

Regional impact analysis of Large scale Research Infrastructures

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The Future Circular Collider Innovation Study (FCCIS) project has received funding from the European Union's Horizon 2020 research and innovation programme under grant No 951754



Brief Introduction

- FCC collaboration agreement addendum between LSE and CERN: a project to identify, based on selected case studies, the regional benefits of a particle-collider based research infrastructure set up as a global project can create.
- We are still at a very early stage as we started working on this project only in mid-October.
- Steep learning curve to familiarize with methods and technologies.




Motivation & Aims of the research project



What we know so far on the socio-economic impact



Challenges in measuring the regional benefits



Our suggested approach (work in progress) and timeline



Why

- **Contribution to the Big Debate:** Can we afford investing in curiosity-driven basic research that doesn't promise precise and immediate applications in society? (OECD, 2019)
- **Regional dimension:** We have started to learn more about the socio-economic benefits of investing in RIs. But we don't know the impact on the wider local economy: What are the territorial benefits of a global RI like the LHC and the HL-LHC and what can this tell us about the potential impact of future ones, like the FCC?
- **New methods:** How do we measure the regional impact of past RIs? How do we leverage these findings to forecast future investment in RIs? (Double challenge)
- **Policy Lesson:** What is the role of RIs in local innovation policies like the regional smart specialization strategy?



What we want to achieve

- Identify the regional economic benefit that a particle-collider based research infrastructure set up as a world-wide distributed project can create.
- Develop quantitative estimates for regional benefit for different scenarios and technologies, such as superconducting radiofrequency cavities.
- Use these estimates to develop a quantitative forecasting model for regional impacts based on a set of key indicators (employment, wages, patents).
- Provide policy insights on the role that RIs can play in regional smart specialization strategies.




Motivation & Aims of the research project



What we know so far on the socio-economic impact

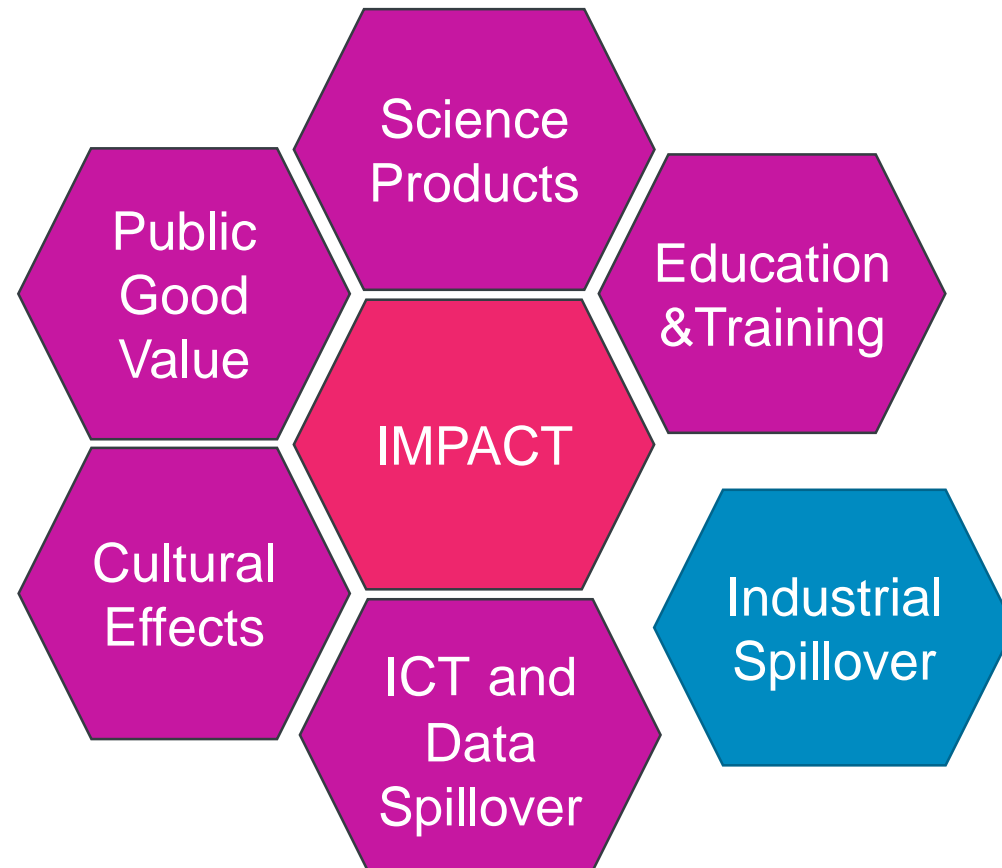


Challenges in measuring the regional benefits



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There are different pathways through which RIs can have a socio-economic impact



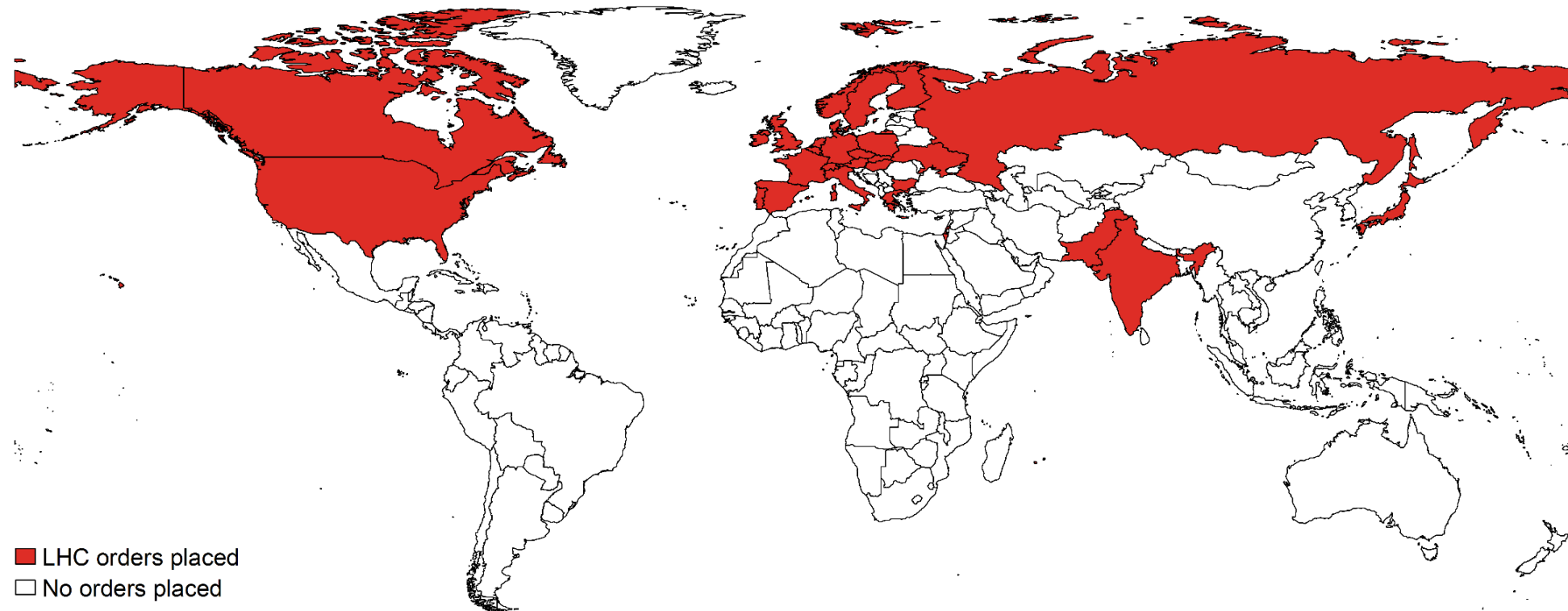
Source: Gutleber (2018)

Looking at procurement, we know about the benefits to suppliers...

| The value of the LHC high-tech procurement benefits Florio et al. (2016) | Long-term effects of CERN on suppliers' performance Castelnovo et al. (2018) | Drivers of performance for CERN supply chain Florio et al. (2018) |
|---|--|--|
| <ul style="list-style-type: none">• The expected present value of the economic benefits for high-tech suppliers over the entire LHC lifetime amounts to approximately 2 billion euro (at 2008 prices) | <ul style="list-style-type: none">• Being a CERN supplier is likely to increase R&D investment, patent filing, labour productivity and, eventually, profitability.• Benefits are higher for firms which supplied high-tech products | <ul style="list-style-type: none">• Closer collaboration between CERN and its suppliers lead to greater benefits• Benefits spill over along the whole supply chain also subcontractors• Benefits are greater for larger firms supplying more innovative and high-tech products• Positive reputational effects are enjoyed by most suppliers |

...but this is only part of the story as firms from across the world work with CERN...

Approx. 4,200 firms located in 47 countries have collaborated with CERN for the LHC project during the 1995-2015 period delivering over 33,400 orders



...procurement could indirectly affect regional economies in complex ways






Motivation & Aims of the research project



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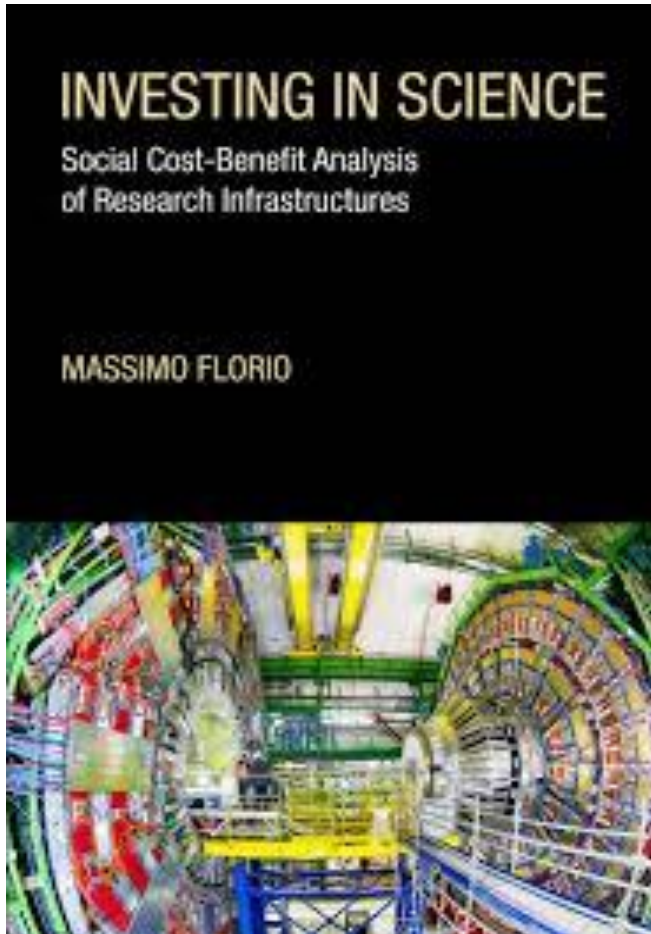


Challenges in measuring the regional benefits



Our suggested approach (work in progress) and timeline

There are two initial challenges in measuring the potential regional benefits of FCC (1)



Challenge 1: Identifying methods to measure the regional impact

Two main quantitative approaches to measure CERN procurement socio-economic benefits:

- Cost-Benefit Analysis
- Knowledge Production function

We need to explore different methods to estimate the regional impact.

There are two initial challenges in measuring the potential regional benefits of FCC (2)



Challenge 2: Measuring the potential impact of a new technology

CERN asked us to focus on superconducting radiofrequency systems – a key technology for a post-LHC Higgs factory (FCC-ee).

The production project is expected to last 10 years with an estimated investment of 1bn euro. It will also require significant R&D efforts beyond the current state-of-the-art.

How do we measure the regional impact of this technology?




Motivation & Aims of the research project



What we know so far on the socio-economic impact



Challenges in measuring the regional benefits



Our suggested approach (work in progress) and timeline

Challenge 1: A possible new methodological approach (work in progress) for regional studies

Synthetic control method in a nutshell

Step 1: Analyse the changes in key indicators (employment, wages, GVA, patents) in the region in which the supplier of the technology of interest is located, before and after the contract was assigned.

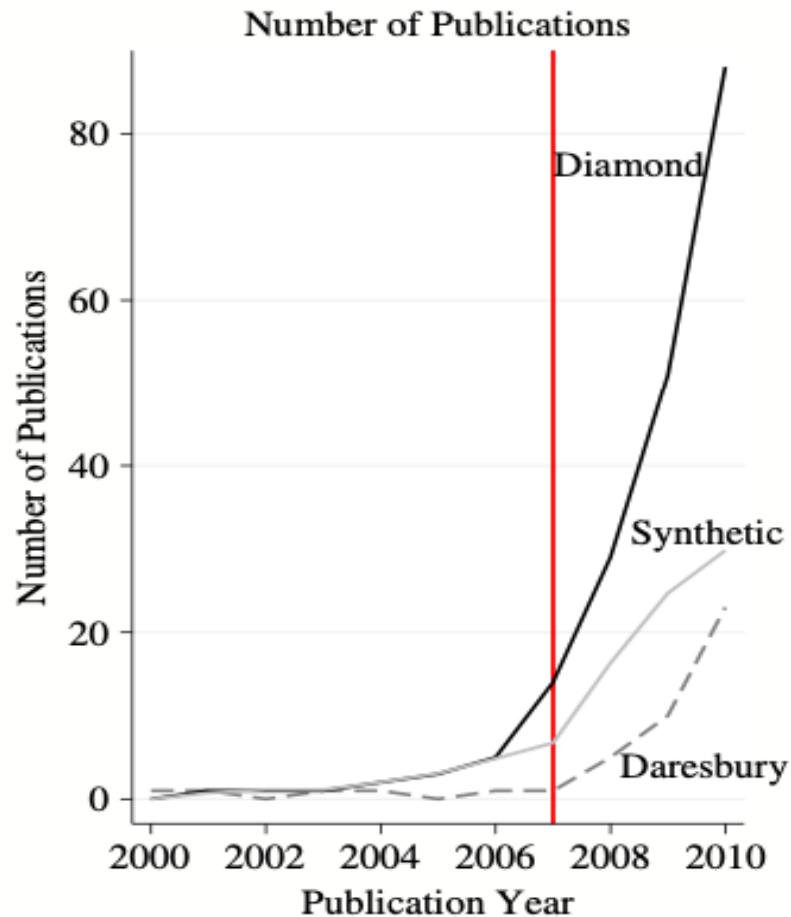
Step 2: Take a combination of similar regions to the treated one but without the supplier companies (Synthetic control) and estimate the variation for the same indicators and period.

Step 3: Compare the results in the two regions and find the effect that can be attributed to procurement

Challenges:

- Pre-treatment effects
- Direct outcome variables
- External validity

An example: the Diamond Light Source



Helmets & Overman's (2018) study of the Diamond Light Source

- What is the effect of the synchrotron on local scientific output?
- Using Synthetic Control methods and other counterfactual techniques they found that scientists located within a 25-kilometre radius of Diamond produced around 11 per cent more scientific articles.

Caveats:

- Helmets & Overman looked at an existing RI – we want to understand the potential impact of the new collider.
- The study focuses on another channel and the effects in the proximity of the RIs.

Challenge 2: Understanding the potential regional impact of particular technologies (work in progress)

In order to gauge the local economic effects of superconducting radiofrequency systems, we propose a two-step approach.

Step 1

We could look at other research centres that have already developed these technologies as case studies such as:

- JLAB in the USA
- INFN LNF in Italy
- DESY in Germany

As well as relevant industries involved in developing, prototyping and building the final products.

Step 2

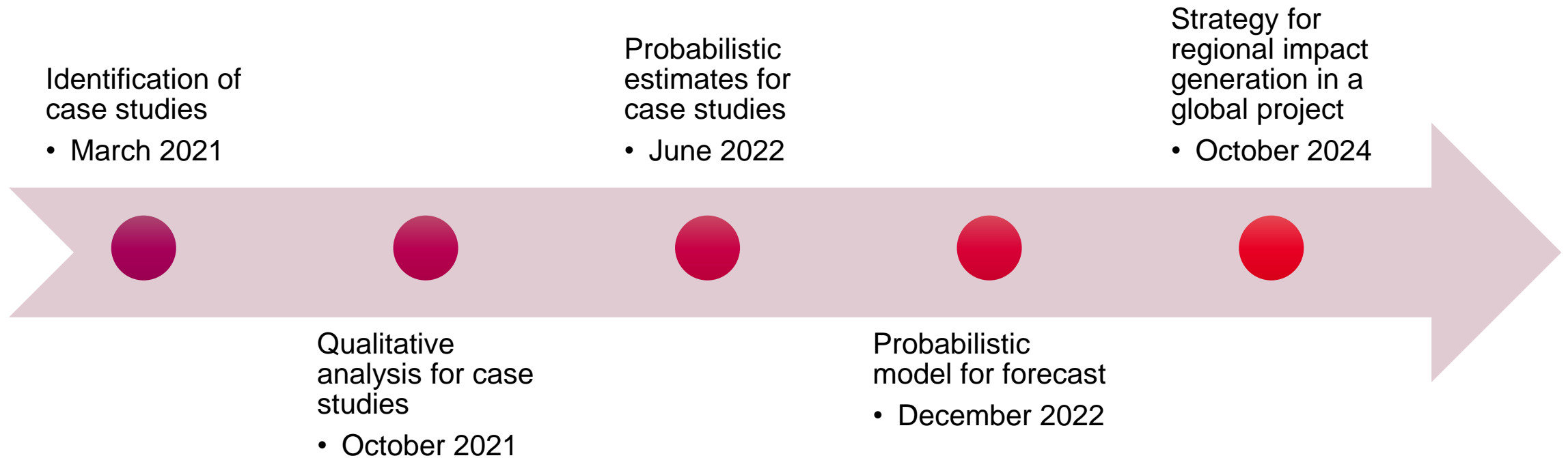
Other technologies relevant to the FCC study could be included in our analysis to better understand the local economic impact of RIs procurement activities and address the external validity challenge.



Next steps

- Work closer with the other beneficiaries of the FCCIS project and the members of the FCC collaboration
- Contact other research labs that have developed superconducting radiofrequency systems to understand what data is available
- Map other technologies relevant to the next collider
- Identify the most suitable case studies and additional data requirements
- Explore the validity of Synthetic Control Method and other relevant methods

Timeline of the project





Any questions?

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