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EvaRIO - Evaluation of Research Infrastructures in Open innovation and research systems

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EvaRIO

Toward a method of evaluation of RIs in open innovation and research systems

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About the project

A two-year support action for research infrastructures in FP7

(Contract n°262281. CALL FP7-INFRASTRUCTURES-2010-1)

Objective : to develop a method for evaluating some economic effects of RIs ➔ learning effects

to be tested in some RIs of the BMS field

Work in progress: stage of implementation of the case studies

One participant : BETA (University of Strasbourg / CNRS)

a team specialised in knowledge economics

with an established competence in R&D evaluation

➔ cf the so called "BETA method"

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Outline

1. BMS and the evaluation problem
2. About existing evaluation approach
3. Main features of EvaRIO – BETA approach
4. Typology of effects – learning effects
5. Toward indicators – some examples
6. Conclusion

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1. BMS and the evaluation problem

- RIs = facilities, resources or services of a unique nature
  that are needed by the S&T communities
  to conduct basic or applied R&D
  + the associated human resources

(EC 2010, ESFRI Roadmaps, ESF 2007 definitions)

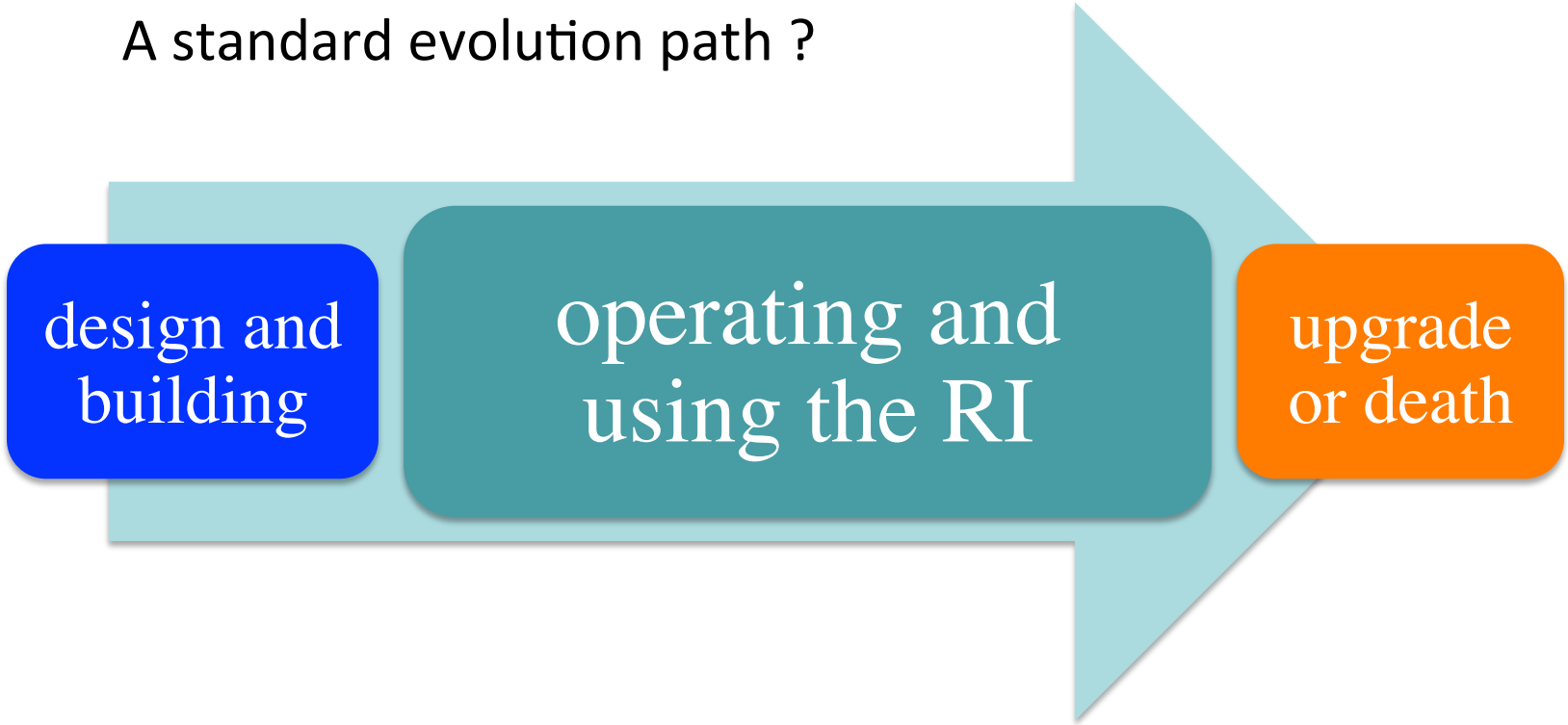
- Choice of BMS field ?
  Because it covers a wide variety of RI configurations

1. **Variety of accessible resources**
   - **instruments**: *synchrotron beamlines, NMR, electronic microscopy to be provided via INSTRUCT*
   - **competences**: *clinical trial competences to be provided via ECRIN*
   - **collections**: *mutant mice archives provided via EMMA*
   - **data**: *biomedical data / curation provided via EBI ELIXIR*

1. BMS and the evaluation problem

2. Variety of evolution paths

A standard evolution path ?

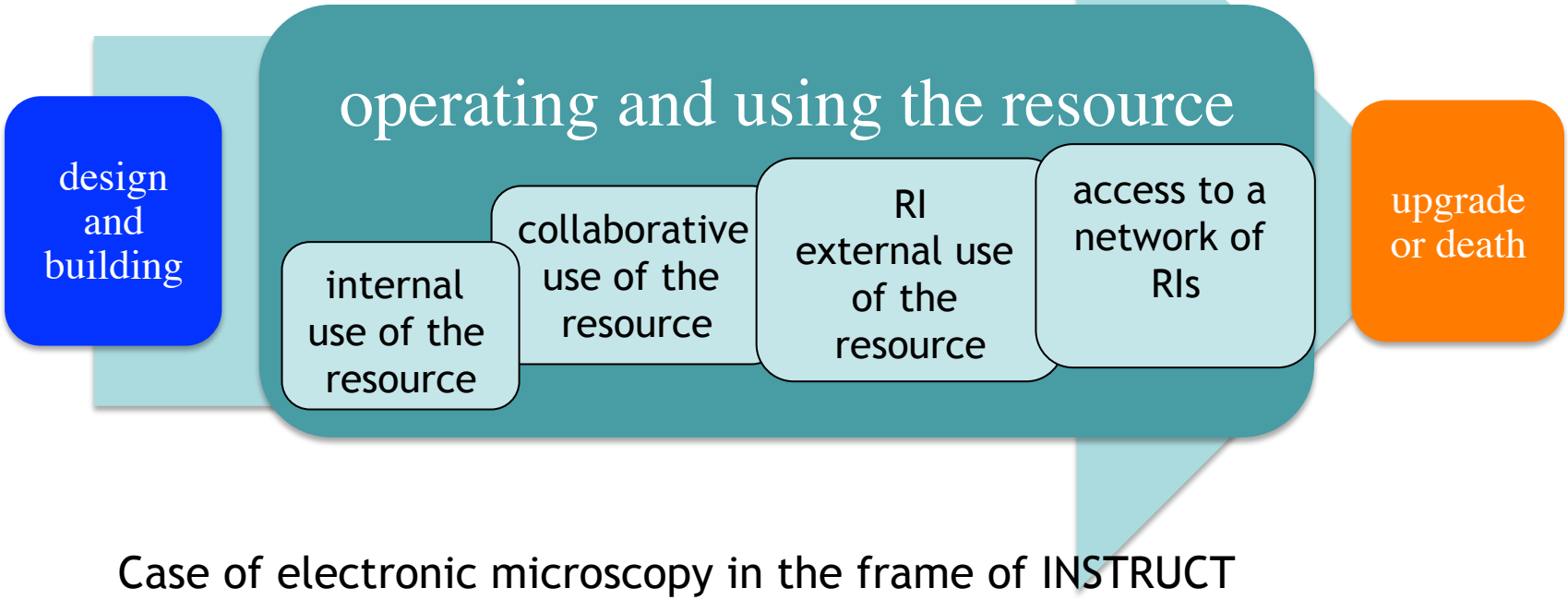


➔ *usual case of RIs as large monosite facilities (Ex of synchrotron)*

1. BMS and the evaluation problem

2. Variety of evolution paths

Intermediate steps corresponding to an increasing degree of openness of the resource



Case of electronic microscopy in the frame of INSTRUCT

➔ first acquired for internal / collaborative use

➔ then open to external users via a network

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2. About existing evaluation approaches

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Traditionally 2 main approaches are used

Economic impacts

- direct economic effects of RI (expressed in monetary terms)
- measured via the level of expenses injected into the economic system
- cf input-output matrix
- adapted to the case of large facilities

Vs.

Societal impacts

- wide scope + long term effects of scientific advances in a given field: ICT, health, environment, energy
- measured via ad hoc tools and method specific to each domain
- cf welfare gain due to long life expectancy, energy cost savings
- specific to an S&T domain and difficult to isolate RI impact

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2. About EvaRIO – BETA approach

As an intermediate approach

Economic impacts

- direct economic effects of RI
- adapted to the case of large facilities

EvaRIO - BETA
Learning impacts around RI

- effects in terms of knowledge & competency creation
- experienced by RI actors (builders, users, operators)
- measured via specific and original indicators (monetary + non monetary)
- adapted to the variety of RI types and scientific domains

Societal impacts

- effects of science in ICT, health, energy,...
- adapted to a S&T field and far from RI

3. Main features of the approach

Adaptation of the original BETA method of evaluation to RIs
(used so far for publicly funded RD programmes/projects)

As in the original approach...

- **Micro-analytical level** = effects for RI actors performing R&D
- **Retrospective method**, mainly through direct interviews
- **Quantification of gain** resulting from using / valorizing new knowledge

...But also important changes

- Focus on 3 types of RI actors: **builders, operator, users**
- A time based approach considering ≠ stages in RI life cycle
  (from design, building to upgrade, death, networking with other RIs...)
- **Renewal of categories of learning effects**
- Additional investigations on specific topics
  (R&D networks, "open source like" enrichment dynamics, flexibility,...)

4. A renewed typology of effects

For a given actor

✓ **Direct economic effects**

Immediate economic value generated by the RI activity itself (building the RI, operating the RI, using the RI)

While carrying out the RI activity, this actor learns... Hence :

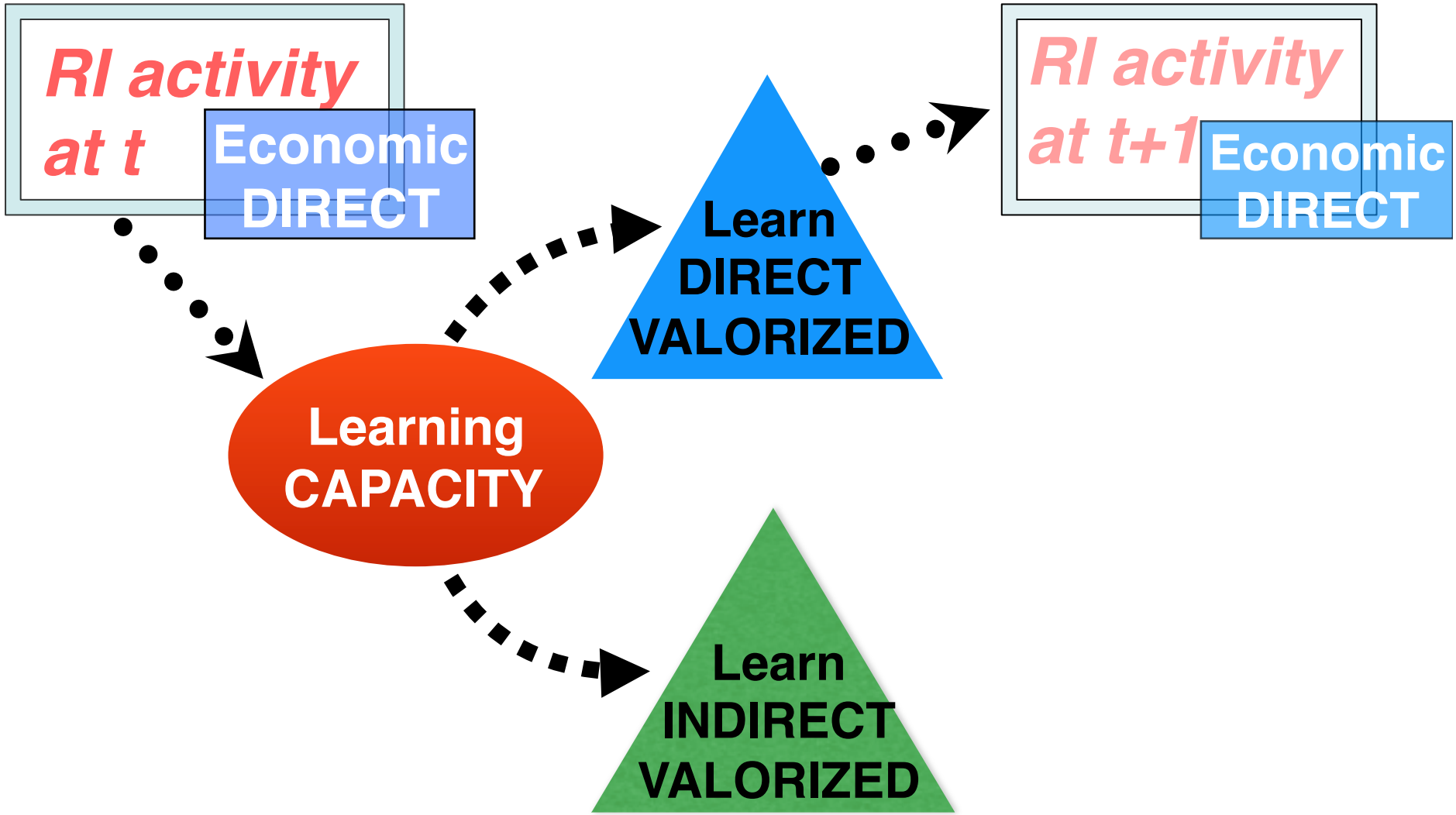
✓ **Learning effects**

➔ **capacity effect *(new)*** : higher level of competences of human capital, improved capacity (extended /diversified) for current and future exploitation

➔ **valorized effect** : observable economic value from an effective exploitation of the new competence

- **Direct** if it concerns the RI **(on RI)**
- **Indirect** *(cf BETA method)* if redeployed elsewhere **(out RI)**

4. Learning effects



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5. Analytical grid for learning effects (toward indicators)

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Learning processes lead to a reconfiguration of actor's capacity and to the creation of new pieces of knowledge…

…Which can be (partly) valorized, ie converted into economic value

Learning effects / Nature of knowledge	Capacity Effect	Direct valorized effect (on RI)	Indirect valorized effect (out RI)
Science & technology *new or improved equipment, product, prototype, model, simulations, data, protocol, experimental design,...*			
Organization & management *quality management, project design, organisational changes,...*			
Networking *know-who, relational competences,...*			
Reputation and commercial *reference, label,...*			

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5. Toward indicators: some examples in the case of "instrumentation RIs"

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*Actor = **operator** of a large instrumentation RI*

Learning effects / Nature of knowledge	Capacity Effect	Dir Valo Eff	Ind Valo Eff
Science & technology	Standard STI indicators (patentometrics, bibliometrics,...) R&D and technicians staff members New indicators in terms of: reliability, quantity, diversity, renewal, degree of customization,... of **experiments** that can be conducted thanks to the RI ➔ specific to the operator's core competency		
O&M			
Networking			
Reputation & comm			

5. Toward indicators: some examples in the case of "large instrumentation RIs"

*Actor = **user** (scientific team) of a large instrument on site*

Learning effects Nature of knowledge	Capa Eff	Direct valorized effect (on RI)	Ind Valo Eff
S&T			
Organization & management		During a first RI use, learning about project design and application ➔ time and cost saving (salary)	
Networking		During a first RI use, encountering a potential partner ➔ new project using the RI, in collaboration with the partner (budget)	
Reputation&Comm			

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5. Toward indicators: some examples in the case of "large instrumentation RIs"

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*Actor = **builder** industrial supplier of scientific equipment*

Learning effects Nature of knowledge	Capa Eff	Direct Valo Eff	Indirect valorized effect (out RI)
Science & technology			During RI building, development of a new technology (new material for instance) that is redeployed in another commercial product: ➔ sales of the new product (minus costs)
O&M			
Networking			
Reputation and commercial			Thanks to RI building, gain in reputation leading to a new commercial contract ➔ amount of contractual payoffs

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6. Conclusion

- ✓ Mix of roles: operators of large instruments do research and are also users ➔ stronger and richer effects
- ✓ What about other RI resources (cf. collections, HR and data)
  - ➔ another mix of roles, the builder-user
    when some users contribute to building the resource
  - ➔ importance of the "open source like" enrichment logic
    (1st additional investigation in the frame of EvaRIO)
- ✓ RIs as hubs, or "brokers of knowledge"
  - ➔ they contribute to structure scientific communities
  - ➔ important role of RIs in R&D networks
  - ➔ (2nd additional investigation in the frame of EvaRIO)

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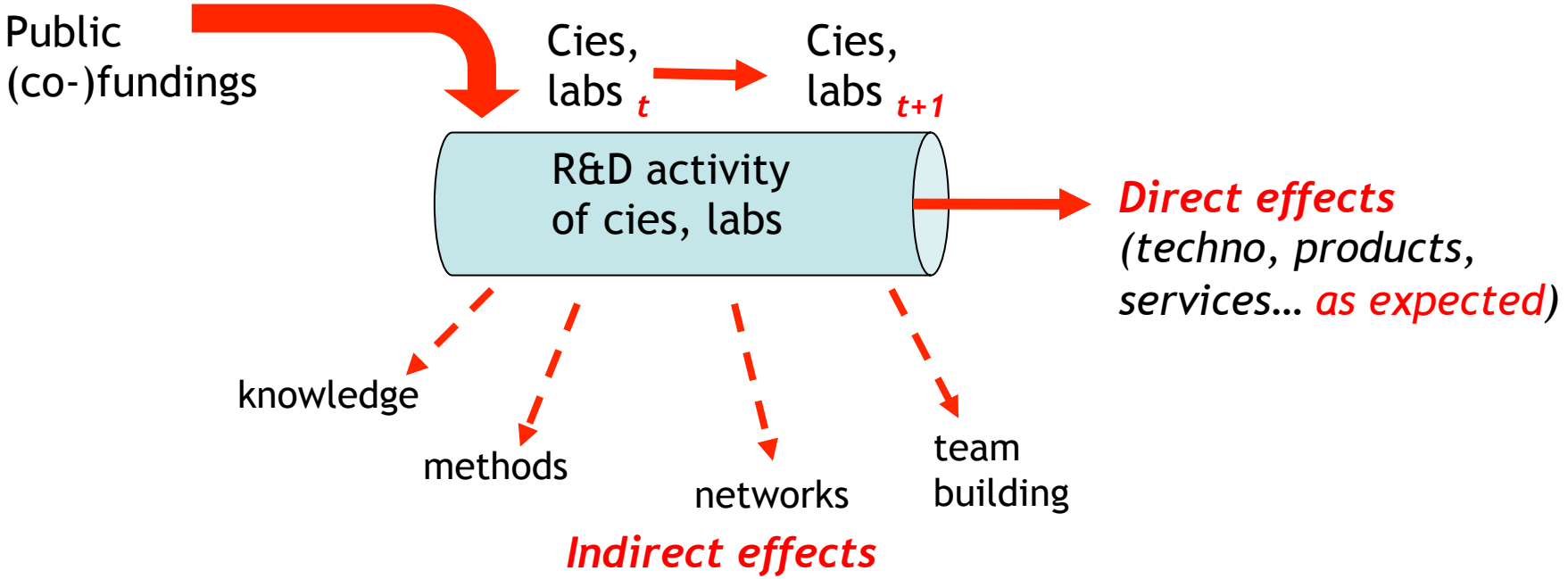
Thank you for your attention

ANNEX1: The "original" BETA method

- Specific context : *publicly funded R&D programmes/projects, with objectives + timeframe*
- Theoretical base : *learning mechanisms/valorization, at micro-level*

- Scope : *effects for the projects' partners – ex-post view*
- Method : *direct interviews of (a sample of) participants to evaluated projects (sum up at programme level)*



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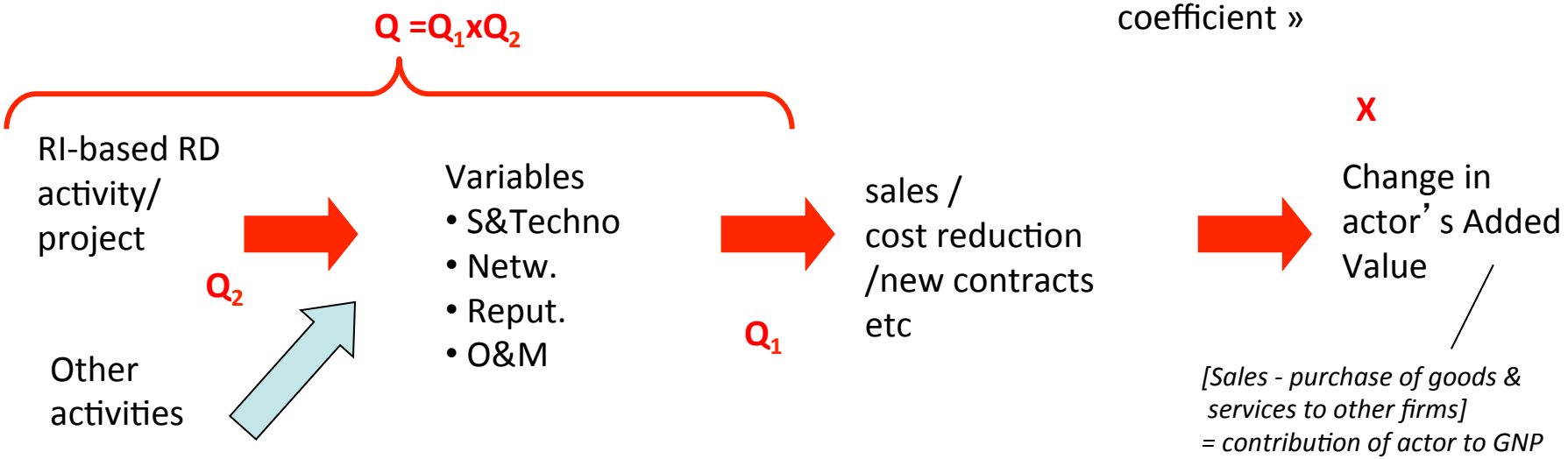
Indirect effects: the measurement of the "actual impact"

Indicators
sales of products
sales of process
sales of services, including training
cost reductions : in terms of resources (materials, instrumentation, …) and/or time (access to collection, partners seeking, …)
research fundings (contracts, grants etc)
revenues from awards, prizes, donation etc
revenues from licensing, royalties
revenues from spin-off

actual impact (€) =

$$\sum_{t=0}^{T} X_t \times Q$$

X : actor's Added Value (measured via indicator)
t : index for time interval
Q : specific influence of RI-based R&D = « attribution coefficient »



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learning effects: the assessment of the change in actor's capacity

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Science & Technology capacity *improvement/enlargement of the scope of scientific & technological resources, competences and dynamic capabilities*
Organization & Method capacity *improvement of managerial capabilities, especially as regards S&T activities*
Networking capacity *Improved ability to form, join and exploit R&D partnerships and networks*
Reputation capacity *improved visibility and acknowledgment by third parties*

Work factor (fundamental) capacity *Enlargement/diversification of the "critical mass", ie the number and type of staff required to sustain/access to a given level of capabilities*

Strategic power generated by the changes in capacity *in terms of options for future choices*

Existing indicators:

Standard STI indicateurs (patentometrics, bibliometrics, social networks metrics…), certification, prizes, awards, …

Development of new indicators:

more advanced S&T, creation/exploration of new S&T fields, larger scope of existing S&T fields covered, interactions with other S&T fields / multidisciplinarity, large scope of knowledge along the science-industry axis, capacity to economically exploit S&T results, creation of/development of/links to knowledge communities, …