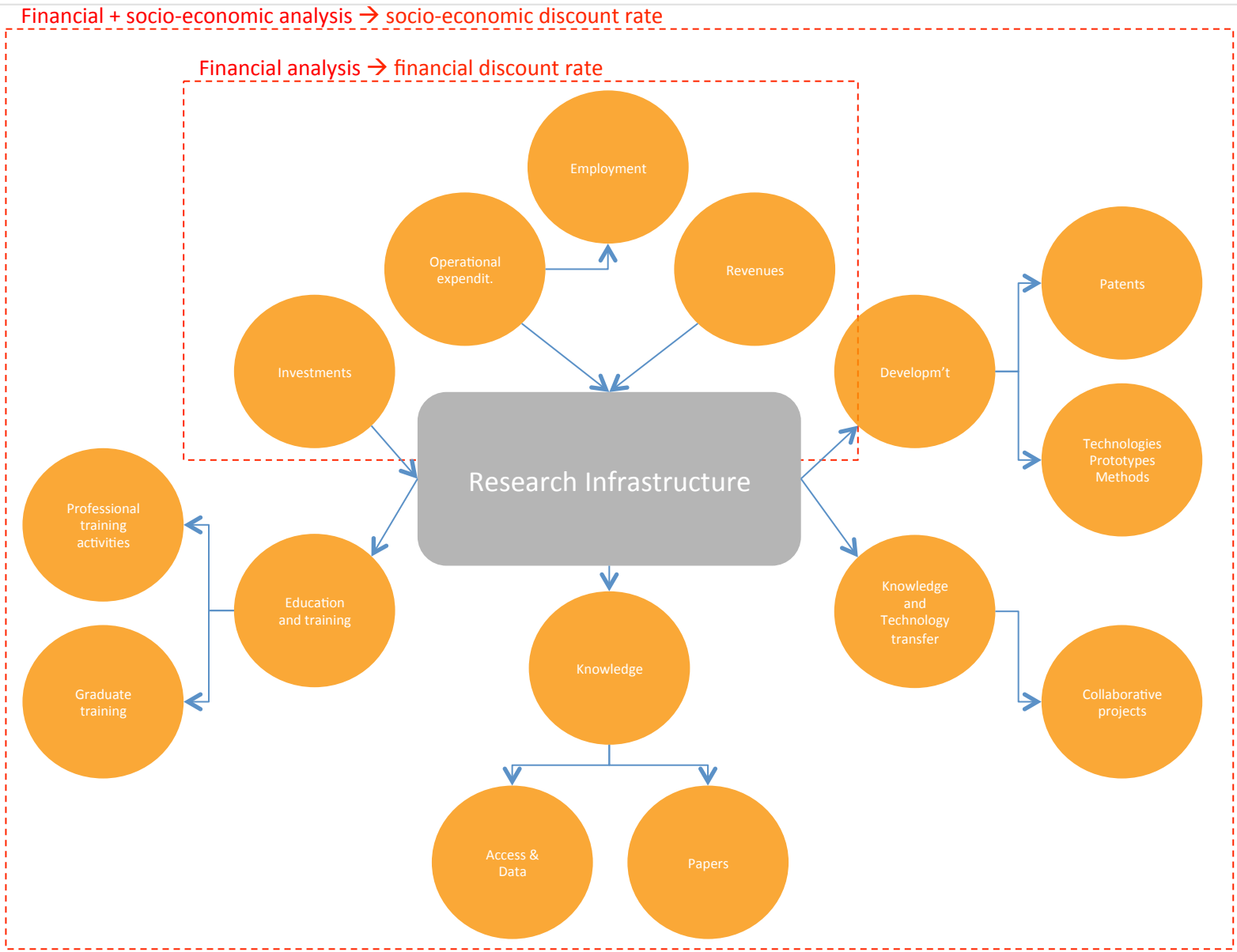
Cost Benefit Analysis

- EU Cohesion Policy regulations require a **cost-benefit analysis** for all major investment projects (over €50M or €25M) applying for assistance from the funds (including ERDF)
- The EC provides capital grants (not loans) and takes substantial risks on behalf of the EU citizens: **it needs reliable evaluation tools** to take transparent investment decisions
- As the name indicates, a CBA allows to assess the relevance on an investment (and to compare it with other investment options) by **computing the *net present value* of its financial and economic costs and benefits over a certain reference period** (i.e. weighing them over time)

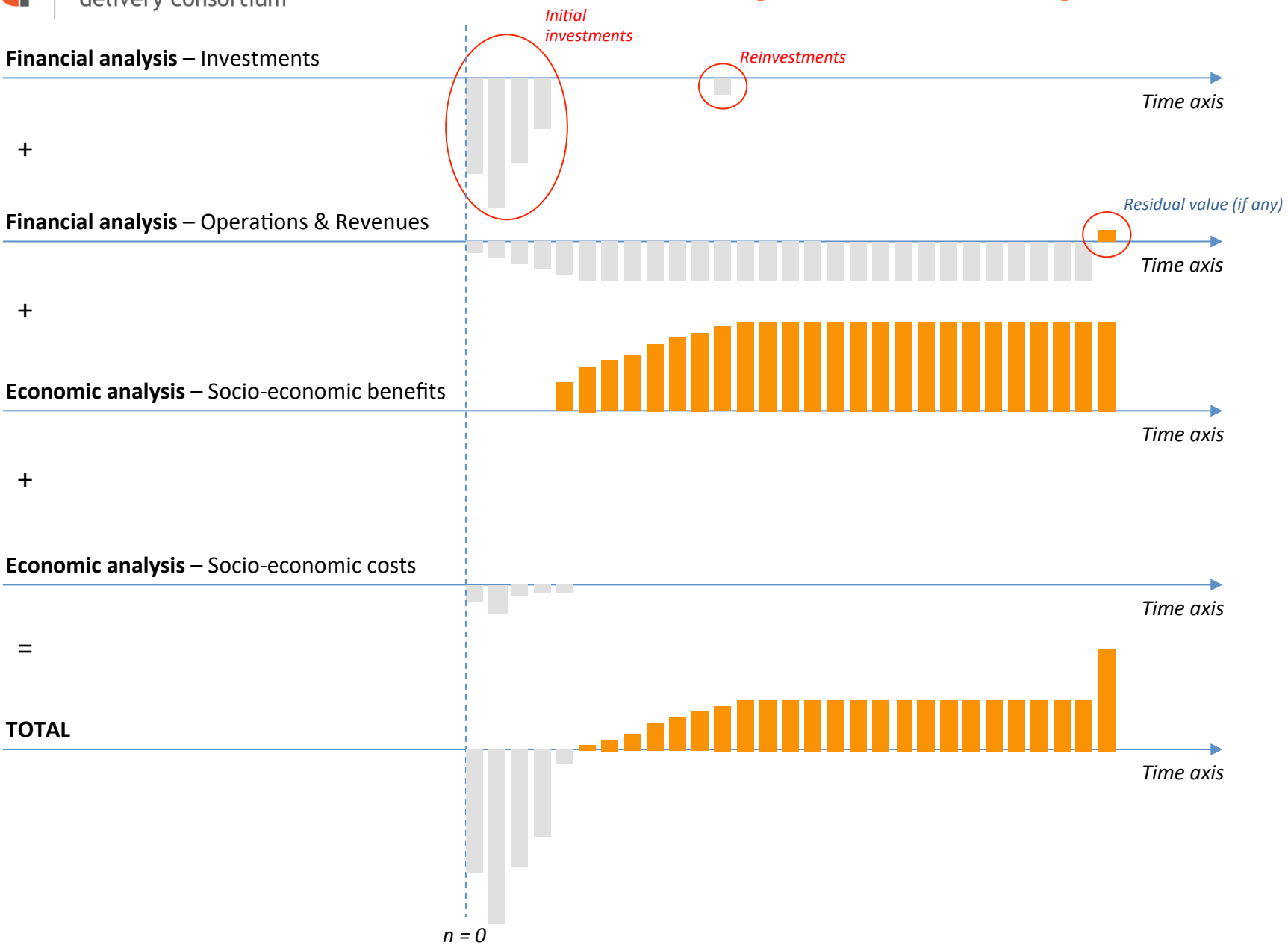
Structure and objectives of the CBA

- The CBA consists of two interconnected parts: financial analysis + A socio-economic analysis
- In the context of a grant application, the objective of the CBA is not to provide an all-inclusive evaluation of the socio-economic impacts, but to demonstrate that:
  - The economic net present value is positive
  - The economic rate of return is higher than the socio-economic discount rate
- The benefits and costs that should be taken into account in a socio-economic analysis are those that are generated directly by the project (need for a stakeholders' analysis)

Perimeter of the CBA



Simplified CBA profile



Typical indicators used for ELI

Knowledge – Typical benefit indicators: Number of Publications in Impact factor journals, Number of Publications in other journals, Value of the access granted to external researchers through an open access policy

Development – Typical benefit indicators: Number of National patents granted, National patents operated in practice, International patents (Europe, USA, Japan) granted, Number of Technologies developed in-house and transferred, Number of Prototypes developed, and Number of methodologies/industrial designs transferred.

Education and training – Typical benefit indicators: Number of graduates (M.A. level) trained in the infrastructure, Number of graduates (PhD level) trained in the infrastructure, Number of students (MA, Ph.D.) using the infrastructure.

Employment – Typical benefit indicators: Number of newly created jobs (non-research staff), Number of newly created jobs (researchers), Number of newly created jobs (researchers under 35 years).

Knowledge transfer and collaborations – Typical benefit indicators: Number of collaborative projects with application sphere, Volume of contract research, Volume of competitive funding (national), Volume of international grants.

Quantification issue

Quantification

Naturally, evaluating quantities is more or less difficult depending on the type of benefit:

- For some benefits, a reasonable estimate can be obtained fairly easily as proportions will depend on the strategy and policies of the research infrastructure (number of jobs created, access policy)
- For other types of benefits – typically those related to the output of the infrastructure (i.e. knowledge creation), the quantification of the benefits is complicated due to natural uncertainty and serendipity
- One possible solution: using the ***track-record of the applicant*** (if relevant) as a basis + a premium reflecting the quality of the RI project

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Monetisation

Monetizing benefits ex-ante is difficult:

- ***Absence of markets and prices*** makes the valuation of articles, patents, and hours of access difficult
- ***Production vs. transfer*** issue, as only those outputs (e.g. patents) transferred to the economy generate a socio-economic benefit, and the transfer of technology is induced by a demand on a case-by-case basis
- ***Value chain*** issue: there is a long way from research to the final socio-economic benefit, several steps (marketing, industrialization process, etc.) can alter (positively or negatively) the impact of the research work.

- **Potential solutions:**
  - Consensual value (Managing Authority and JASPERS), and if possible, consistent with the empirical economic literature
  - Using a willingness-to-pay approach

Limitations

- Quantification:
  - Outputs of RI activities are by nature not predictable
  - Not codified knowledge is valuable
- Monetisation issue
- Appropriation issue due to diffusive nature of knowledge
- **Focus on technology and knowledge outputs rather than on the mechanisms of their diffusion**
- **The issue of the ex-ante evaluation of the socio-economic returns of RIs cannot be disconnected from the investigation of the mechanisms that condition impact delivery.**

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Brief overview of economic literature

- Schumpeter's trilogy (steps): invention, innovation, diffusion
- Broad consensus on benefits from investment in public R&D
- Focus of economists on:
  - Conceptual frameworks to explain each step
  - Factors explaining variability of technology diffusion
  - What interface between public and private sphere
- Methodologies for assessing economic returns of investment in research (production function models, microeconomic models, investment analysis, I/O)
- No academic literature specific to assessment of technological impact of research infrastructures (mainly technology programmes).

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Conclusions and recommendations

- Assessment of socio-economic impact relevant to inform investment decision
- *Ex ante* valuation of technological impact hardly possible
- Investment in technology transfer, industrial relation and commercialisation activities necessary
- In the context of “smart specialisation”, need for conceptual frameworks to understand dissemination mechanisms and define best diffusion strategy
- Need for RI-specific literature and studies on this topic

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