



The impacts and added value of research infrastructures

Identification, Estimation, Determinants

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Why talking about impact?

1969 – US Congressional Joint Committee on Atomic Energy – R.R. Wilson (Fermilab) is questioned on the justification for a \$200-million investment in a new generation of accelerators

- **Congressman:** *Is there anything connected in the hopes of this accelerator that in any way involves the security of this country?*
- **Wilson:** *No sir; I do not believe so.*
- **Congressman:** *It has no value in that respect?*
- **Wilson:** *It only has to do with the respect with which we regard one another, the dignity of men, our love of culture. It has to do with those things. It has nothing to do with the military, I am sorry.*
- **Congressman:** *Is there anything here that projects us in a position of being competitive with the Russians, with regard to this race?*
- **Wilson:** *Only from a long-range point of view, of a developing technology. Otherwise, it has to do with: Are we good painters, good sculptors, great poets? I mean all the things that we really venerate and honour in our country and are patriotic about. In that sense, this new knowledge has all to do with honour and country but **it has nothing to do directly with defending our country, except to make it worth defending.***

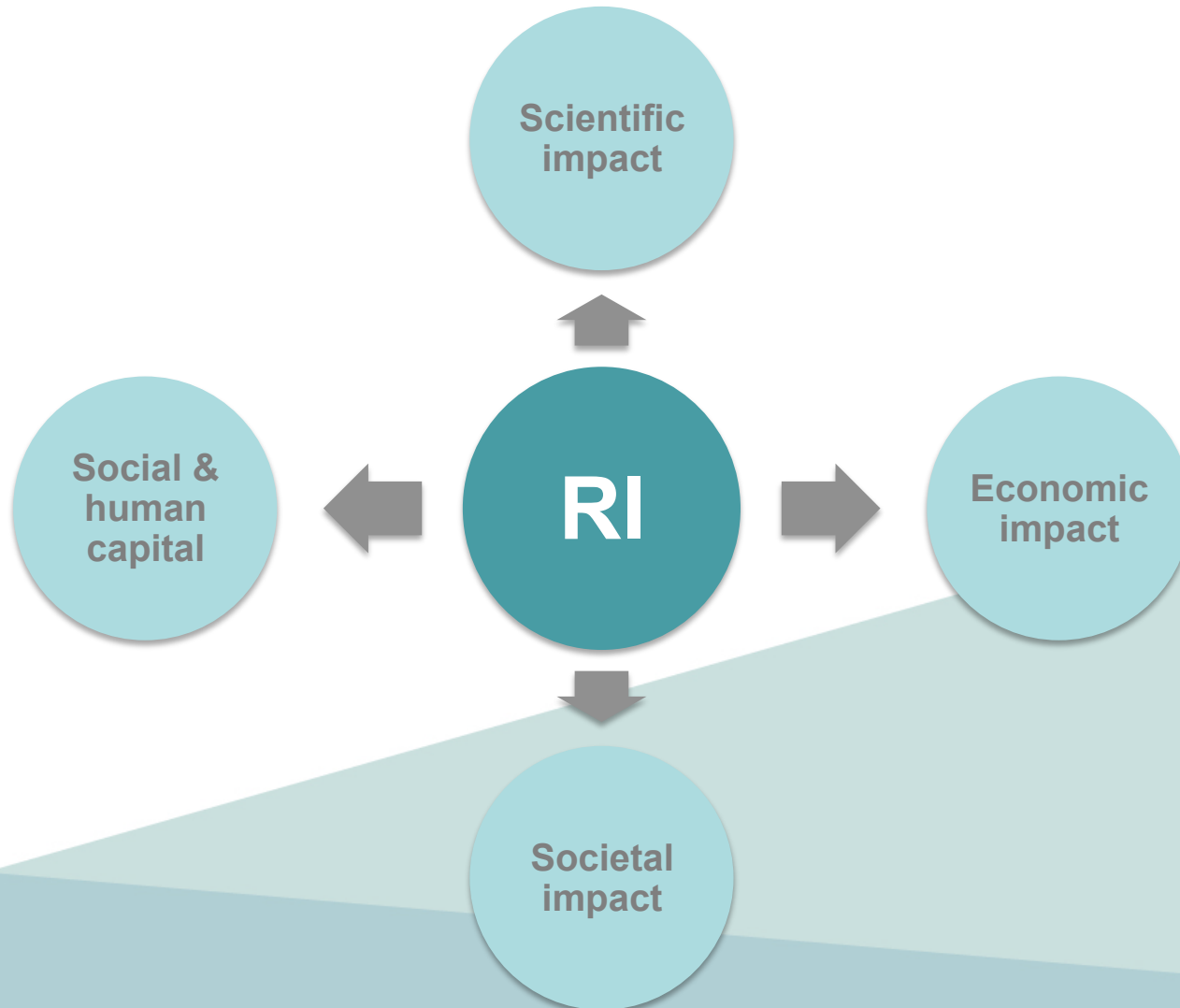
Why talking about impact?

- New public management
 - Accountability of decision-makers to citizens
 - Accountability of scientists to decision-makers and society
- The need for investment decision tools
 - A research infrastructure is an investment
 - The scarcity of public money calls for tools to choose among investment options
- Efficiency
 - The mechanisms converting knowledge production into growth are still very unclear
 - Studying impact creation contributes to improving the “efficiency” of RIs

Agenda

- What are the main types of impacts of RIs?
- How to measure socio-economic impacts?
- What mechanisms underpin the delivery of impacts?

What types of impacts?



What types of impacts?



Scientific
impact

- Pioneering scientific research with large-scale instruments
 - Teaming up resources for unique instruments or use of networking effects by linking instruments
 - Addressing complexity and creating new knowledge through multidisciplinary
 - Credibility and reputation of science
- Evolution in the organisation of research
 - Increased integration
 - The role of e-infrastructures
 - Mix of collaboration and competition
 - Harmonising of practices (access, quality, etc.)

What types of impacts?



Social & human capital

- Creation of social capital
 - Benefits from the creation of formal and informal social networks as a result of the variety of stakeholders interested in the development of RIs
 - Networks of scientists / networks of scientists and non-scientists
 - Learning processes and knowledge-sharing facilitated by trust and reciprocity
 - The importance of “tacit knowledge”
- Creation of human capital
 - RIs as magnets for best researchers
 - Influence on mobility
 - Interaction between social capital and human capital
 - Capacity building through training and learning effects at the European scale

What types of impacts?



Economic impact

- Direct and indirect economic impact
 - Activity linked to the development and operation of RIs through procurement
 - First and second-order employment
 - Spin-offs based on the knowledge generated by RIs or the support of RIs
- Connection to the innovation system
 - RIs as “launching customers” through procurement
 - Investment in research that is too risky for companies
 - The scarcity of public money calls for tools to choose among investment options
 - “Path-shaping investment” (an investment-friendly environment)

What types of impacts?



Societal impact

- Contribution to solving “Grand challenges”
 - Direct contribution (sustainability, climate, biodiversity)
 - Indirect contribution through new knowledge leading to innovation
- Scientific communication and education
 - Training environment
 - Visibility of big science and accountability

How to value socio-economic impacts?

- Ex-ante vs. ex-post evaluation
 - **Ex-ante valuation:** justification for investment decisions
 - **Ex-post valuation:** reporting and accountability, search for improvements
- Main difficulties in the valuation of impacts
 - **Ex-ante valuation:** by definition, it is difficult to value the impact of RIs, since their outcomes (in terms of knowledge creation) are partly unforeseeable
 - **Ex-post valuation:** difficult to define the scope of analysis

How to value socio-economic impacts?

- Examples of tools used to quantify the socio-economic impact of RIs
 - **Cost-benefit analysis (CBA):** well-established investment decision tool leading to the calculation of an Economic Rate of Return through the quantification of positive and negative economic impacts of RIs (need to define and value indicators)
 - **Input-output analysis:** calculation of the impact of an investment on the economy through the simulation of an “economic circuit” representing the interactions between the various sectors of the economy

How to value socio-economic impacts?

- An alternative option: knowledge narratives
 - Difficult to value intellectual capital from an accounting point of view
 - Need for accountability through planned objectives, organisation of resources and performance indicators
 - Knowledge narrative = how knowledge resources are organised to form value creation (resources, activities, effects)

What mechanisms underpin the delivery of impacts?

- Three approaches to the link between research, innovation and growth
 - **Linear model:** basic research leads to applied research and to inventions, that are transformed into innovations, which lead to greater growth (link between R&D and patents)
 - **Systems of innovation:** study of territorially-embedded institutional networks favouring or deterring the generation of innovation, combination of social and structural conditions (social filter)
 - **Knowledge spill-overs approach:** focus on the conditions of diffusion and assimilation of innovation
- Important role of geographical distance in the process of innovation
 - Tension between the increasing availability of standard “codified” knowledge and the spatial boundaries constraining the flow of “tacit” knowledge

What mechanisms underpin the delivery of impacts?

- Economic approach to the connection between knowledge and growth
 - **Neoclassical perspective:** knowledge is a truly public good (non rivalrous and non excludable) available everywhere and to everybody; knowledge and innovation flow from producers to beneficiaries without friction
 - **Endogenous growth:** differences in innovation capacity and potential represent one of the main explanations for differences in wealth and economic performance
- The importance of the context in which innovation takes place and of the assimilation potential of territories
 - The social and institutional conditions of territories have some influence
 - Relevance of the social filter (i.e. the socio-economic realm of the region)

What mechanisms underpin the delivery of impacts?

Main conclusions of the economic literature

- There is a strong and significant relationship between R&D expenditure and economic growth
- Local socio-economic conditions have a better predictive effect than investment in R&D (the “social filter” is strongly and positively associated with growth)
- A good social filter increases the regional capacity to assimilate knowledge spill-overs (from neighbouring regions); this represents an alternative or additional option for regions that do not have sufficient investment capacities
- Spill-over decay with distance (180-minute trip time seems to be an important threshold in the diffusion of “tacit” knowledge”)

What mechanisms underpin the delivery of impacts?

Implications for Research Infrastructures

- RIs have a critical mass that can help integrate the various dimensions of the knowledge and innovation system
- RIs have potentially strong impacts on science, human and social capital, economy and society
- However, RIs have to be considered in their ecosystem of stakeholders; they have to be territorially embedded
- When considering the impacts of RIs, it is necessary to go beyond the “linear approach” and the issue of impact valuation to define additional measures that support the delivery of impact, its appropriation and assimilation at the local and regional level