RTI evaluation as governance and effectiveness tool: the case of EMBRAPII in Brazil

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Objective:

- Present and discuss the methodological approach of an in-depth evaluation carried out in 2015 and 2016 of a new Brazilian RTI policy instrument/organization:
  - the EMBRAPII's Pilot Phase
- Focus on:
  - the multidimensional methodology
  - the proposal of implementing a complete cycle evaluation at EMBRAPII

About EMBRAPII

EMBRAPII: context

- EMBRAPII - Brazilian Industrial Research and Innovation Association

  - Created in 2013
    - Joint initiative: Confederation of Industry and Brazilian Government
    - Private not for profit
    - A small organization: abtou 25 people
    - Working under management contract with Ministry of Science, Technology and Innovation and Ministry of Education

  - It does not make research
    - it accredits existing research organizations in Brazil to act as "EMBRAPII Units"

  - Inspired by other models (e.g. the French Carnot Institute, the German Fraunhofer, and the Korean KAIST)

EMBRAPII: how does it work?

- To be accredited, a RO presents a Work Plan defining priorities, resources, goals and budget

  - EMBRAPII does not interfere in project selection and in ROs priorities, but…

  - …it demands ROs to implement best practices on managing R&D and Innovation

- Once RO is accredited, it receives funds from EMBRAPII for a 6 year contract
  - Funds are supposed to be used only after the RO get a R&D contract with a company

- EMBRAPII monitors ROs throughout their Work Plans

EMBRAPII: mission

EMBRAPII's mission is to foster innovation in Brazilian industry through pre-competitive R&D projects in collaboration between companies and industrial research organizations (ROs), lowering innovation risks

Pilot phase

1. Pilot phase involved
   - 63 projects
   - 3 established ROs (public and private not for profit)
   - 44 companies

1. The pilot phase represented a total investment of circa US$ 50 million
   - one third supported by EMBRAPII
   - one third by the companies
   - one third by the ROs (economic, but not necessarily financial)

2. All contracted projects involve managers from the company side
   - It has to be monitored
   - Completion only after a letter of acceptance from companies

EMBRAPII: implementation

- ROs from Pilot Phase
    - Institute for Technological Research (IPT): 20 projects
    - National Institute of Technology (INT): 13 projects
    - National Service of Industry's Integrated Campus for Manufacturing and Technology (SENAI-CIMATEC): 30 projects

- Companies from different sectors:
    - ++++ Cosmetics
    - +++ Oil and Gas
    - ++ Chemical, Pharmaceutical, Health Equipment, Software, Steel
    - + Others

EMBRAPII: implementation

| Pilot Phase (2013-2015)	Regular Phase (2016-2018)
US$ 50 million	US$ 350 million
3 ROs	14 ROs
44 firms	tbd
63 R&D and Innovation projects	tbd

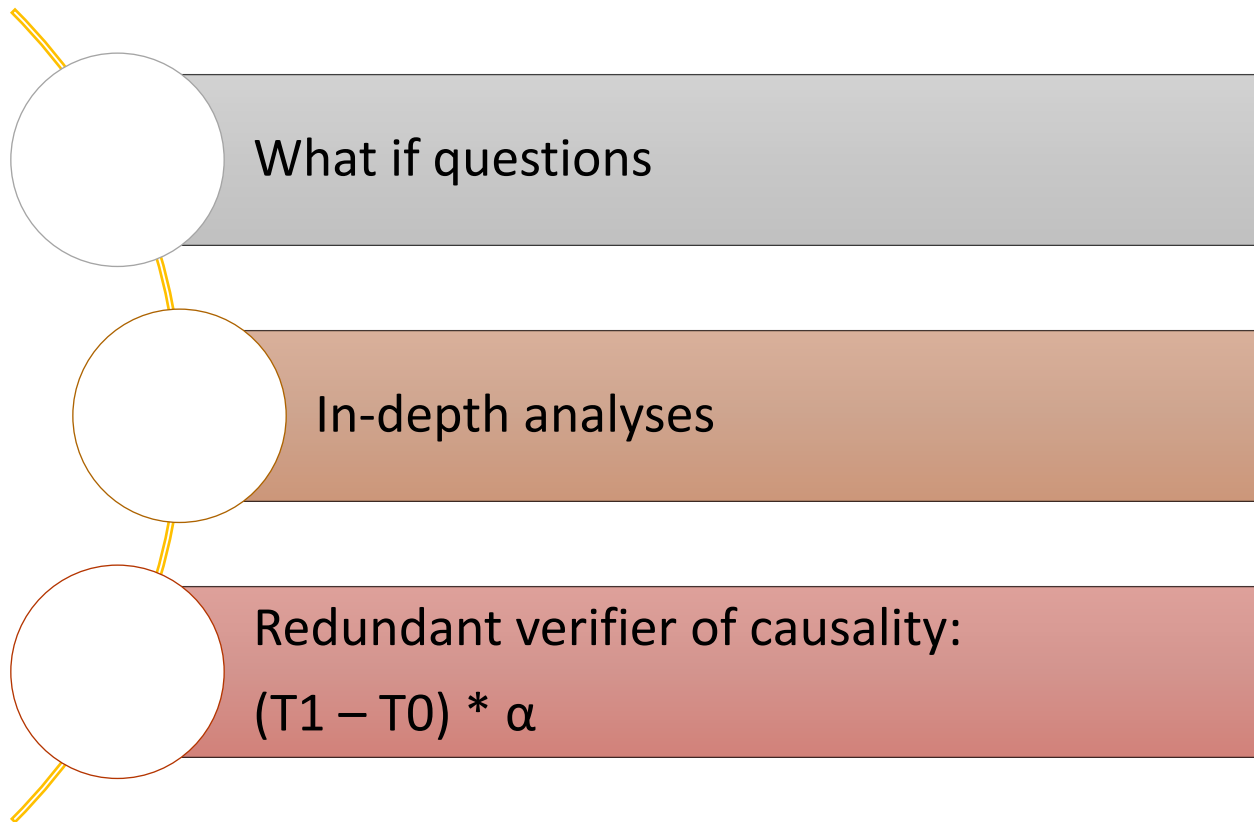# Evaluation of EMBRAPII's Pilto Phase

Evaluation objectives

3 main purposes:

1- Measuring outputs and outcomes of the R&D and innovation projects (technological results and its appropriation)

2- Measuring behavioral changes of ROs (following good practices of R&D and innovation planning and management).

3- Creating a complete-cycle evaluation system

Data collection

Data collecting instrument		Applied to	Applied by	Population	Answers
Q1	In depth interviews	Heads of Research Organizations	Evaluation team	3	3
Q2	Web survey	Project Coordinator at RO	Evaluation team	63	62
Q3	Web survey	Project Manager at Companies	Evaluation team	63	44
Q4	In depth interviews	Project Coordinators and Project Managers	Experts (consultants)	25	25

Sequence of data collection

Counterfactual
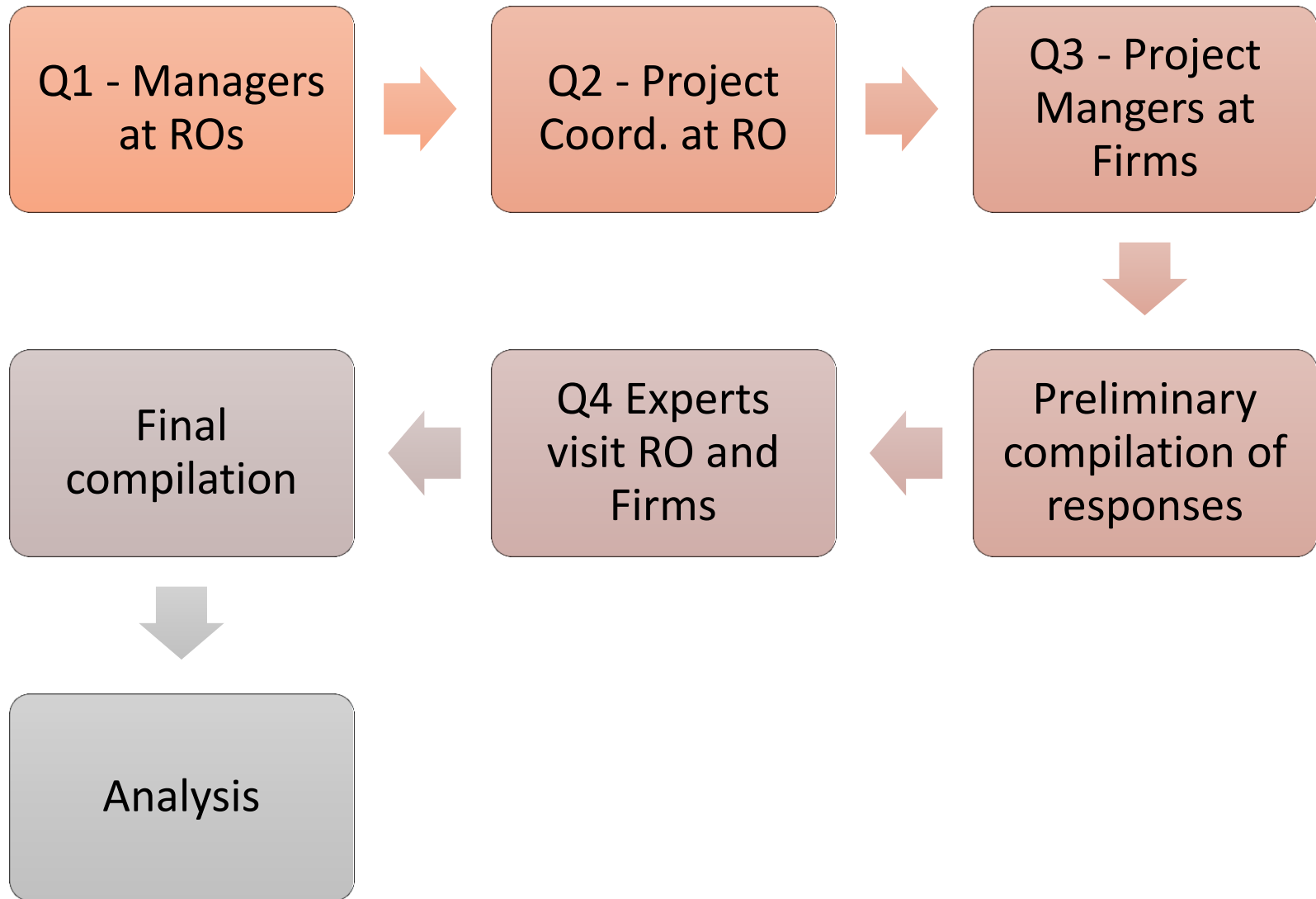
- Control Groups were not possible: singular experience, no best-rejected, just three ROs, few projects per lab…

What if questions

In-depth analyses

Redundant verifier of causality:

$(T1 - T0) * \alpha$

redundant causality identifier

A sequence of 3 questions:

1. Is there any observable change for indicator "j" ?
   - $g_{ij}=[-1,0,1]$.

2. How much?
   - $(|a_{ijt1}-a_{ijt0}|=|\Delta(a_{ij})|)$

3. From the observable change, how much can be attributed to the intervention?
   - (α_{ij})
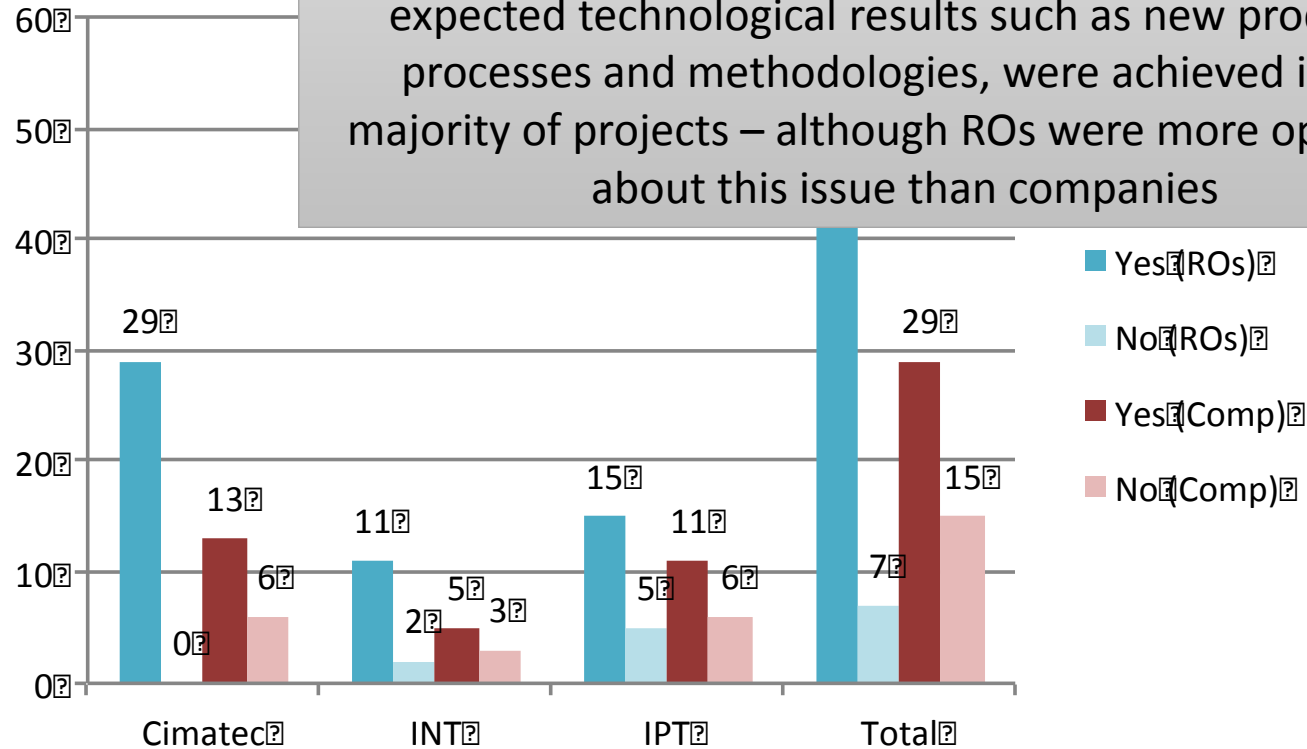
$$g_{ij} | \Delta(a_{ij}) | \alpha_{ij} = I_{ij}$$

- the average impact of an indicator "j" over all n respondents, I_j is given by:

$$I_j = \frac{1}{n}\sum_{i=1}^{n} I_{ij}$$

Dimensions and indicators
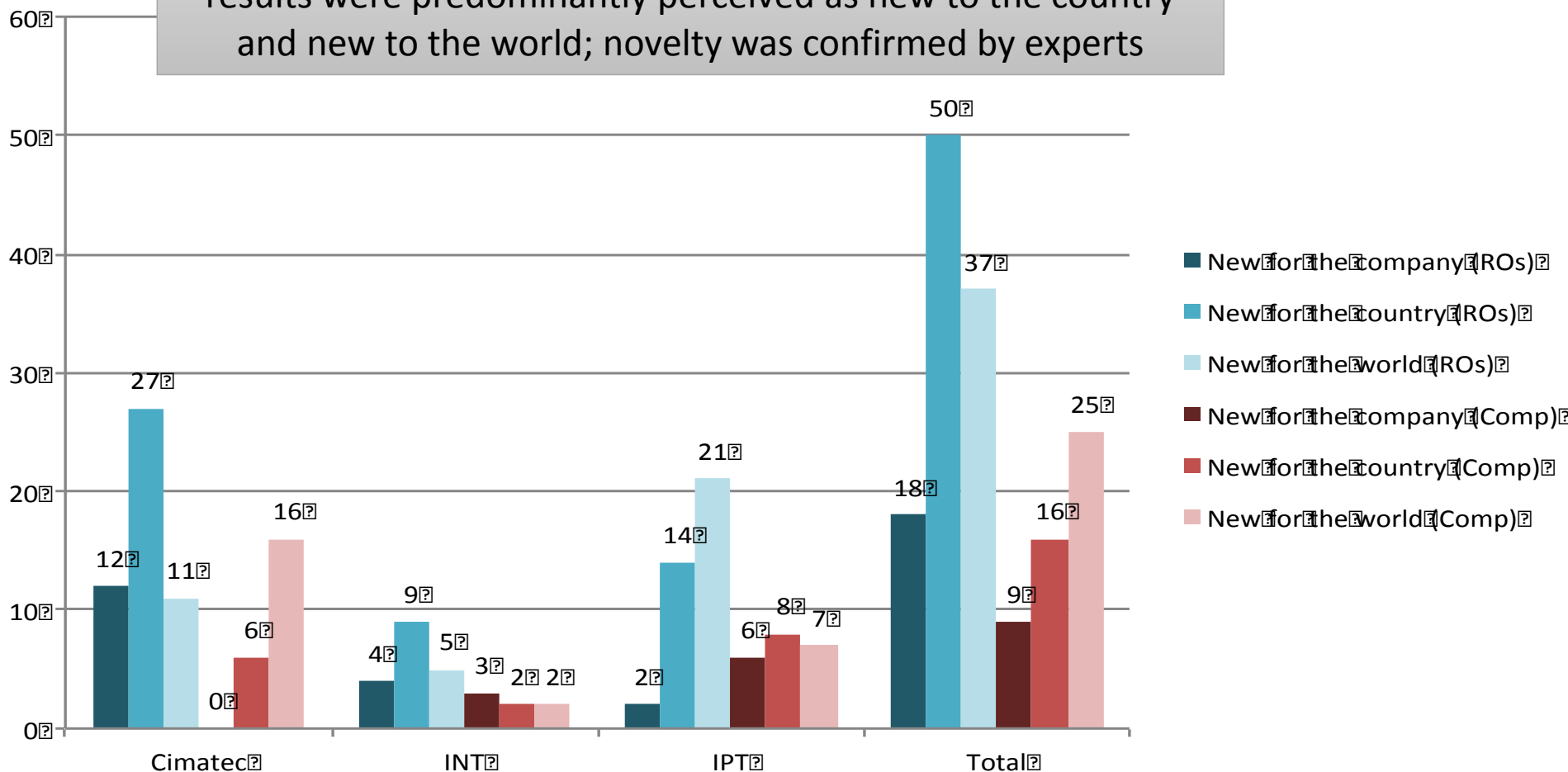
- Multidimensional approach
    - Input
        - Resources at ROs
        - Organizational efforts at ROs
    - Output
        - Technologies (TRL from 3 to 6)
        - Innovation (products and processes)
    - Behavior / Learning
        - R&D Project and portfolio management skills at ROs
        - Organizational rearrangements at ROs level
        - IP managerial skills
        - Project valuation skills
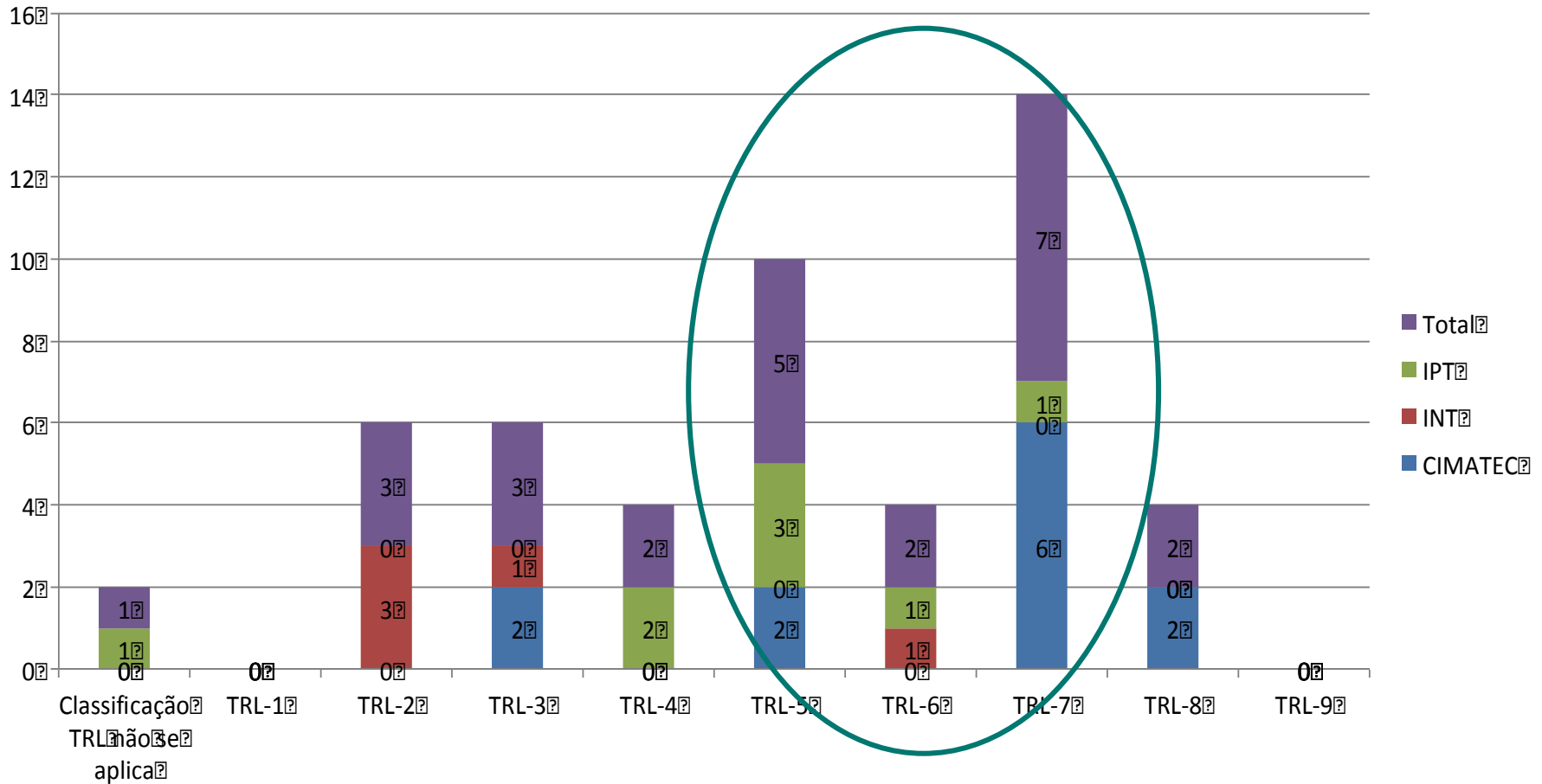   - Negotiation skills
        - Prospective skills

Some results

expected technological results such as new products, processes and methodologies, were achieved in the majority of projects – although ROs were more optimistic about this issue than companies

Legend:
- Yes (ROs)
- No (ROs)
- Yes (Comp)
- No (Comp)

	Cimatec	INT	IPT	Total
Yes (ROs)	29	11	15	
No (ROs)	0	2	5	7
Yes (Comp)	13	5	11	29
No (Comp)	6	3	6	15

results were predominantly perceived as new to the country and new to the world; novelty was confirmed by experts

Legend:
- New for the company (ROs)
- New for the country (ROs)
- New for the world (ROs)
- New for the company (Comp)
- New for the country (Comp)
- New for the world (Comp)

| Category	New for the company (ROs)	New for the country (ROs)	New for the world (ROs)	New for the company (Comp)	New for the country (Comp)	New for the world (Comp)
Cimatec	12	27	11	0	6	16
INT	4	9	5	3	2	2
IPT	2	14	21	6	8	7
Total	18	50	37	9	16	25

Technological Readiness Level (TRL)

experts classified projects from the sample mainly as having TRL from 5 to 7, following EMBRAPII's expectation about 'pre competitive' projects

Outputs: IP and TT

- Intelectual property rights (patents, industrial design, software, brands)
  - 2/3 of the projects (from ROs perspective)
  - 1/2 of the projects (from companie's perspective)
- Technology transfer contracts (licences, assignments, technology supply)
  - 11 projects (from ROs perspective)
  - 20 projects (from companie's perspective)
- 2 spin-offs

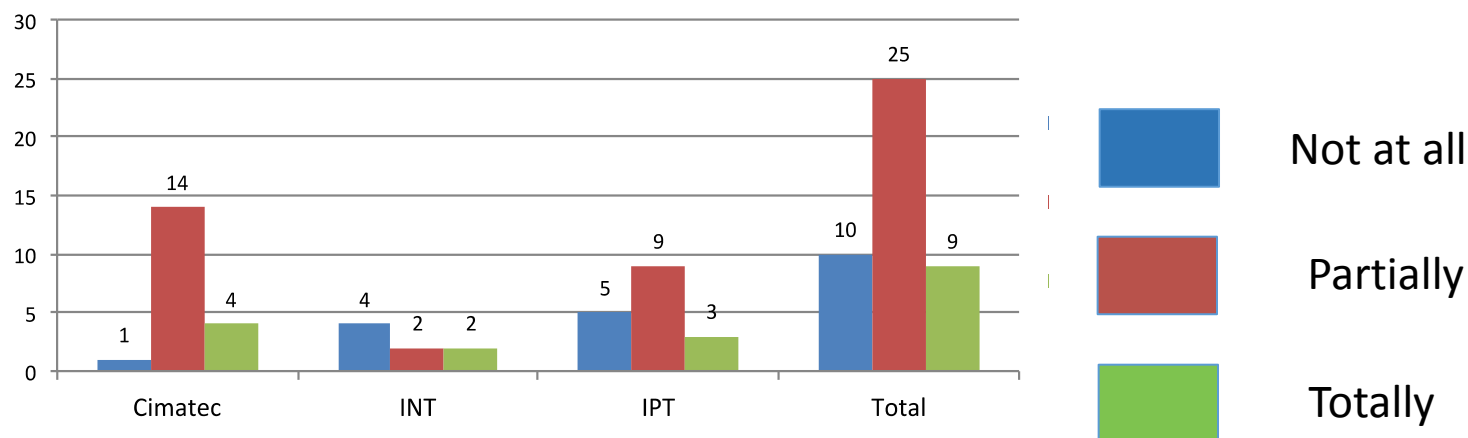# Impacts on inputs of ROs

- Financial resources in ROs:
  - Amount of budget for R&D projects with companies compared to the previous 3 years:
    - RO1 multiplied by 7
    - RO2 multiplied by 1,5
    - RO3: doubled

+ 80% within or above expectations
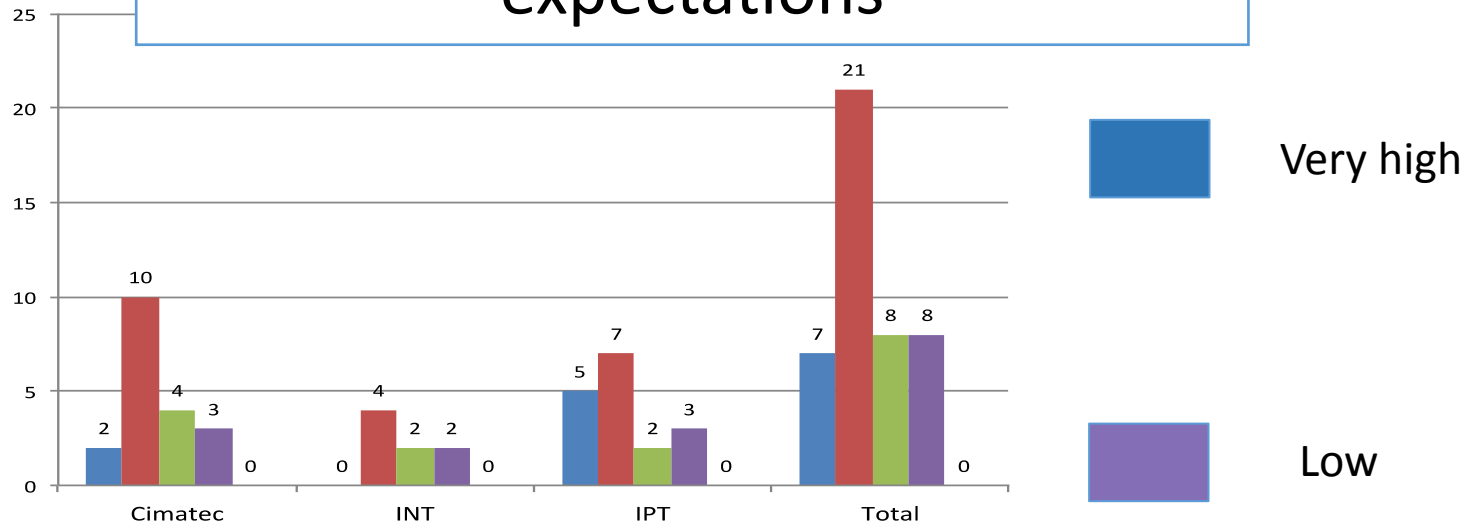
Just 4 said "no"

YES
NO

	Cimatec	INT	IPT	Total
YES	16	8	16	40
NO	3	0	1	4

Behavioral changes: ROs
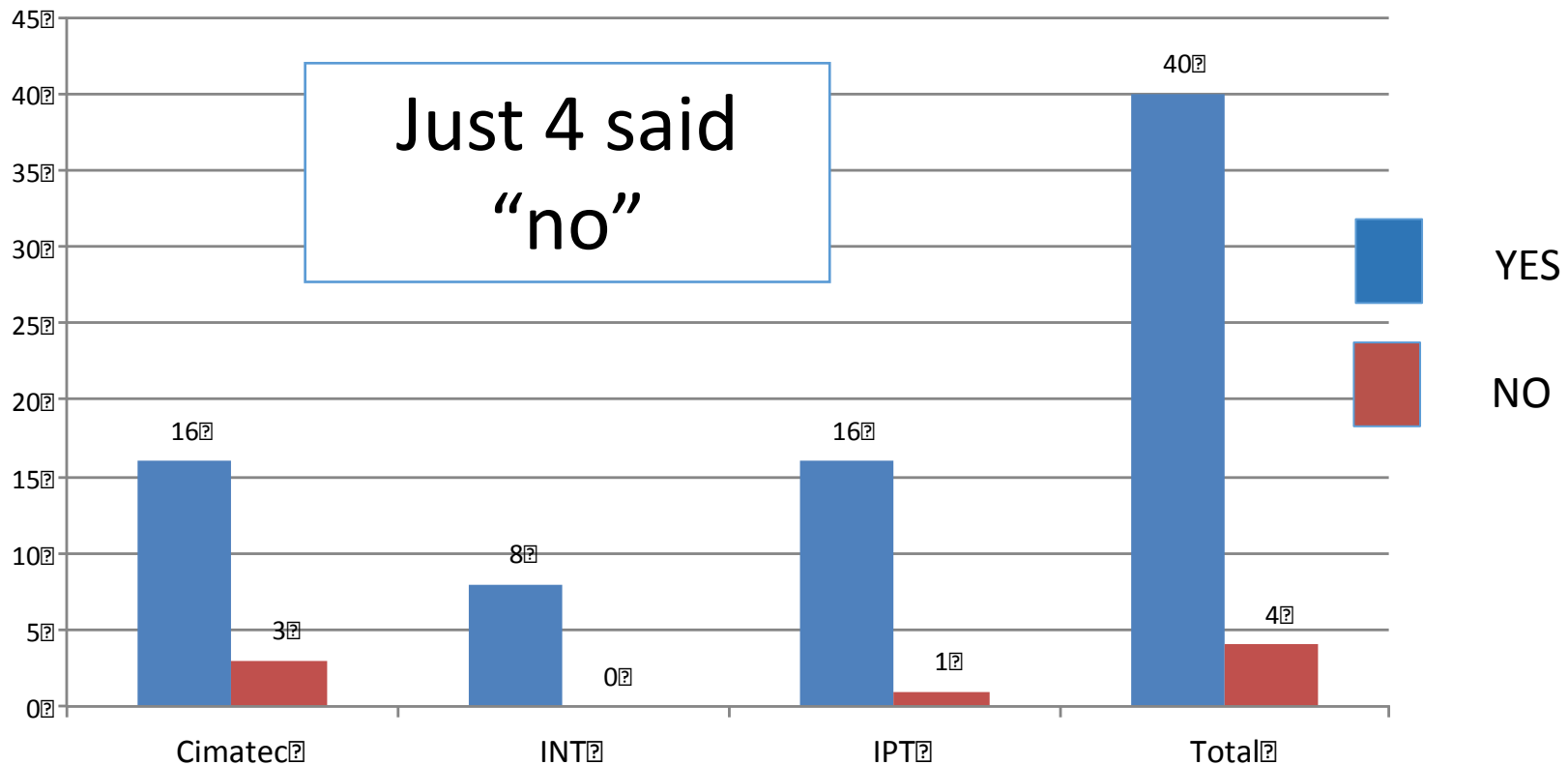
New prospecting processes

Formal competences in R&D Management

Established project management processes
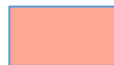
Internal policy of valuation and negotiation

Organizational rearrangements

Levels of divergence and oposition comparing Q2 and Q3

Q2	Q3	Enunciado		grau de divergência	Divergence	grau de oposição	Oposition
1.1	1.1	A motivação para o desenvolvimento do projeto pode ser entendida como tendo sido:	TODOS	48%	MÉDIA BAIXA	2%	BAIXA
			CIMATEC	42%	MÉDIA BAIXA	0%	BAIXA
			IPT	47%	MÉDIA BAIXA	0%	BAIXA
			INT	63%	MÉDIA ALTA	13%	BAIXA
1.2	1.2	O escopo do projeto em termos de seus principais objetivos e abordagens:	TODOS	74%	MÉDIA ALTA	71%	MÉDIA ALTA
			CIMATEC	84%	ALTA	84%	ALTA
			IPT	60%	MÉDIA ALTA	53%	MÉDIA ALTA
			INT	75%	ALTA	75%	ALTA
1.3	1.3	O relacionamento entre sua empresa e a ICT parceira no presente projeto:	TODOS	38%	MÉDIA BAIXA	38%	MÉDIA BAIXA
			CIMATEC	37%	MÉDIA BAIXA	37%	MÉDIA BAIXA
			IPT	33%	MÉDIA BAIXA	33%	MÉDIA BAIXA
			INT	50%	MÉDIA ALTA	50%	MÉDIA ALTA

Very high: > 75%

Medium high: < 75 > 50%

Medium low < 50% > 25%

Low < 25%

Q2	Q3	Enunciado		grau de divergência	Divergência (quartil)	grau de oposição	Oposição (quartil)
1.11	1.8	Embora não seja requisito do modelo Embrapii, pergunta-se se houve alocação de recursos humanos por parte da empresa (além do gestor ou contraparte que contratou e acompanha o projeto pelo lado da empresa) e/ou de terceiras partes (outras ICTs e/ou outras empresas) durante o desenvolvimento do projeto (independente se esse RH foi fisicamente alocado na ICT ou na empresa/terceiras partes)?	TODOS	60%	MÉDIA ALTA	60%	MÉDIA ALTA
			CIMATEC	53%	MÉDIA ALTA	53%	MÉDIA ALTA
			IPT	67%	MÉDIA ALTA	67%	MÉDIA ALTA
			INT	63%	MÉDIA ALTA	63%	MÉDIA ALTA
1.12.	1.9	Houve contratação de terceiras partes (outras ICTs e/ou outras empresas que não a sua) no desenvolvimento do projeto?	TODOS	40%	MÉDIA BAIXA	40%	MÉDIA BAIXA
			CIMATEC	42%	MÉDIA BAIXA	42%	MÉDIA BAIXA
			IPT	40%	MÉDIA BAIXA	40%	MÉDIA BAIXA
			INT	38%	MÉDIA BAIXA	38%	MÉDIA BAIXA
1.12.1.	1.9.1	Indique o percentual aproximado que a contratação de terceiras partes representou do custo total do projeto.	TODOS	30%	MÉDIA BAIXA	0%	BAIXA
			CIMATEC	33%	MÉDIA BAIXA	0%	BAIXA
			IPT	25%	MÉDIA BAIXA	0%	BAIXA
			INT	-		-	
1.13.	1.10	Embora não seja requisito do modelo Embrapii, pergunta-se se na execução do projeto houve alocação temporária ou permanente de recursos materiais (equipamentos e instalações tais como laboratórios, plantas piloto, etc.) por parte da empresa (tenha sido a alocação feita na própria empresa ou na ICT)?	TODOS	52%	MÉDIA ALTA	52%	MÉDIA ALTA
			CIMATEC	47%	MÉDIA BAIXA	47%	MÉDIA BAIXA
			IPT	53%	MÉDIA ALTA	53%	MÉDIA ALTA
			INT	63%	MÉDIA ALTA	63%	MÉDIA ALTA
1.17.	1.11	O projeto foi gerenciado a partir de diretrizes ou modelos de gestão de projetos e portfólio de projetos de P&D e Inovação (p.e. NBR 16502, PMBoK, ICB/IPMA)?	TODOS	20%	BAIXA	20%	BAIXA
			CIMATEC	13%	BAIXA	13%	BAIXA
			IPT	20%	BAIXA	20%	BAIXA
			INT	50%	MÉDIA ALTA	50%	MÉDIA ALTA
1.18.	1.12	O projeto contou com outras fontes externas de financiamento, além dos recursos alocados pela Embrapii, pela empresa e pela ICT?	TODOS	19%	BAIXA	19%	BAIXA
			CIMATEC	11%	BAIXA	11%	BAIXA
			IPT	27%	MÉDIA BAIXA	27%	MÉDIA BAIXA
			INT	25%	MÉDIA BAIXA	25%	MÉDIA BAIXA
1.19.	1.13	O desenvolvimento do projeto impulsionou (ou está em vias de impulsionar) a continuidade da relação de parceria entre a ICT e a empresa por meio de novos projetos ou outros tipos de atividades?	TODOS	12%	BAIXA	12%	BAIXA
			CIMATEC	11%	BAIXA	11%	BAIXA
			IPT	7%	BAIXA	7%	BAIXA
			INT	25%	MÉDIA BAIXA	25%	MÉDIA BAIXA

Systematic evaluation at Embrapii

Evaluation Cycle
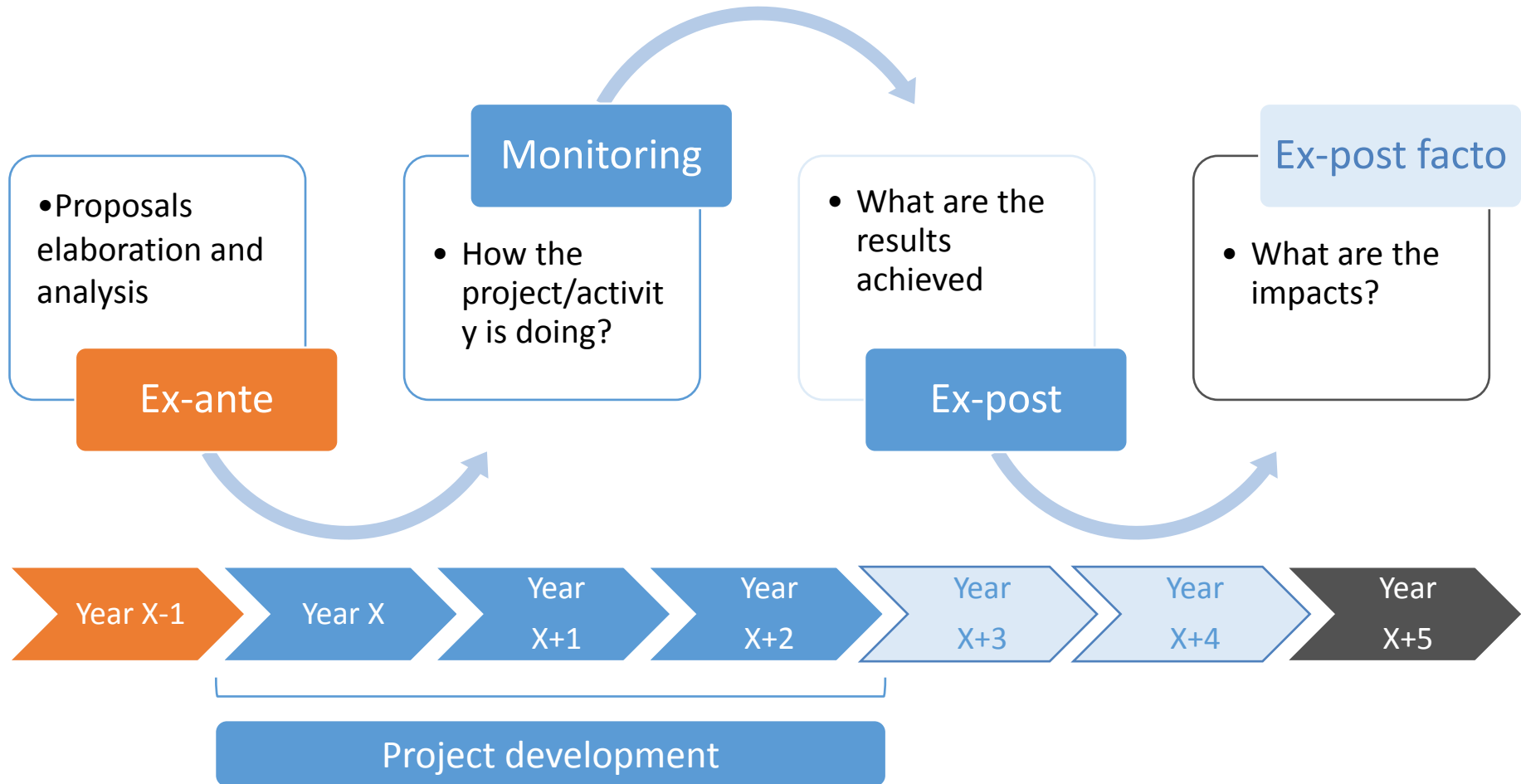
Summary of dimensions and themes of evaluation

Dimensions	Themes
R&D and Innovation	Efforts
	Generation of technologies
	IP & TT
	Financing
	Impacts of new products and services
Cooperation	Partnership for RDI
	Knowledge sharing
	Lasting of partnerships
Creating competencies	Consolidating capabilities
	Creating capabilities
	Technological initiation (young students)
R&D management	Governance
	Prospection
	Negotiation of contracts
	Project and portfolio management
	Capabilities in evaluation
Institutional Development	Networking
	Sectorial and regional effects
	Institutional planning
	Communication

Conclusions

Conclusions on Methodology

- Combination of approaches
  - Multidimensionality
  - Input + Output + Behavior additionality
  - Impossibility of control groups
  - Alternative counterfactuals

- Combination of tools
  - Questionnaires from different standpoints: RO, Firms and experts
  - In depth Interviews by evaluation team
  - In depth Interviews by experts

- Permanent validation with contractor

- Complete cycle
  - Getting the baseline, monitoring and measuring outputs and outcomes

Conclusions of the Results

- Policy rationale shows promising perspectives
  - Projects contracted under matching funds, objectives and jointly monitored may show better results
    - High degree of achievements of outputs
    - High level of satisfaction from companies
  - Organizational and behavioral effects observed

- Problems of governance of partnerships
  - Mismatch of perceptions of outputs and outcomes between ROs and companies

- Expectations of finally getting baselines, monitoring and evaluating outputs and impacts

Thank you.

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