Jaspers
Joint Assistance to Support Projects in European Regions

JASPERS Working Paper

Economic Analysis of Research Infrastructure Projects In the Programming Period 2014-2020

Dorothee Teichmann

Robert Swerdlow

Brussels, 31st May 2016

European Investment Bank
European Bank

Content of presentation

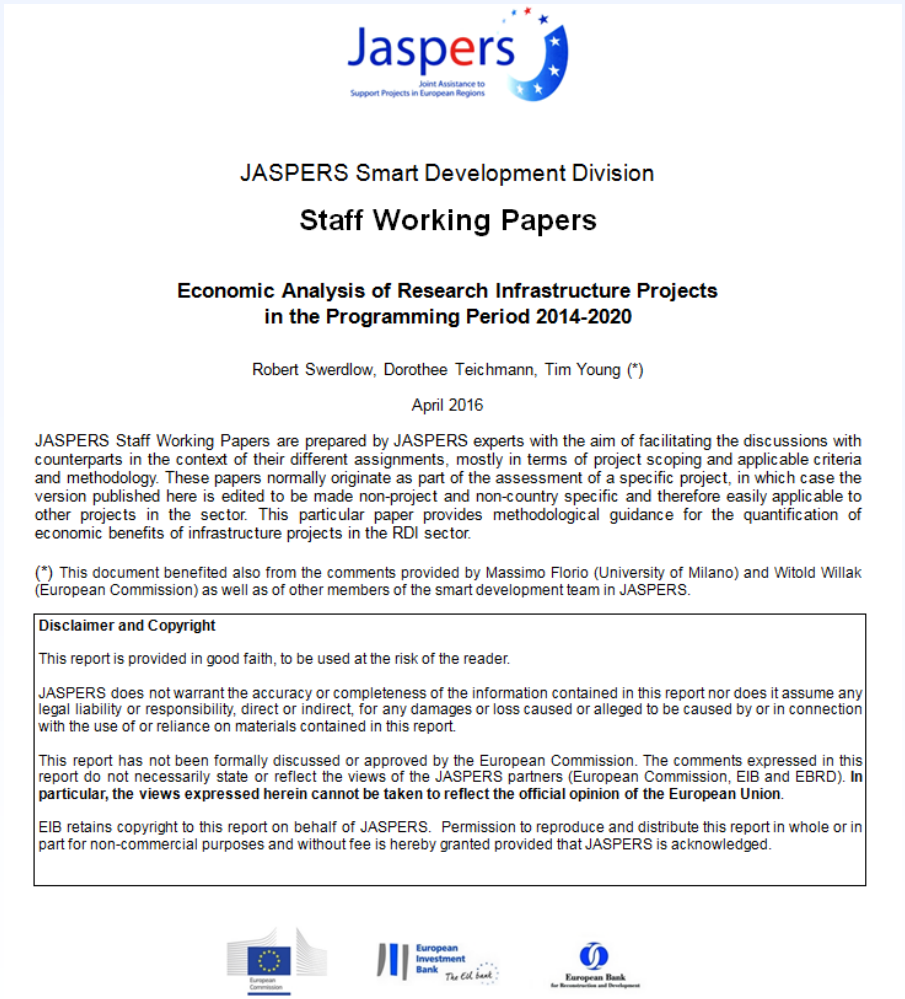
- Introduction to JASPERS 2016 working paper
  - Contents of the paper
  - Scope and purpose
  - Results of testing
  - Climate change and the CBA
- Case study application of the methodology
  - Benefit-by-benefit example of methodology

Economic analysis as part of the CBA

1. Socio-economic, institutional and political context
2. Definition of objectives
3. Project identification
4. Technical feasibility & Environmental sustainability
5. Financial analysis
6. Economic analysis
7. Risk assessment

JASPERS Working Paper

- Simplified, practical methodology for the quantification of economic benefits that builds on Chapter 7
- Addresses each of the benefits described in annex III of IR (EU) 2015/207
- Provides additional complimentary guidance



JASPERS Smart Development Division

Staff Working Papers

Economic Analysis of Research Infrastructure Projects in the Programming Period 2014-2020

Robert Swerdlow, Dorothee Teichmann, Tim Young (*)

April 2016

JASPERS Staff Working Papers are prepared by JASPERS experts with the aim of facilitating the discussions with counterparts in the context of their different assignments, mostly in terms of project scoping and applicable criteria and methodology. These papers normally originate as part of the assessment of a specific project, in which case the version published here is edited to be made non-project and non-country specific and therefore easily applicable to other projects in the sector. This particular paper provides methodological guidance for the quantification of economic benefits of infrastructure projects in the RDI sector.

(*) This document benefited also from the comments provided by Massimo Florio (University of Milano) and Witold Willak (European Commission) as well as of other members of the smart development team in JASPERS.

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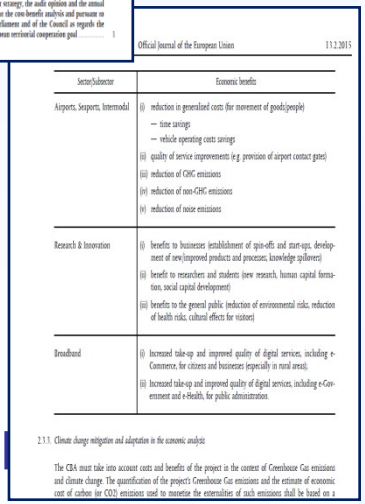
Contents of JASPERS Working Paper

1. Calculation of economic benefits for RDI projects
   - benefits to businesses:
     - establishment of spin-offs & start-ups
     - development of new/improved products & processes
     - knowledge spill-overs
   - benefit to researchers & students:
     - "new research"
     - human capital formation
     - social capital development
   - benefits to the general public:
     - reduction of environmental risks
     - reduction of health risks
     - cultural effects for visitors
2. Open access to facilities and learning by doing (additional
3. Climate change and the CBA
4. Risk assessment


Official Journal L 38
of the European Union
English edition Legislation Volume 58 13 February 2015
Contents
II Non-legislative acts
REGULATIONS

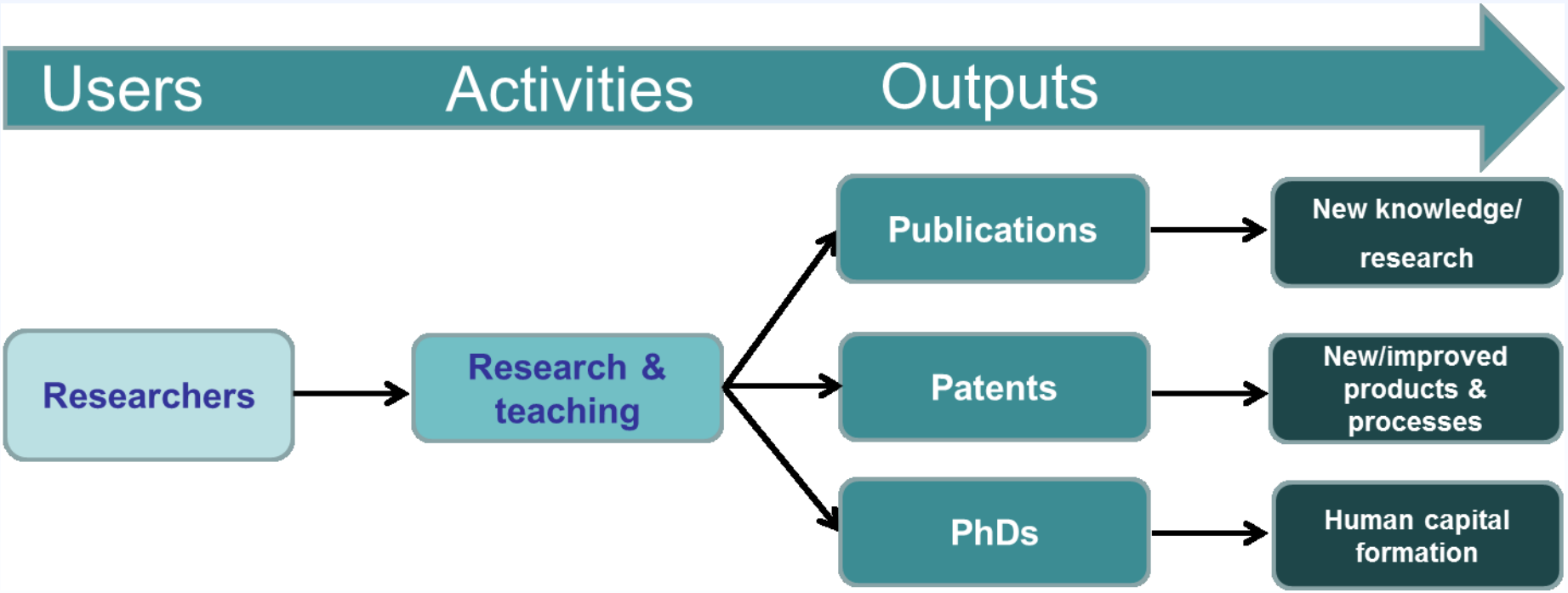

Official Journal of the European Union 13.2.2015

Sector/Subsector	Economic benefits
Airports, Seaports, Intermodal	(i) reduction in generalised costs (for movement of goods/people) – time savings – vehicle operating costs savings (ii) quality of service improvements (e.g. provision of airport contact gates) (iii) reduction of CHC emissions (iv) reduction of non-GHG emissions (v) reduction of noise emissions
Research & Innovation	(i) benefits to businesses (establishment of spin-offs and start-ups, development of new/improved products and processes, knowledge spillovers) (ii) benefit to researchers and students (new research, human capital formation, social capital development) (iii) benefits to the general public (reduction of environmental risks, reduction of health risks, cultural effects for visitors)
Broadband	(i) Increased take-up and improved quality of digital services, including e-Commerce, for citizens and businesses (especially in rural areas); (ii) Increased take-up and improved quality of digital services, including e-Government and e-Health, for public administration.

2.3.3. *Climate change mitigation and adaptation in the economic analysis*

The CBA must take into account costs and benefits of the project in the context of Greenhouse Gas emissions and climate change. The quantification of the project's Greenhouse Gas emissions and the estimate of economic cost of carbon (or CO2) emissions used to monetise the externalities of such emissions shall be based on a

Identification of Economic Benefits



JASPERS Working Paper

- For each benefit the paper presents:
  - A summary of the approach in the CBA Guide
  - Supplementary guidance from JASPERS

Example of Quantification of economic benefits

Establishment of spinoffs and start-ups

Approach in the CBA Guide

- Annual and total number of spin-offs/start-ups expected to be generated
- Expected value of annual profits earned by spin-offs/start-ups
- Average lifetime of spin-offs/start-ups

Potentially challenging areas

- **Predicting annual profits ex-ante**
- **Limited data on the life time of spinouts and start-ups**

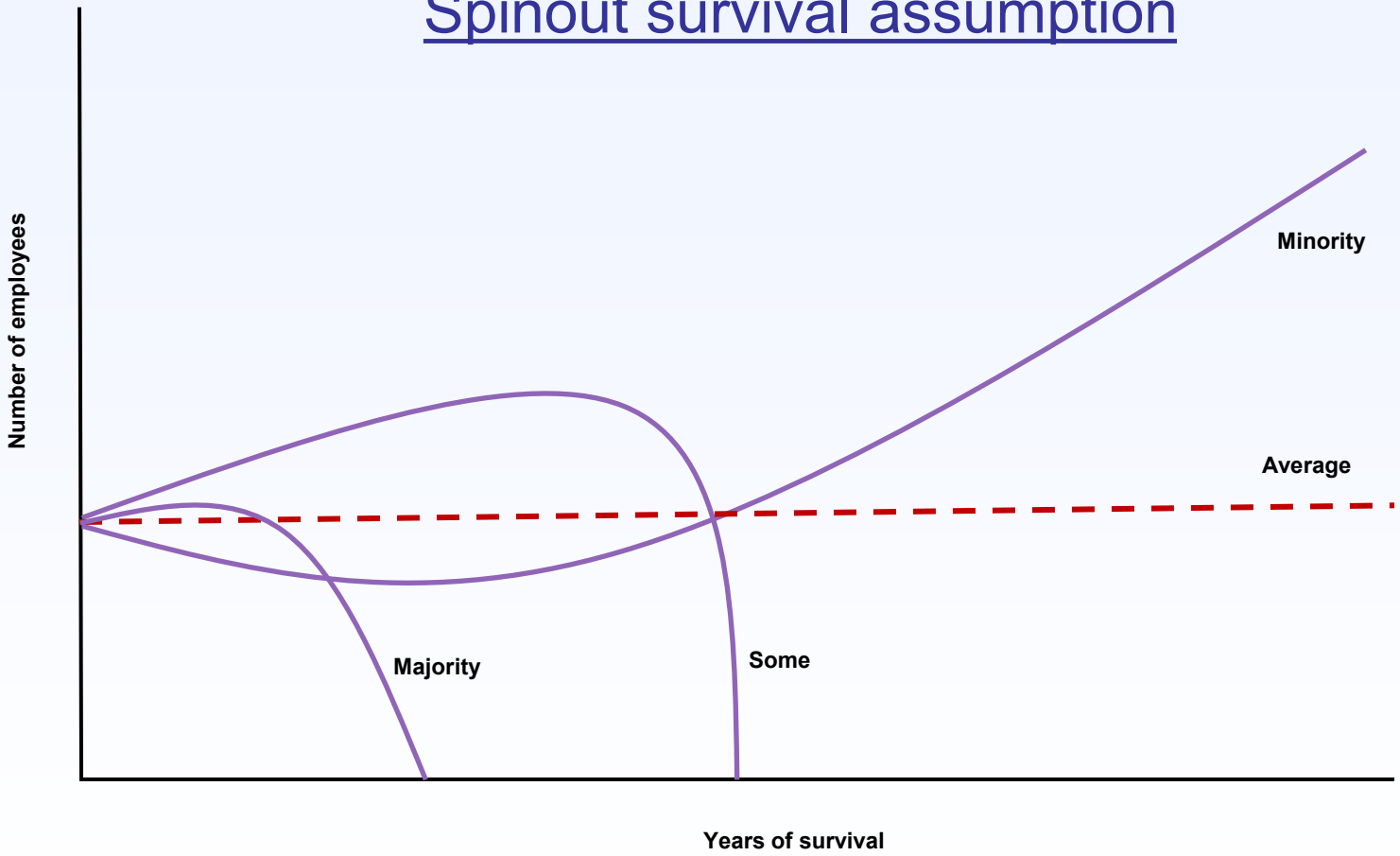
Establishment of spin-offs and start-ups

Supplementary guidance from JASPERS

- Quantity - Historical track record of the project promoter
- Total profits - number of staff employed by spin-out * shadow profit associated with one such employee
- Survival assumption - Growth in the employment of companies that survive cancels out the loss of employment in companies that do not survive i.e. **the number of employees stays constant**

Establishment of spin-offs and start-ups

Spinout survival assumption



JASPERS Working Paper

- Focus is on:
  - Data that is easy to source like national accounts
  - Practical assumptions
  - Benefits linked directly to project outputs

BUT…

- It is conservative - output focus does not reflect full impact

Testing of the Methodology

- Tested on JASPERS projects from the previous and current programming period

- Results:
  - Validated
  - Lower ENPV in comparison to previous JASPERS methodolog
  - Shift in importance/value of certain benefits
  - Easy to apply

Climate Change and CBA Requirements

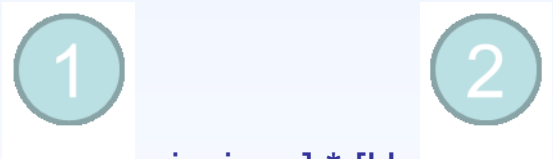
Inclusion of climate change in the CBA is required by Annex III of the Implementing Regulation

1. Mitigation and GHG emissions:
   - CBA should take into account the costs and benefits related to GHGs emitted by the project

2. Adaptation:
   - Costs of measures aimed at enhancing the resilience of the project to climate change impacts included in the economic analysis; and
   - Benefits of those measures assessed and included in the economic analysis if they can be quantified; otherwise properly described.

Climate Change and CBA Mitigation

- For RI projects, GHG emissions normally due to the building's use of heat and electricity. Calculation required:



Cost of GHG Emissions = [Volume of GHG emissions] * [Unit shadow price of tCO2e]

1. GHG emissions - follow The EIB Carbon Footprint Methodology:

CO2e per year (in t) = Electric Energy Use * Country Electricity Grid Emissions Factor + Heat Energy Use* Project specific heat emission factor

2. Value for each tCO2e - follow the unit shadow price of carbon in CBA Guide

Climate Change and CBA Adaptation

- All projects required to assess vulnerability to potential climate hazards as part of a project specific climate risk assessment
- Promoter is required to include the cost of measures implemented, and assess the benefits

Cost

- Difficult in practice to identify and separate the exact costs…however;
- Cost is inherently part of the total cost of the project, so **inclusion** should not be problematic

Benefit

- Quantifying benefits likely to be difficult. If so, suggestion is to describe qualitatively

The European Supercomputing Research Centre

An application of the JASPERS working paper

Dorothee Teichmann

Robert Swerdlow

Brussels, 31st May 2016

The European Supercomputing Research Centre

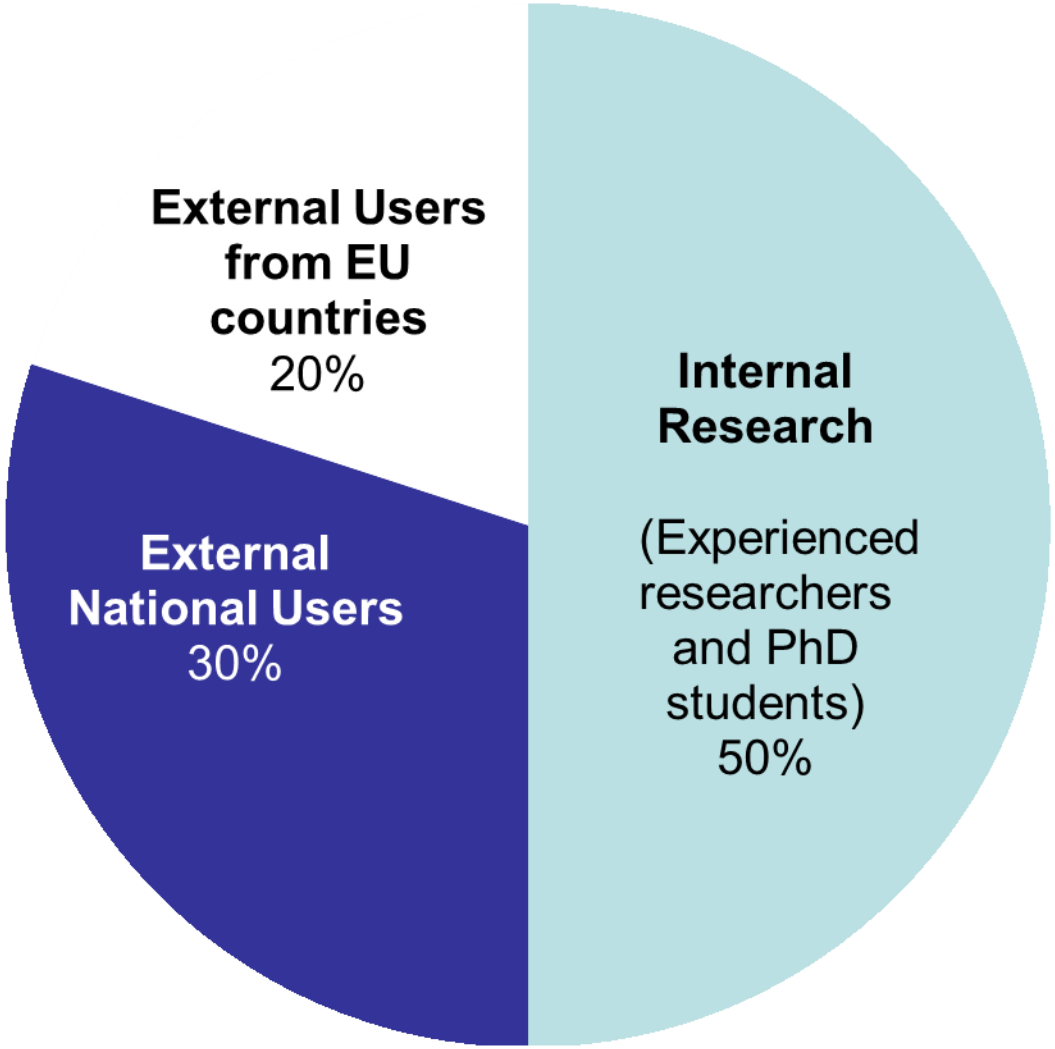
- Supercomputer center for High Performance Computing (HPC) for advanced computer modelling
- Construction of building next to existing university campus (in total 14,000m2)

- Overall Investment costs: 72.4 million
- Available for researcher and clients from the academic as well as the business sphere, both nationally and internationally.

The European Supercomputing Research Centre

- Up to 140 researchers to be employed by the center by 2025
- Up to 25 PhD students per year 2025
- The project also foresees:
  - Technology transfer undertaken by the Incubator (part of the planned investment) to be integrated into the European Supercomputing Research Centre,
  - Open access policy to enable visiting researchers from home and abroad and the private sector to use the facility,
  - Establishing of a centre for international academic conferences

Planned use of computing capacity



Main outputs:

- Human capital formation
- Publications
- Spin-offs

The economic analysis

- Methodological approach
  - Based on financial analysis
  - Discounted cash flow method
    - →Economic discount rate: 5% real (constant prices)
  - Incremental approach
  - Reference period: 15 years (of which 3 years construction and 12 years of operation)
  - 3 steps:
    - Conversion of financial costs into economic costs
    - Conversion of financial revenues into economic benefits (where applicable) and estimation of economic externalities
    - Calculation of ERR and ENPV

Identification of economic benefits (1/2)

From users of the infrastructure to quantifiable project outputs

Businesses		
Private Companies that rent research space	Private companies that contract research	Spin-offs created through the incubator activities
⇩	⇩	⇩
Hours of open access	Number of contract research	Number of start-ups and spin-offs and number of jobs created

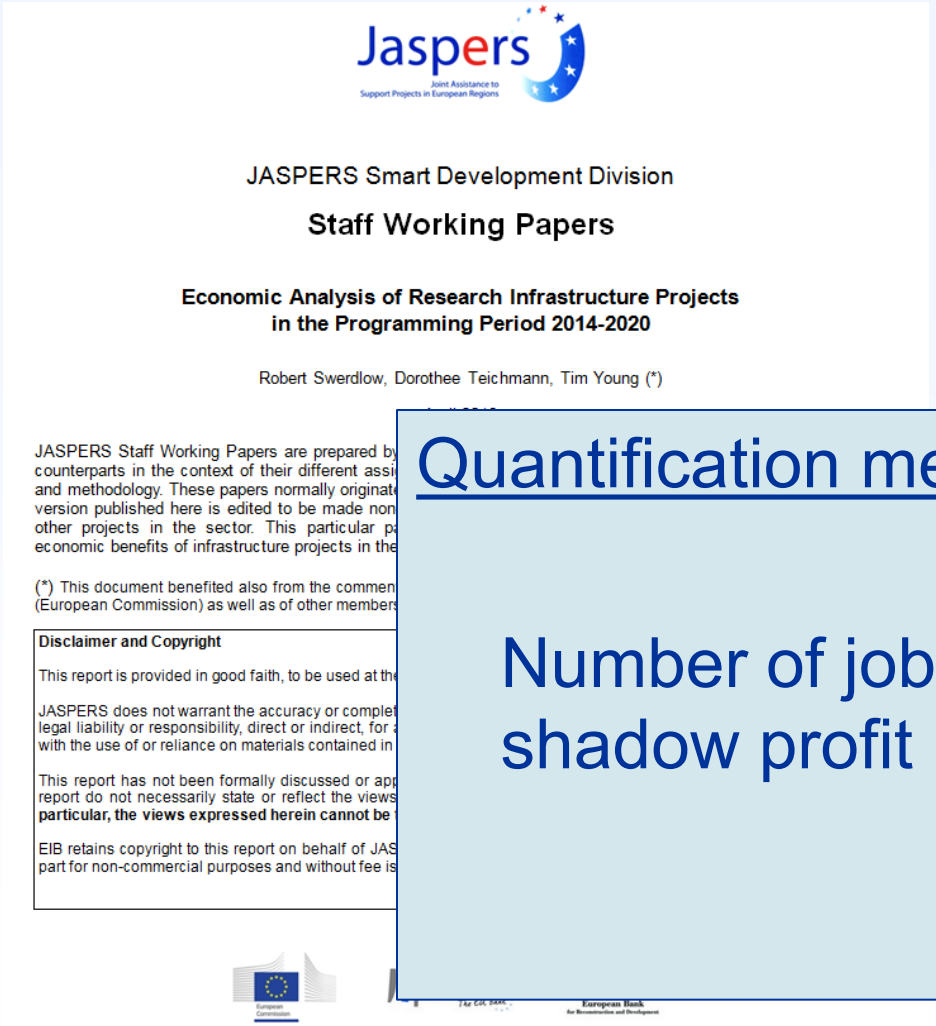
Identification of economic benefits (2/2)

Researchers and students			
PhD Students	Researchers that are employed by the infrastructure	Visiting researchers	Researchers attending conferences
⇩	⇩	⇩	⇩
Number of PhD students, publications, patents	Publications, patents	Hours of open access	Number of organized conferences

From project outputs to economic benefits

Output	Last year (incremental)	Benefit
PhD Graduates	25	Human Capital Formation
Articles in impacted journals	214	“New Research”
National and international patents	5	Development of new/improved products & processes
Spinout companies	3	Establishment of spin-offs & start-ups
Hours of open access to research facility	3,942	Open Access to RI
Number of conferences organised	3	Social Capital Development

Establishment of spin-offs & start-ups



JASPERS Smart Development Division

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Robert Swerdlow, Dorothee Teichmann, Tim Young (*)

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Quantification method

Number of jobs created * present value of shadow profit per employee

Establishment of spin-offs & start-ups

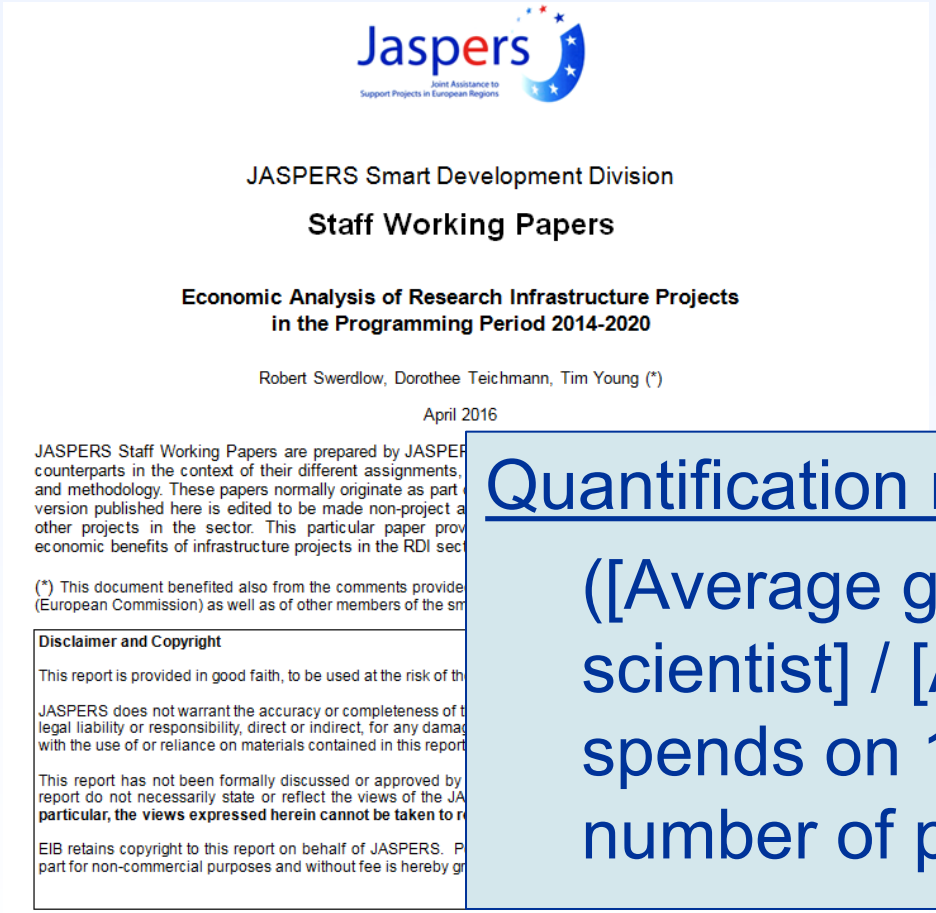
Data input and sources:

Data input	Unit	Sources	Value in last year of ref period
Number of newly established entities	Number/year	Project specific, based on track record	3
Average number of employees per entity	Number/entity	Project specific, based on track record	4
Shadow profit per employee	EUR/year	EUROSTAT, one employee in the scientific R&D sector (NACE sector M72)	23,200

Economic benefit in last year of reference period:

Accumulated no. of jobs	Shadow profit at adjusted price level	Economic Benefit
96	EUR 36,262	EUR 3,481,174

Benefits due to “new research”



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Quantification method

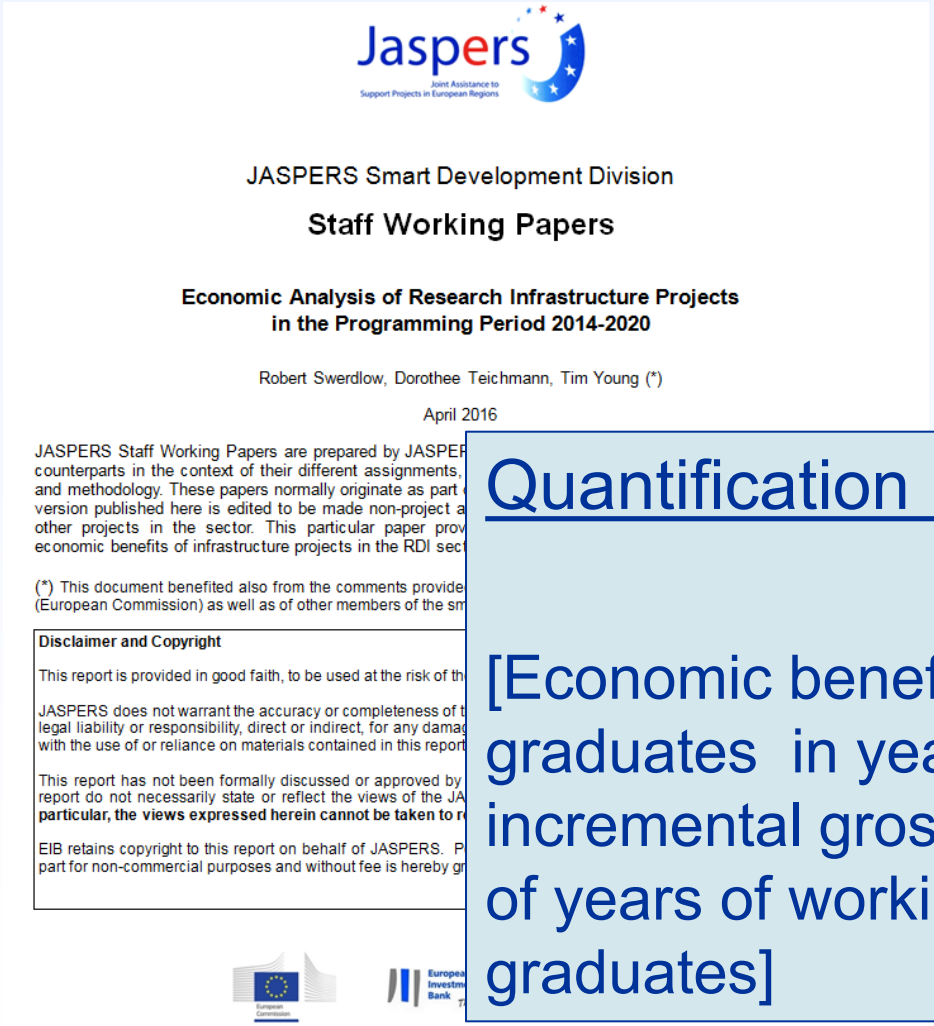
([Average gross annual salary of scientist] / [Average % time researcher spends on 1 publication per year]) * number of publications per year

Benefits due to “new research”

Data input and sources and calculation

Data input	Unit	Sources	Values
Average gross salary of a scientist	EUR/year	Project specific	32,500
Calendar days required per average publication	Days	Project specific	90
Value of one publication	EUR	Calculation	8,008
Total average number of publications per year	Number	Project specific based on past track record of researchers	214
Economic benefit in last year of reference period	**EUR**	**Calculation**	**1,713,758**

Benefits due to Human Capital Formation



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Quantification method

[Economic benefit in year t] = [Number of PhD graduates in year t] * [Present value in year t of incremental gross salary over average number of years of working career ahead of PhD graduates]

Benefits due to Human Capital Formation

Simplified example calculation for year 10

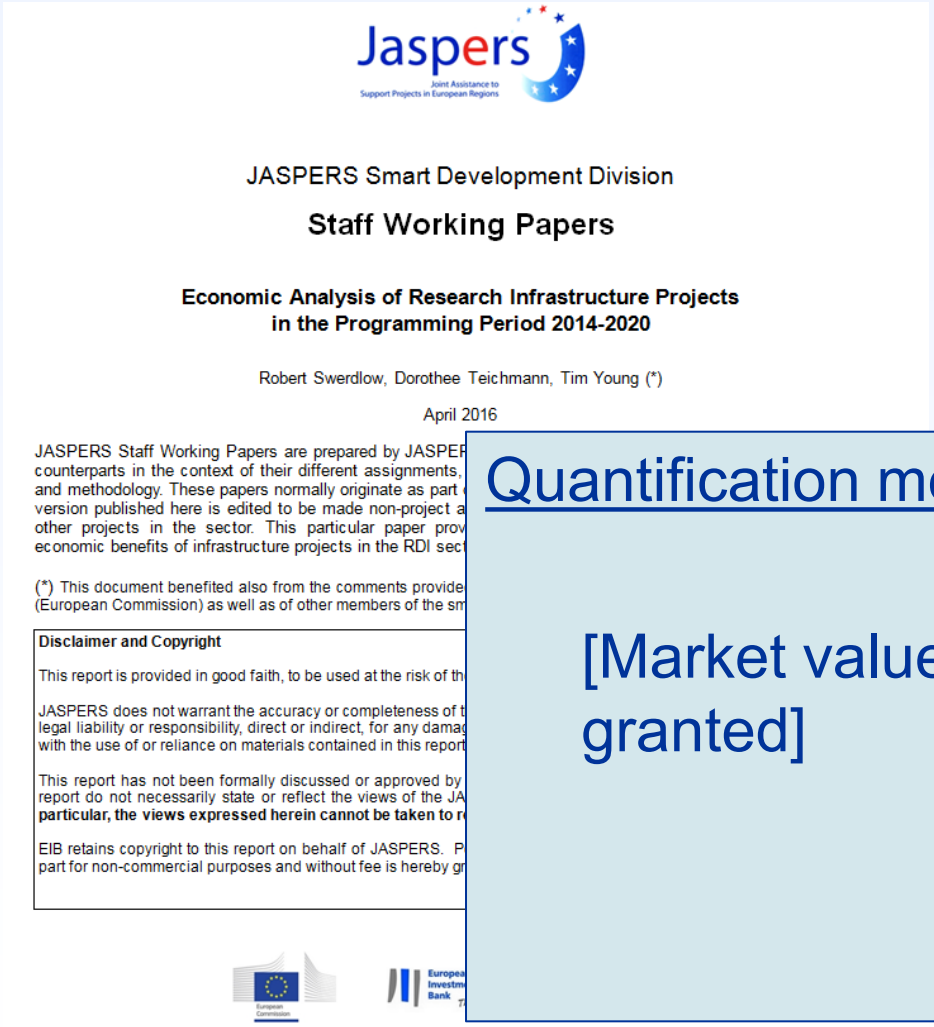
Main assumptions	
Annual salary without PhD (EUR/year)	15,000
Annual salary with PhD (EUR/year)	24,000
Annual salary deferential	9,000
Average length of career	35
PhDs gained by project researchers per year	25

Basic calculations of salary differential over *1* researcher's career						
Y11	Y12	Y13	Y14	Y15	…	Y45

NPV (5%)

⇨ Multiply by 25

Benefits due the development of new/improved products and processes



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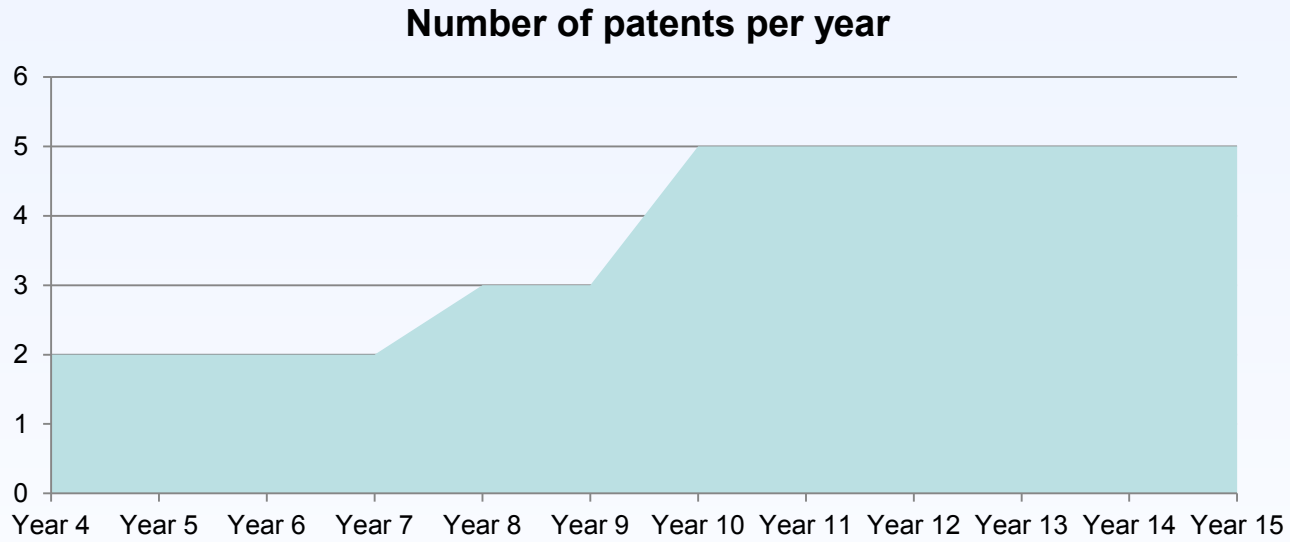
Quantification method

[Market value of patent] * [number of patents granted]

Benefits due the development of new/improved products and processes

- Estimation of number of patents (based on track record)



- Value of patents:
  - A value of 85,000 EUR per patent is assumed (source: EIB, 2013)

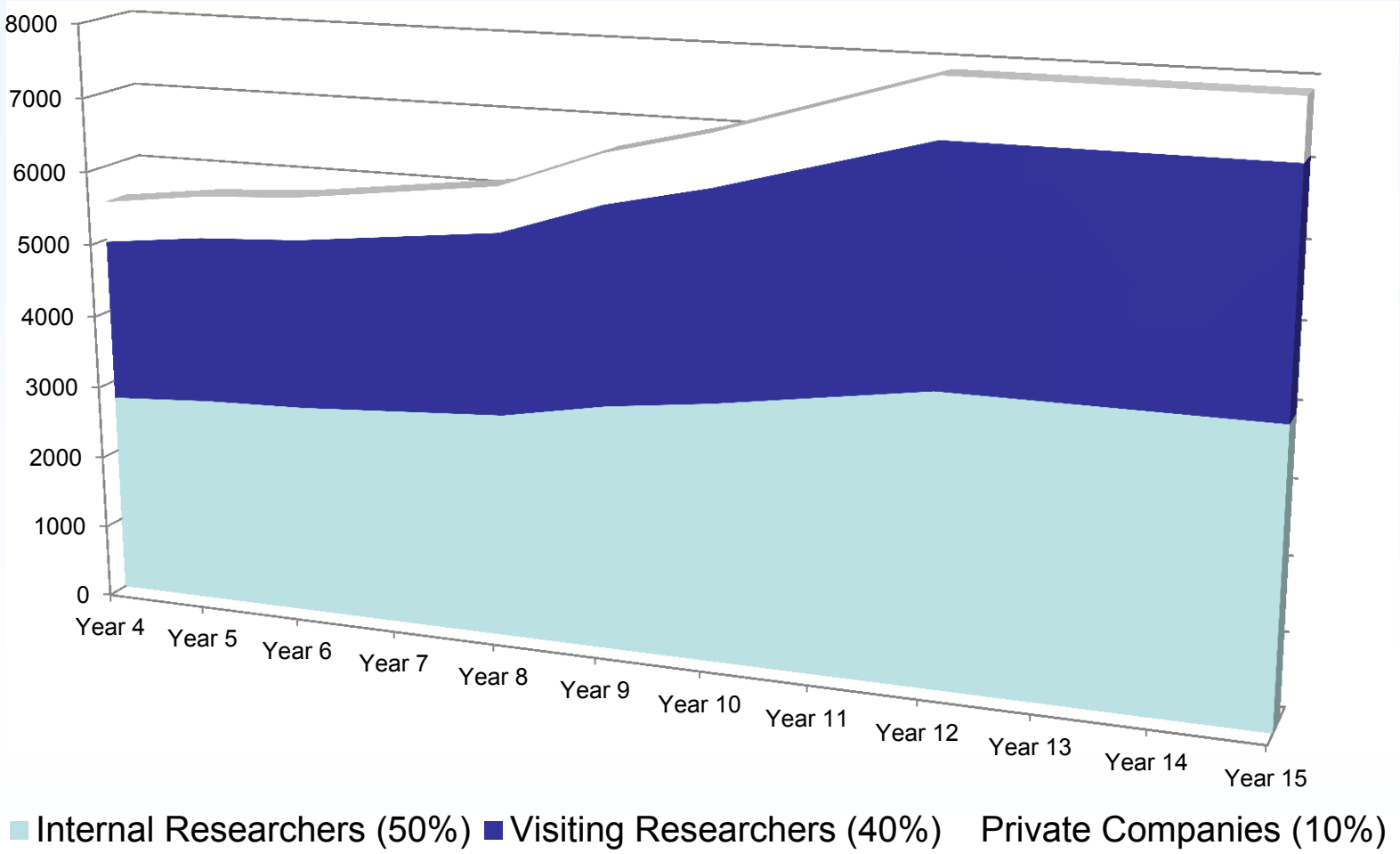
Benefits due to Open Access to the RI

Two separate approaches for:

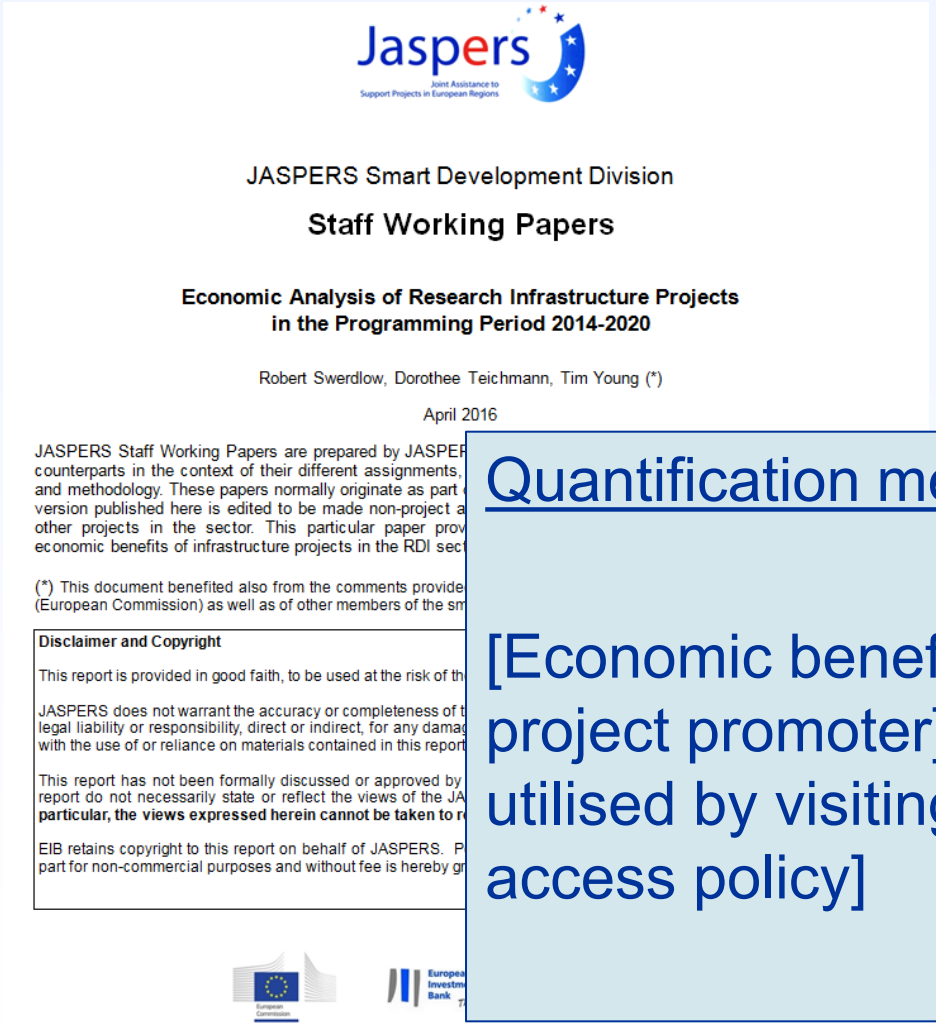
1. External researchers use of facilities
2. Private sector use of RI facilites

Benefits due to Open Access to the RI

Use of facility (hours per year)



Open Access for visiting researchers



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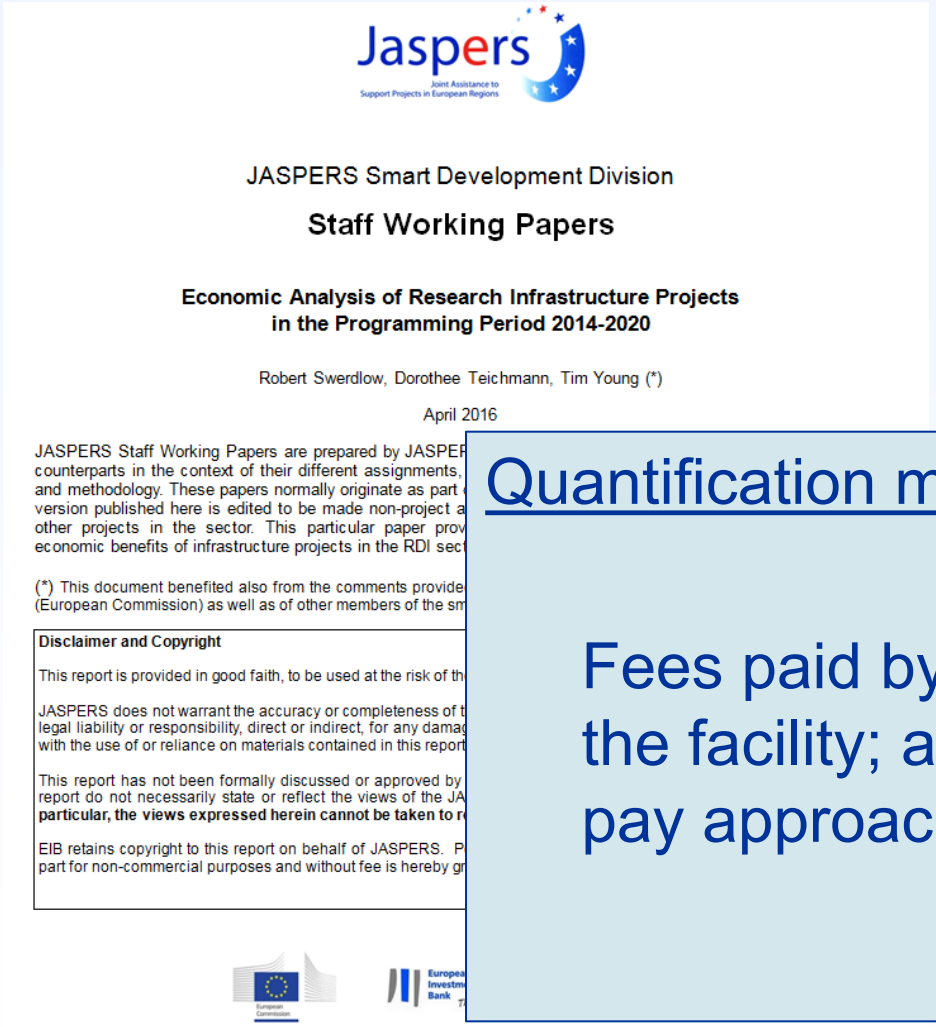
Quantification method

[Economic benefits per unit of capacity used by project promoter] * [Units of capacity to be utilised by visiting researchers under open access policy]

Open Access for visiting researchers

Calculation for last year of reference period	
% of use by internal researchers	50%
% of use by additional visiting researchers	40%
Economic benefits created by internal researchers (spin-offs, patents, publications and human capital development) in last year of reference period	EUR 9.8 million
Additional economic benefits created by visiting researchers in last year of reference period	EUR 7.9 million

Access to RI by private sector



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Quantification method

Fees paid by private sector for access to the facility; alternatively, a willingness-to-pay approach

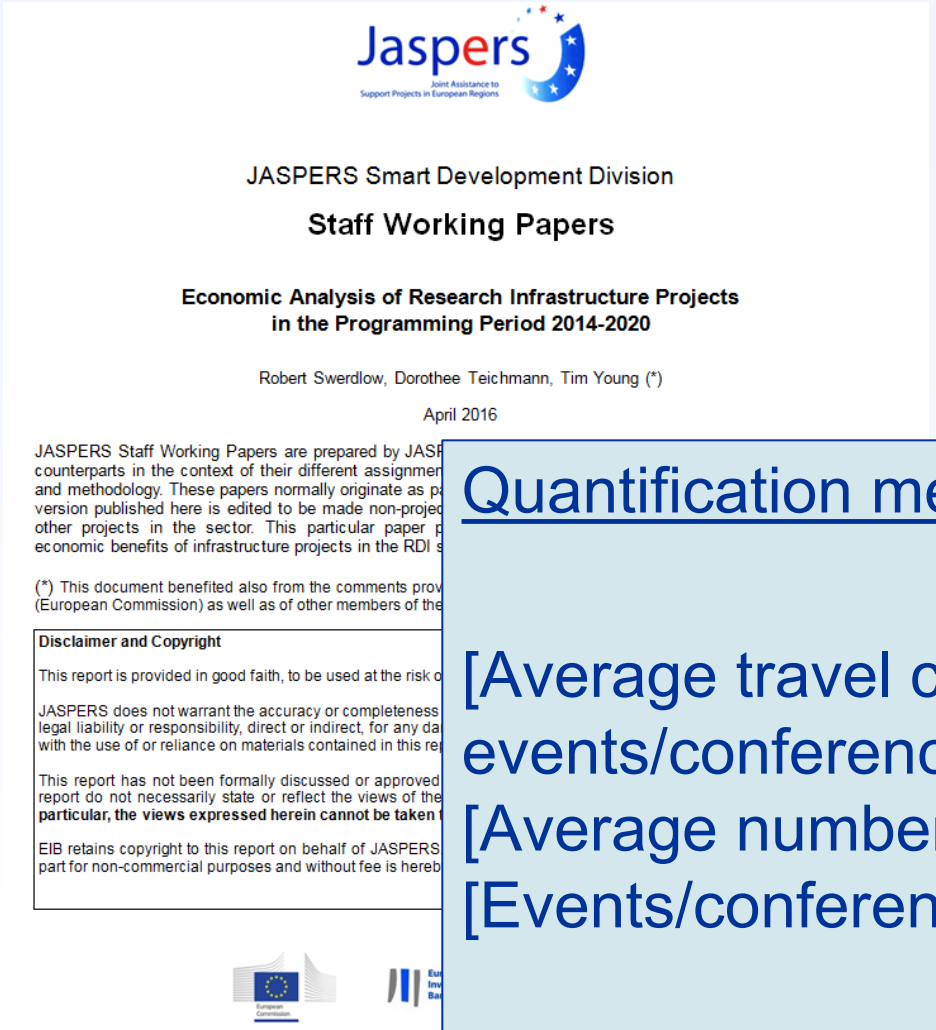
Benefits due to Open Access to RI

- Two pieces of information are needed:
  - Proportion of the facilities capacity devoted to use by the private sector (% of hours of overall use): 10%
  - Revenue (EUR/h): 605

⇨ Economic benefit in last year of reference period: EUR 0.5 million

- Both values need to be based on thorough demand analysis

Benefits due to Social Capital Development



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Quantification method

[Average travel costs + Average events/conference fee paid by participants] * [Average number of attendees] * [Events/conferences organised per year]

Benefits due to Social Capital Development

Data input	Unit	Sources	Values
Average charge to attend networking event	EUR	Project specific	100
Average number of participants	#	Project specific	500
Average number of events per year	#	Project specific	3
Average travel cost	EUR	Project specific	150
Economic benefit in last year of reference period	**EUR**	**Calculation**	**375,000**

Costs necessary to organize the conferences are included in the operating costs of the project.

Summary

- The approach put forward by JASPERS:
  - Provides supplementary guidance
  - In line with Implementing Regulation and CBA guide
  - Relatively easy to apply
  - Avoids being too prescriptive
- Working paper available on the JASPERS Networking Platform website soon

Thank you!

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