The impact of auctions on technological innovation

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Objective

1. Introduction

Task 4.3: Impact of auctions on technological innovation

Objective

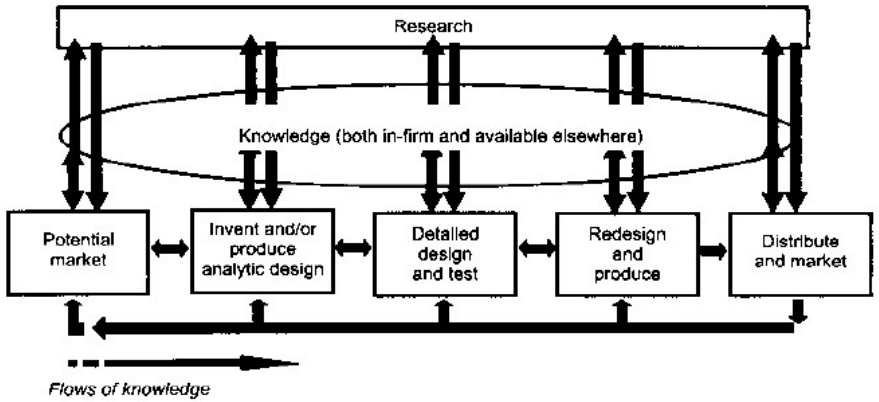
- Impact of auctions on technological innovation
- Impact of auctions design elements on technological innovation.

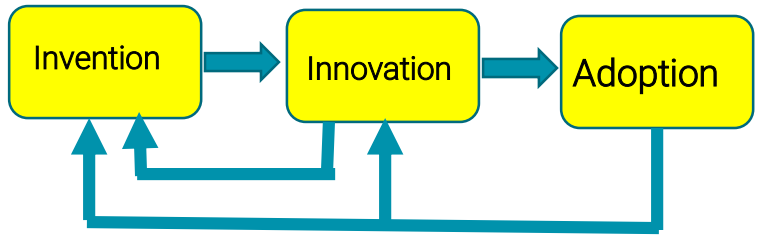
AIM: to provide a comprehensive **analytical framework** and **some propositions** on the links between auctions and technological innovation (an exploratory study).

1. Introduction

- **Starting point:**
  - Innovation in general and, more specifically, innovation in renewable energy technologies (RETs) will be a critical component of the energy transition (IEA 2020).
  - Three main stages: invention, innovation and diffusion.
    - The linear model vs. the chain-linked model.
  - Supply-push vs demand-pull instruments.
  - Demand-pull instruments to support the diffusion (deployment) of technologies, such as auctions or administratively-set support, may have an impact on previous stages of the technological change process.
    - Auctions can have an indirect impact on innovation in RETs through their effects on the diffusion of these technologies.

Chain-Link Model of Innovation, Kline, 1986





Innovation: an invention with an economic value which is ready to be adopted by the market.

1. Introduction

Motivation: The research gap.

- The lack of research on the topic, existence of data availability problems and the qualitative character of this issue.
- Exploratory analysis: Based on literature reviews and exchanging views with stakeholders on the main aspects (variables, relationships between variables and causal links).

2. Design elements

Volume	Generation, capacity or budget	
	Disclosure (vs. non-disclosure)	
Schedule (vs. non-schedule)		
Frequency: high (vs. low)		
Diversity	Technology-neutral (vs. technology-specific)	
	Geographically-neutral (vs. geographically-specific)	
	Actor-neutral (vs. actor-specific)	
	Size-neutral (vs. maximum size)	
	Size-neutral (vs. minimum size)	
Prequalification (stringency)	Material prequalifications on projects	
	Material prequalifications on project developers	
	Financial prequalifications	
Seller concentration rules (vs. their absence)		
Local content rules: local industry (vs. their absence)		
Local content rules: local employment (vs. their absence)		
Information provision		
Remuneration type: generation (vs. capacity)		
Remuneration type (FIT, fixed FIP, sliding FIP)		
Selection criteria: price-only (vs. multicriteria).		
Auction format: multi-item (vs. single-item).		
Auction type: static (vs. dynamic)		
Pricing rule: PAB (vs. uniform)		
Ceiling prices	Existence (vs. absence)	
	Disclosure (vs. non-disclosure)	
Realisation period (vs. absence)		
Minimum participation conditions (vs. their absence)		

3. The sources of innovation in RETs: impacts from diffusion.

Innovation mechanisms from diffusion:

-Learning effects
-Market creation.
-Private R&D investments: reinvestment of profits.
-Competitive pressure.
-Knowledge spillovers.

In turn, these mechanisms are triggered by **policy factors**:

-policy framework conditions,
-specific instruments (deployment support + RD&D support)
-Specific deployment instruments (auctions…)
-design elements in those instruments.

…as well as **non-policy factors**…

4. The innovation effects of renewable energy deployment policies: a literature review.

(I) The literature on the innovation effects of deployment support.

- 28 papers. Quantitative/qualitative.
- Low level of granularity
  - The empirical analyses are two broad and usually do not descend to the level of the effects of different types of deployment instruments.
    - R&D support vs. deployment support / Price-based and quantity-based deployment instruments.
- Few analysis on auctions (theoretical/qualitative)
- The influence of different design elements is only addressed in a few contributions (but not with respect to auctions) in the theoretical literature, and it is absent in the empirical one.
- Very limited results: price-based instruments generate more innovation effects than quantity-based ones. Mature vs. less mature technologies.

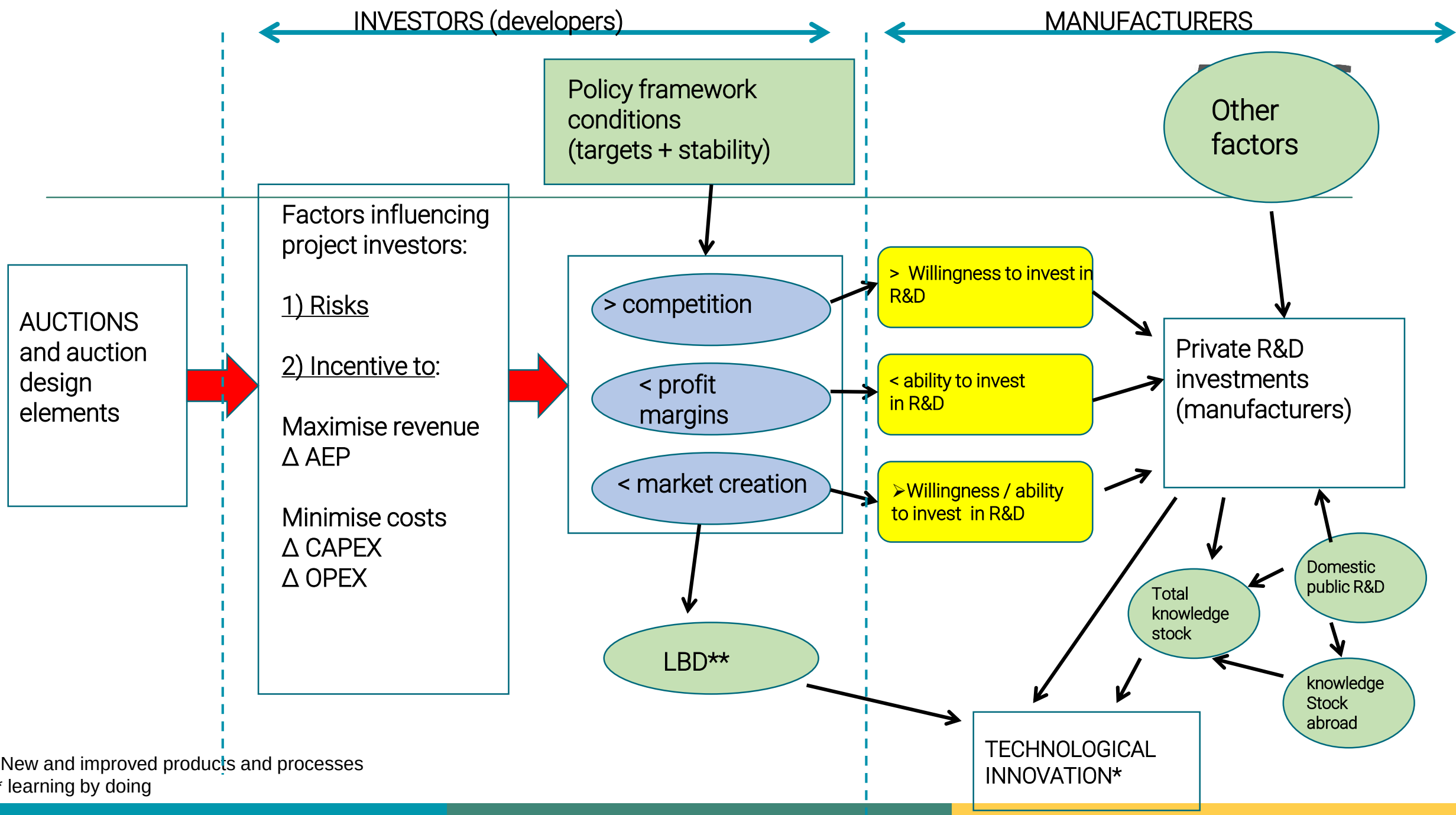
4. The innovation effects of renewable energy deployment policies: a literature review.

(II) The literature on technological innovation systems (TIS).

- 59 papers.
- Only a few references on the influence of auctions on market creation in the TIS literature, which is deemed a negative one.
  - a consequence of an instrument for which deployment is capped.
  - the result of greater transaction costs for entrepreneurs and delays
  - or technology-neutral auctions discouraging the award for less mature technologies
- The functioning of auctions in the policy mix has not been the focus of research in the TIS literature, and should be investigated in the future. Therefore, those negative effects should be regarded as preliminary and taken with caution.

5. Relating RES auctions and innovation effects on RETs.

- Linking the innovation literature and auctions: **mechanisms on the influence of auctions on innovation.**
- Impact of **auctions** on technological innovation (vs. administratively-set remuneration and no support).
- Impact of different auction **design elements** on technological innovation (vs. alternatives).
- Impact of **other factors** on technological innovation and relative importance of auctions in this regard.



* New and improved products and processes
** learning by doing

5. Relating RES auctions and innovation effects on RETs.

The innovation effects of auctions vs. administratively-set support

Innovation mechanisms		General assessment
Learning effects		<
Willingness and ability of equipment manufacturers to invest in R&D	Profit margins	<
	Market creation	<
	Competitive pressure	>
Total		?

5. Relating RES auctions and innovation effects on RETs.

The innovation effects of different auction design elements.

Design elements		Learning effects	Profit margins	Market creation	Competitive pressure	Expected impact on innovation	
Category	Alternatives					Net (positive) impact	Expected degree of impact
Volume	Generation, capacity or budget	GEN and CAP (+), BUD (-)	=	CAP (++), GEN (+), BUD (-)	=	Capacity (generation)	Small
	Disclosure (vs. non-disclosure)	+	Slightly -	+	Slightly -	Disclosure	Small
Schedule (vs. non-schedule)		++	=	++	?	Schedule	High
Diversity	Technology-neutral (vs. technology-specific)	+ (more mature) -(less mature)	+ (more mature) -(less mature)	+ (more mature) -(less mature)	+	Neutral (more mature) Specific (less mature)	High
	Geographically-neutral (vs. geographically-specific)	=	?	=	+	Neutral	Small
	Actor-neutral (vs. actor-specific)	=	? (depends on the specific design)	=	? (depends on the specific design)	? (depends on the specific design)	Small
	Size-neutral (vs. maximum size)	Slightly -	-	Slightly -	+	?	Small
Prequalification (stringency)	Material prequalifications on projects (vs. non-stringent)	+	-	+	-	?	Medium
	Material prequalifications on project developers (vs. non-stringent)	+	-	+	-	?	Medium
	Financial prequalifications (vs. non-stringent)	+	-	+	-	?	Medium

5. Relating RES auctions and innovation effects on RETs.

The innovation effects of different auction design elements.

Design elements		Learning effects	Profit margins	Market creation	Competitive pressure	Expected impact on innovation	
Category	Alternatives					Net (positive) impact	Expected degree of impact
Seller concentration rules (vs. their absence)		?	-	+	+	?	Small
Local content rules: local industry (vs. their absence)*		=	+	?	-	?	Medium
Local content rules: local employment (vs. their absence)		-	=	=	=	?	Small
Information provision		Slightly +	+	+	+	Information provision	Small
Remuneration type: generation (vs. capacity)		=	=	+	=	Generation-based remuneration	Medium
Remuneration type (FITs, fixed FIPs, sliding FIPs)		1. FIT; 2. Sliding FIPs; 3. Fixed FIP	?	1. FIT; 2. Sliding FIPs; 3. Fixed FIP	1. Fixed FIP 2. Sliding FIPs; 3. FIT	?	Medium
Selection criteria: price-only (vs. multicriteria).		=	+	+	+	Price-only	Medium
Auction format: multi-item (vs. single-item).		=	=	+	=	Depends on technology	Small
Auction type: static (vs. dynamic)		-	-	-	+	Dynamic?	Small
Pricing rule: PAB (vs. uniform)		?	?	?	?	?	Small
Ceiling prices	Existence (vs. absence)**	=	=	=	=	?	Small
	Disclosure (vs. non-disclosure)	=	=	=	=	?	Small
Realisation period with an appropriate length (vs. their absence or too long)		+	=	+	=	Realisation period (set with an appropriate length)	Small
Frequency: high (vs. low)		=	=	+	=	High frequency	Small
Minimum participation conditions (vs. their absence)		=	?	=	+	Minimum levels of participation	Small

5. Relating RES auctions and innovation effects on RETs.

Research proposals:

-Auctions and auction design elements influence innovation through their indirect impact on manufacturers and technology developers.

-Four main channels:
-(i) impact on private R&D through a greater profit margin.

-(ii) the expectation that there will be a market for the technology (i.e., where manufacturers and technology developers can sell their technology),

-(iii) impact on technology diffusion and

-(iv) impact on the competitive pressures faced by manufacturers and technology developers to reduce costs or increase revenues.

-Opposing effects (market creation/profit margins vs. competition effects).

-Auctions will be one of the factors influencing innovation in RETs, but probably not the main one. Many other non-policy and policy factors influence innovation (technology-push policies, international competition in a globalised sector).

-Different design elements in auctions have different impacts on innovation. Some design elements discourage them, others encourage them and yet others do not have any impact.

6. Methodology

- The purpose of the empirical analysis is to confirm the set of research proposals on the mechanisms linking auctions and innovation in RETs and the relative importance of other (non-auction)factors in driving innovation.
- Qualitative case study research.
- Focus on R&D (instead of patents) and the micro-level (instead of the macro-level).
- Expert consultation.
- Time focus of the analysis

6. Methodology.

- A questionnaire to main experts knowledgeable of the link between auctions and innovation in RETs on their perception of the topic and the relationships between the different variables.
- 19 experts completed the questionnaire and sent them back to the authors between Nov. and Dec. 2020.
- A wide array of different experts were contacted: technology platforms (2 experts), different Spanish renewable energy associations (5), project developers (3), academic experts (6), a think tank, a non-academic expert and one manufacturer.
- The questionnaire focused on either RETs in general (8 completed questionnaires) or specific technologies (3 for wind, 3 for PV, 4 for CSP and 1 for biomass).

6. Methodology.

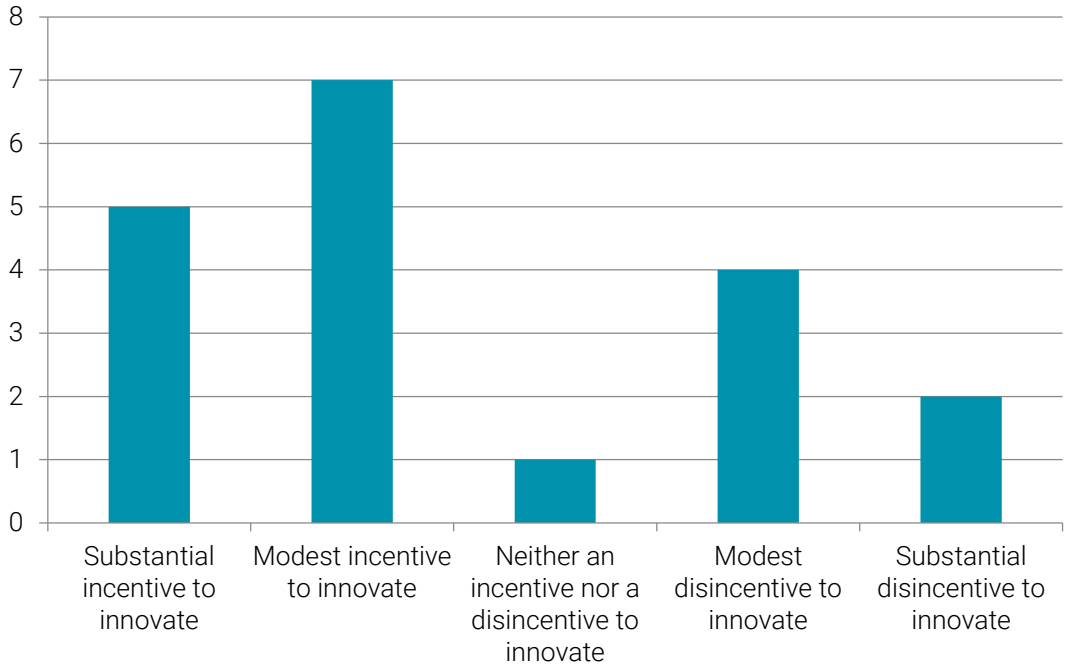
Five blocks of the questionnaire:

- Block 0. Confidentiality clause, objective and definition of technological innovation.
- Block 1: Comparative influence of auctions with respect to other policy options.
- Block 2. Influence of auctions on the deployment-related drivers of innovation.
- Block 3. Impact of different design elements.
- Block 4. Influence of different factors on technological innovation in RETs.

7. Results of the case study.

- Block 1: Comparative influence of auctions with respect to other policy options.

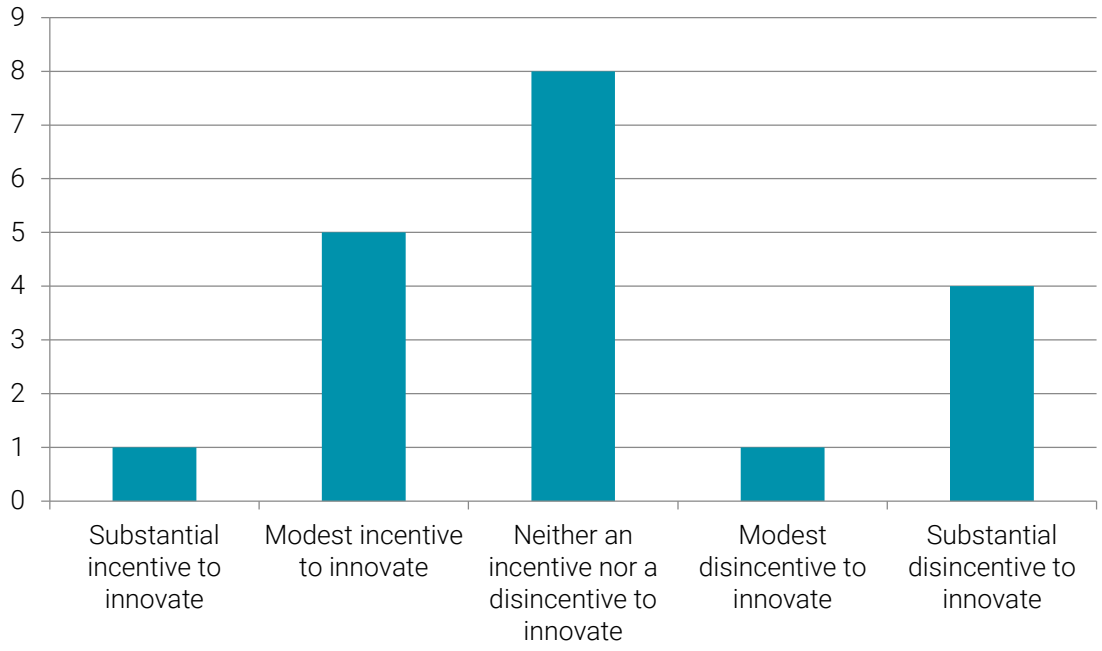
The impact of RES auctions on technological innovation in RETs in Spain with respect to ASR.



7. Results of the case study.

- Block 1: Comparative influence of auctions with respect to other policy options.

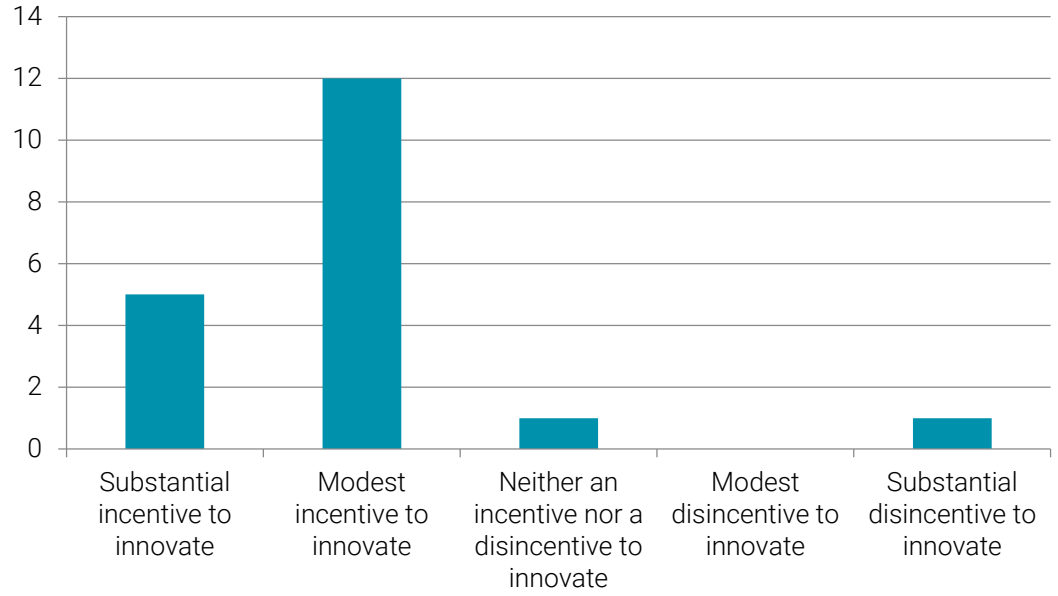
The impact of past RES auctions in Spain on technological innovation in RETs in Spain (with respect to ASR).



7. Results of the case study.

- Block 1: Comparative influence of auctions with respect to other policy options.

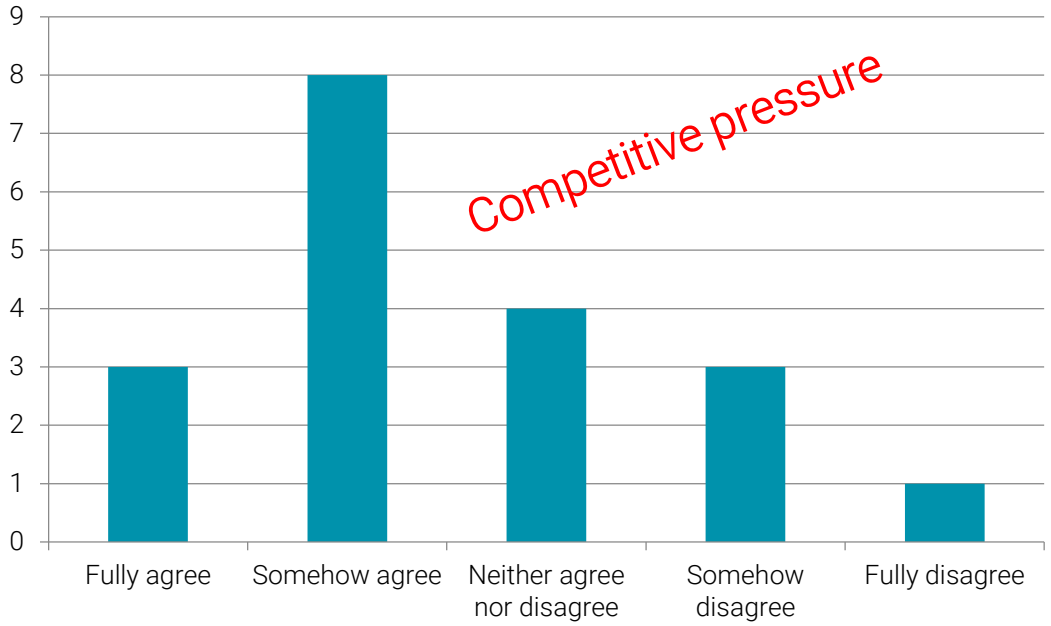
Expected impact of RES auctions on technological innovation in RETs in Spain in the future with respect to the absence of support.



7. Results of the case study.

- Block 2. Influence of auctions on the deployment-related drivers of innovation.

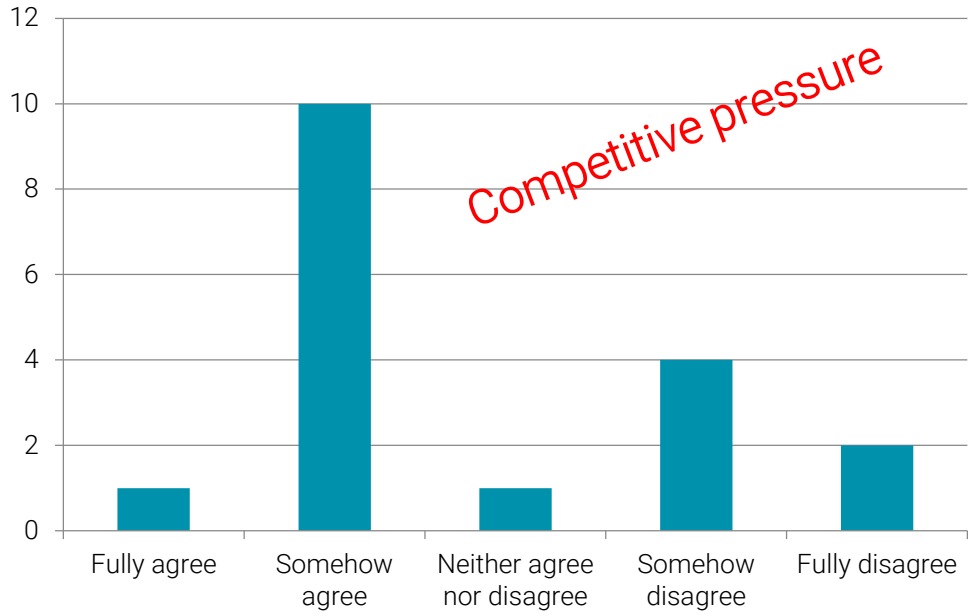
The influence of auctions on the “competitive pressure” deployment-related driver of innovation (with respect to ASR).



7. Results of the case study.

- Block 2. Influence of auctions on the deployment-related drivers of innovation.

The influence of auctions on the “competitive pressure” deployment-related driver of innovation (with respect to the absence of support).



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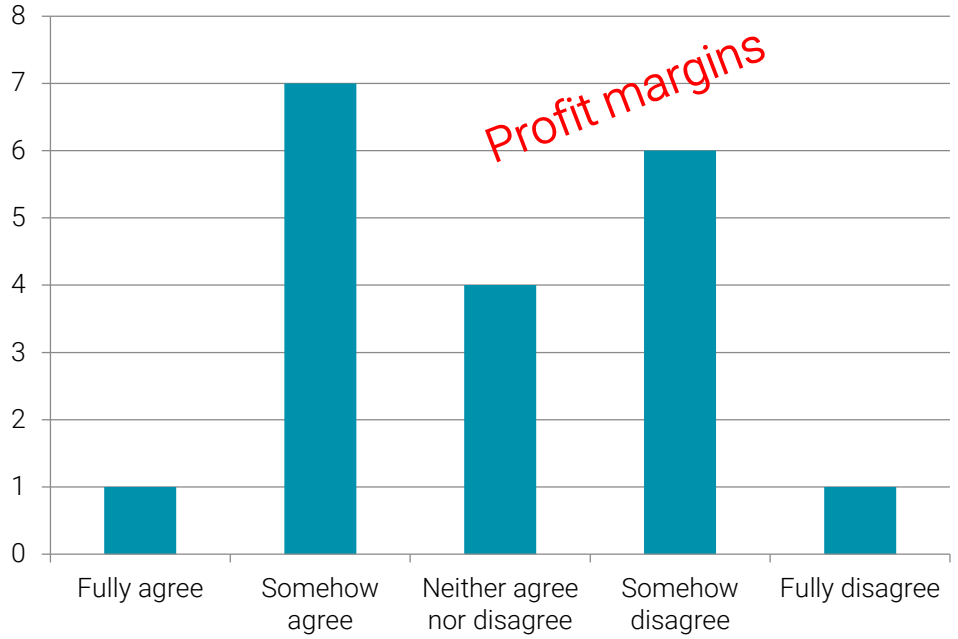
- Block 2. Influence of auctions on the deployment-related drivers of innovation.

The influence of auctions on the “profit margins” deployment-related driver of innovation (with respect to ASR).



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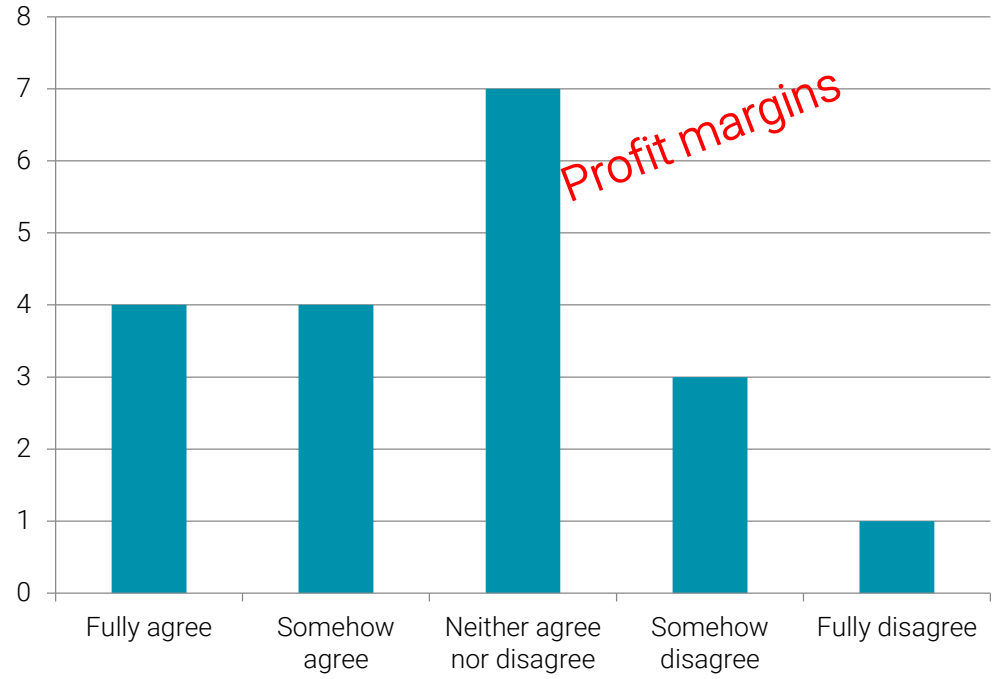
- Block 2. Influence of auctions on the deployment-related drivers of innovation.

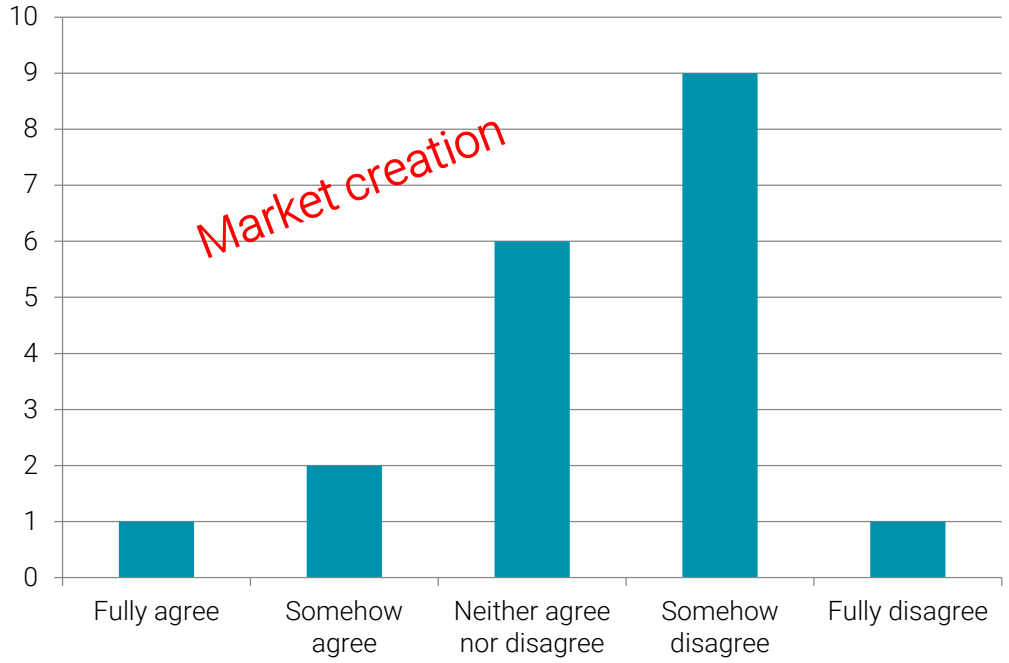
The influence of auctions on the “profit margins” deployment-related driver of innovation (with respect to the absence of support).



7. Results of the case study.

- Block 2. Influence of auctions on the deployment-related drivers of innovation.

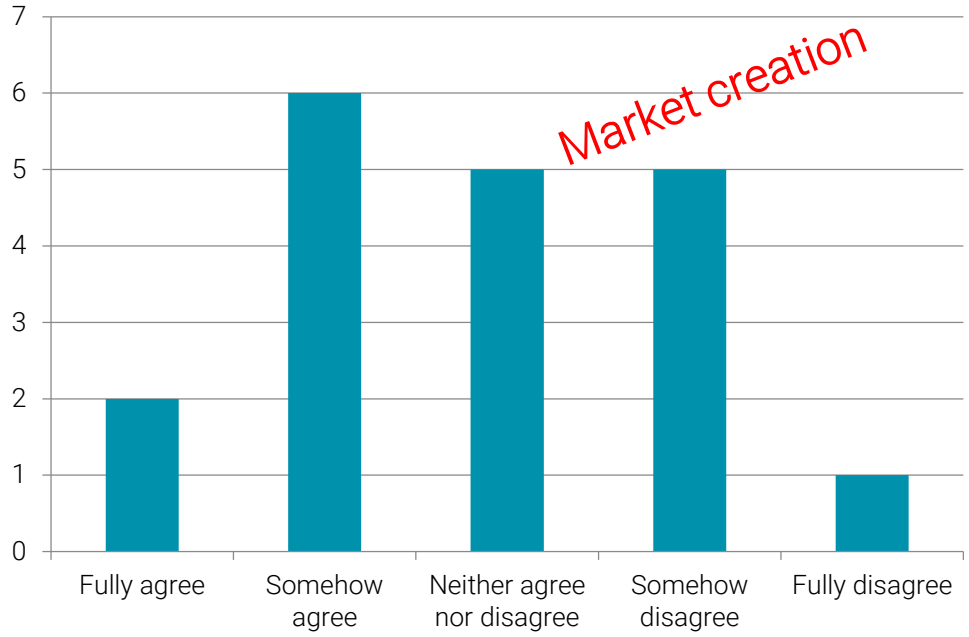
The influence of auctions on the “market creation” deployment-related driver of innovation (with respect to ASR).



7. Results of the case study.

- Block 2. Influence of auctions on the deployment-related drivers of innovation.

The influence of auctions on the "market creation" deployment-related driver of innovation (with respect to the absence of support).

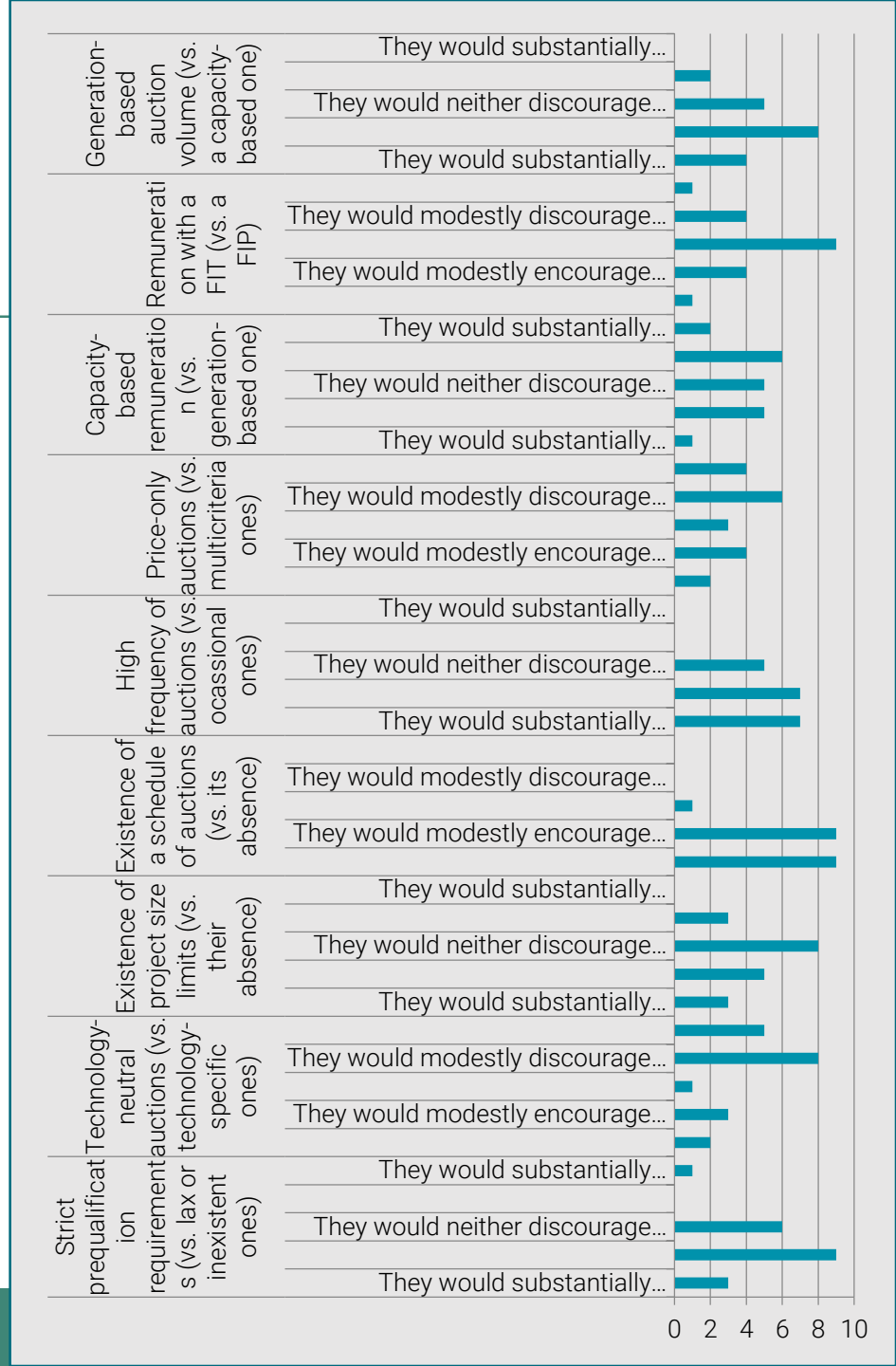


7. Results of the case study.

- Block 3. Impact of different design elements.

Overall, the most influential design elements on technological innovation:

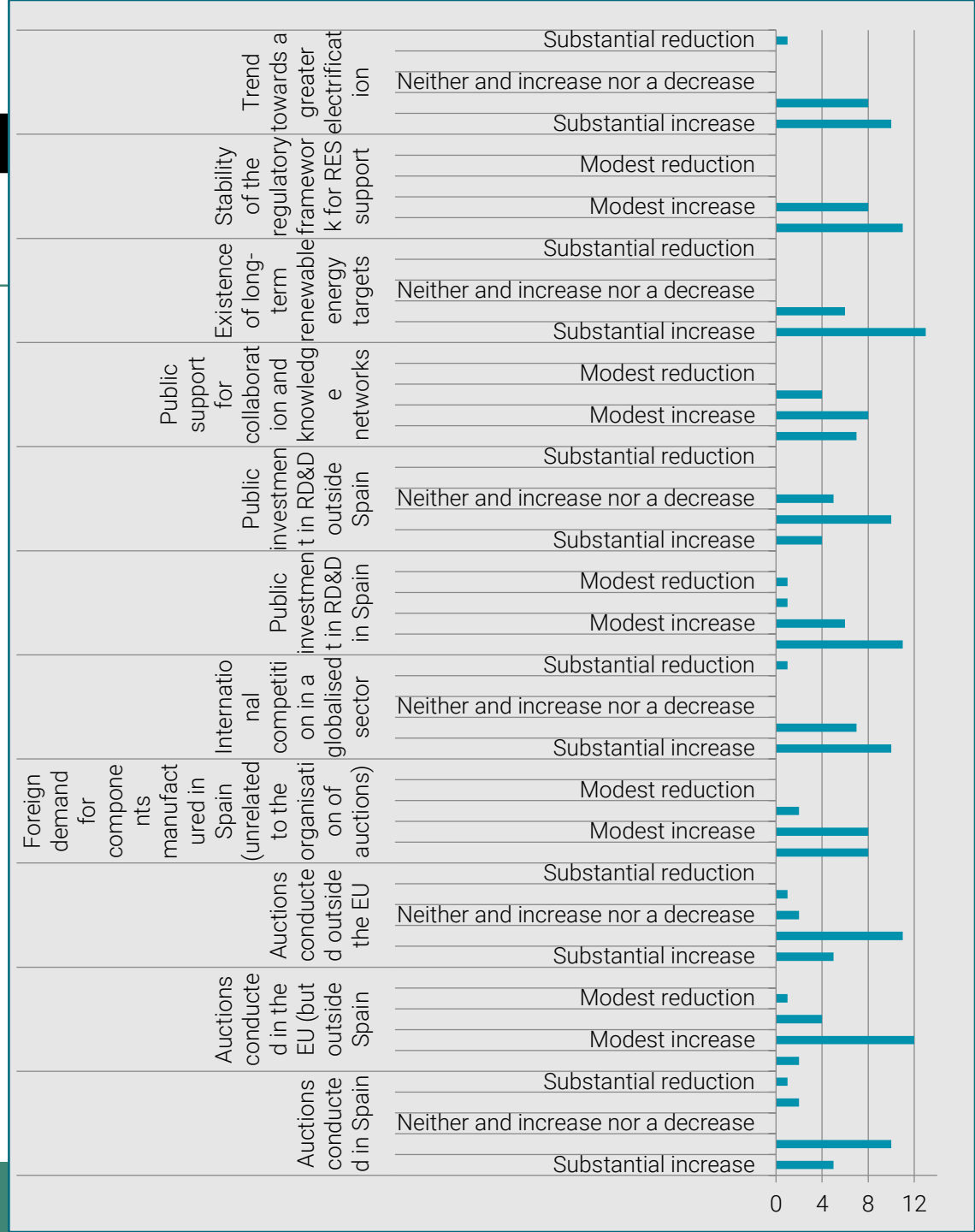
- **the stringency of prequalification requirements,**
- **technological neutrality,**
- **a schedule of auctions,**
- **highly frequent auctions**



7. Results of the case stud

Block 4. Influence of different factors on technological innovation in RETs.

- Auctions perceived to play a limited role in driving technological innovation in RETs compared to other factors.
- The most influential factors are unrelated to auctions:
  - -the existence of international competition in a globalised sector,
  - -public support for R&D
  - -collaboration and framework conditions (long-term goals and stability).



8. Conclusions

-The literature on the innovation effects of auctions is extremely tiny.

-An analytical framework on the mechanisms linking diffusion-driven technological innovation and auctions and their design elements has been provided.

-The perception of key stakeholders on the topic has been identified

-Some research proposals to be investigated in future research have been put forward.

-Substantial methodological challenges in future in-depth empirical analyses on this topic.

Thank You

Pablo del Río, CSIC

AURES II

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