



**IEA Bioenergy**  
Technology Collaboration Programme

Task 42  
Biorefining in a circular economy



## Barriers and incentives for the market diffusion of biorefineries in a circular economy

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**WOOD**  
**KPLUS**

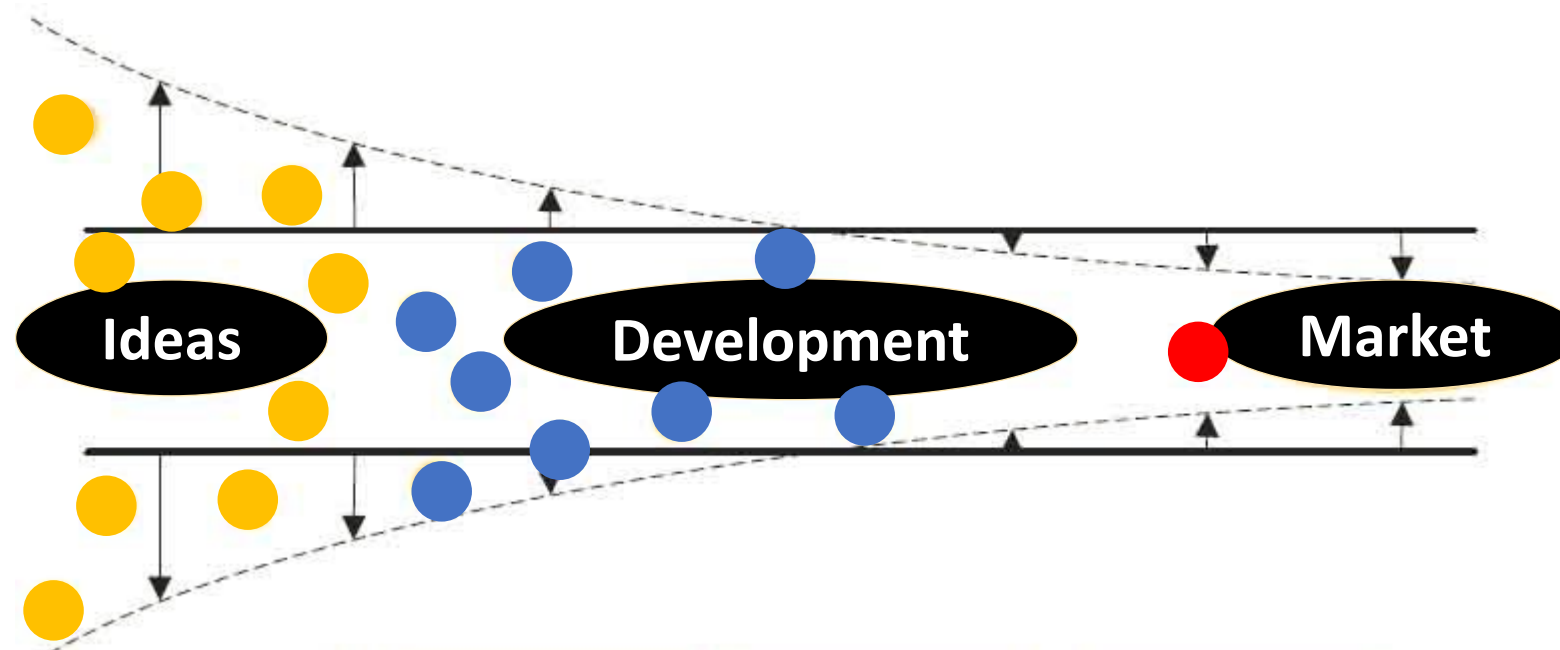
Triennium 2019-2021 / WP 2 / T2.1: Barriers and incentives for the market diffusion

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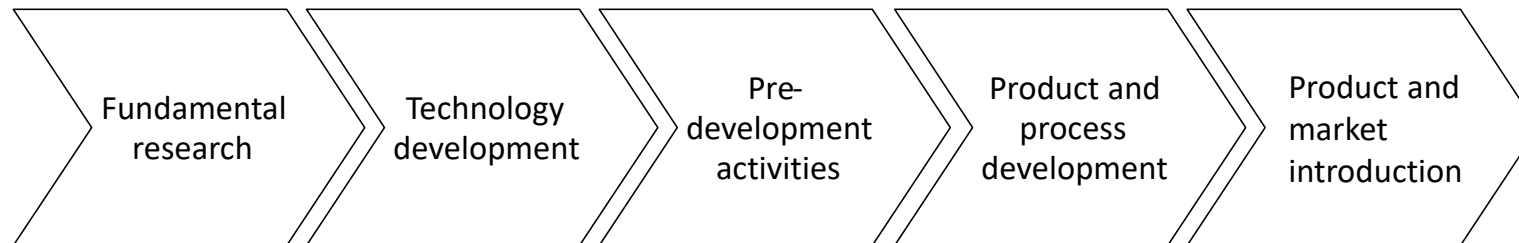
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# From Idea to Market



## Technology Readiness Level (TRL)



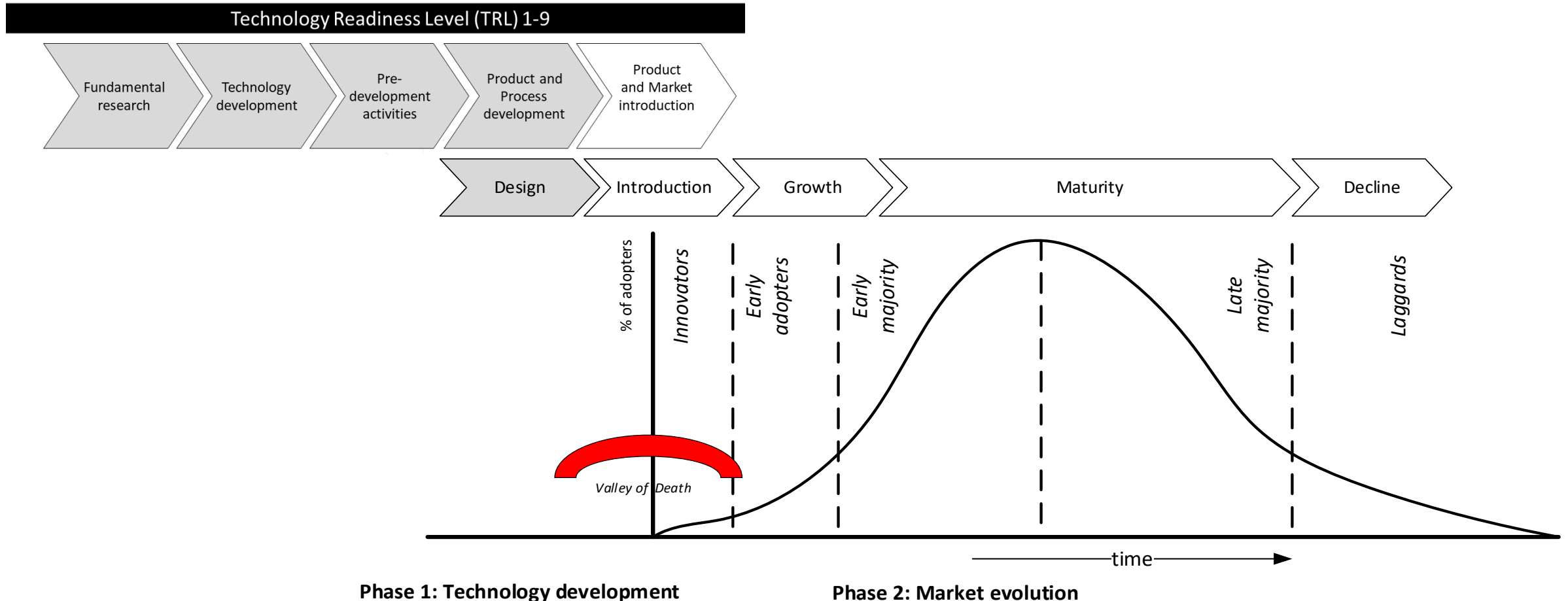
# Innovation

## ... not purely technical problems

*“Technology as such cannot guarantee the success of an innovation if other aspects such as environmental, political, legislative, economic, social, networking and institutional factors are not accepted (not known) by the stakeholders and customers .” (Näyhä et al, 2014)*

*... having knowledge on specific barriers and incentives for a material innovation is seen as a key asset towards a successful market diffusion (Roos et al., 2014)*

# Diffusion of Innovation



*Innovation diffusion (Rogers, 1983), product/innovation life cycle (Kaminski & Rink, 1984) and design stage (Ryan & Riggs, 1997)*

# Case study

- Cases:
  - lignocellulosic biorefineries
  - green biorefineries
  - algal biorefineries
- Collection of commercialization factors from literature
- Prioritization by experts (IEA Bioenergy Task 42)
- International survey among researchers
- Importance Performance Analysis
- Assignment of commercialization factors to steps of the value chain and to different dimensions

## Green biorefineries

Barriers green biorefineries					
Technology	Logistics	feedstock	Costs/investments	Policy	Others
Energy intensive drying of solid fraction after pressing	Complicated logistics	Seasonal availability	High logistic costs (transport, storing, etc.)	No direct economic incentives for farmers to cultivate green biomass for biorefining	Alternative access to bioproducts
	Difficult to storage due to high water content	Only regional available	High cost if not naturally dried for storage		Limited export possibilities
residual juice after extraction as input for biogas plants due to low dry matter contents	Difficult to storage due to rapidly starting degradation process	Continuous biomass supply	Commercial feasibility without biogas plant		
		Consistent quality level of biomass	Cost efficient extraction of components		
			Cost intensive purification of proteins		

Drivers green biorefineries	
technology	economy
Strong machinery and engineering available	Huge markets for proteins from green biomass
Improvements in biorefining through new techniques	Positive effects on employment
	Technology export

		Value chain stage			
		Feedstock supply	Processing/ conversion of feedstocks to intermediates	Applicability of intermediates for bioproduct production	Demand for bioproducts
Dimension	Policy				
	Economics				
	Society & environment				
	Technology				

# Method

Importance Performance Analysis:  
asked experts for their opinion related to the importance and current performance of factors influencing a broader commercialization of biorefineries valorizing lignocellulosic, green and algal biomass to high-value products.

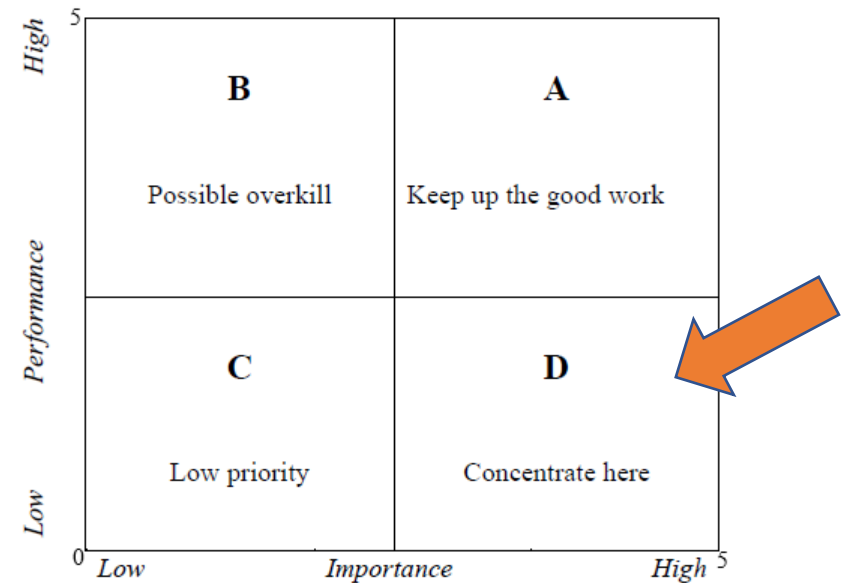
Example for survey question

- factor “**feedstock supply**”
- Importance:

How important is the factor “**feedstock supply**” in your opinion for a broad commercialisation of green/algal/lignocellulosic biorefineries Please rate from 1 (very unimportant) to 5 (very important).

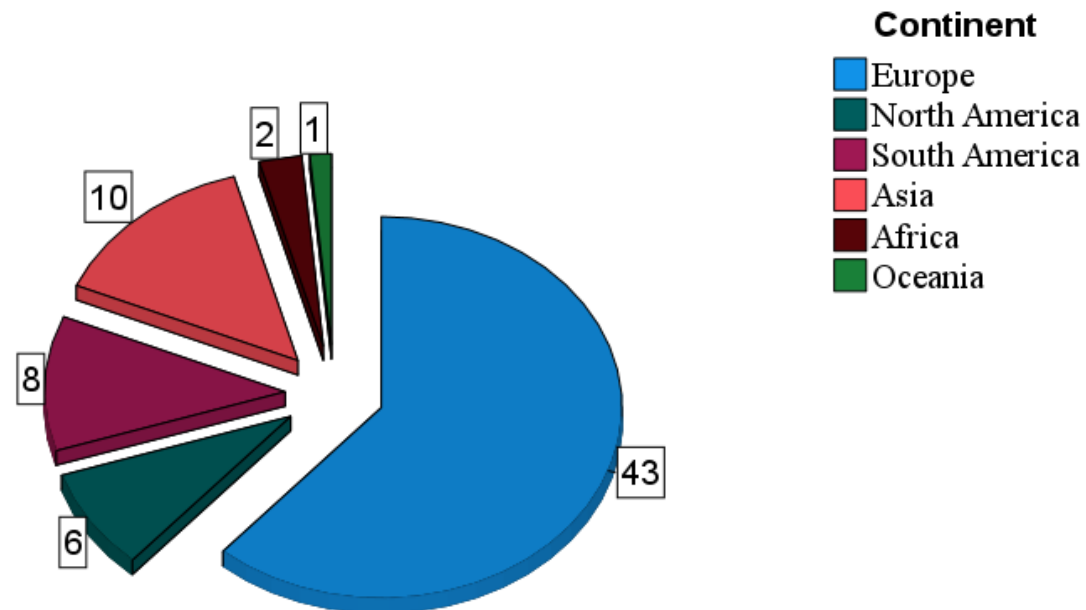
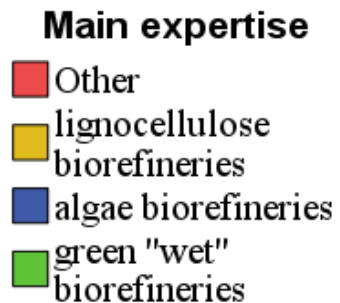
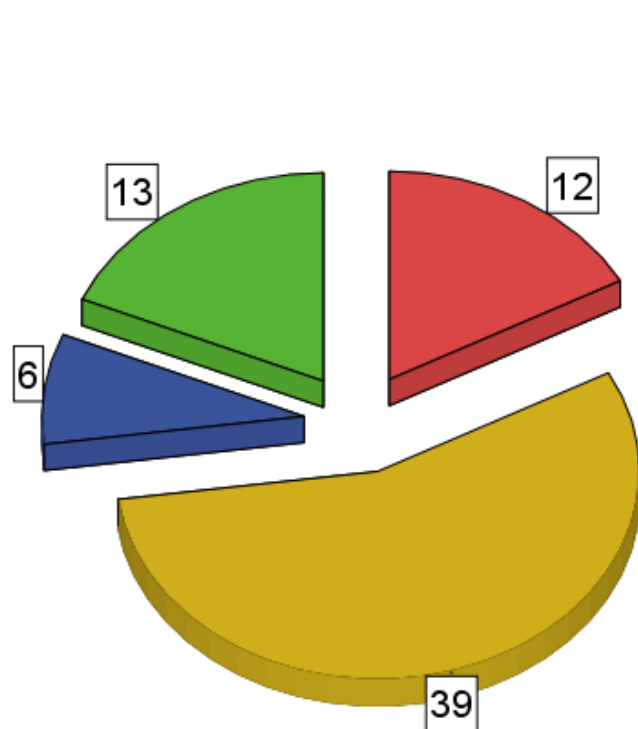
- Performance:

How is the current **performance of the “feedstock supply”** for commercial scale green/algal/lignocellulosic biorefineries in your opinion Please rate from 1 (very low level) to 5 (very high level).



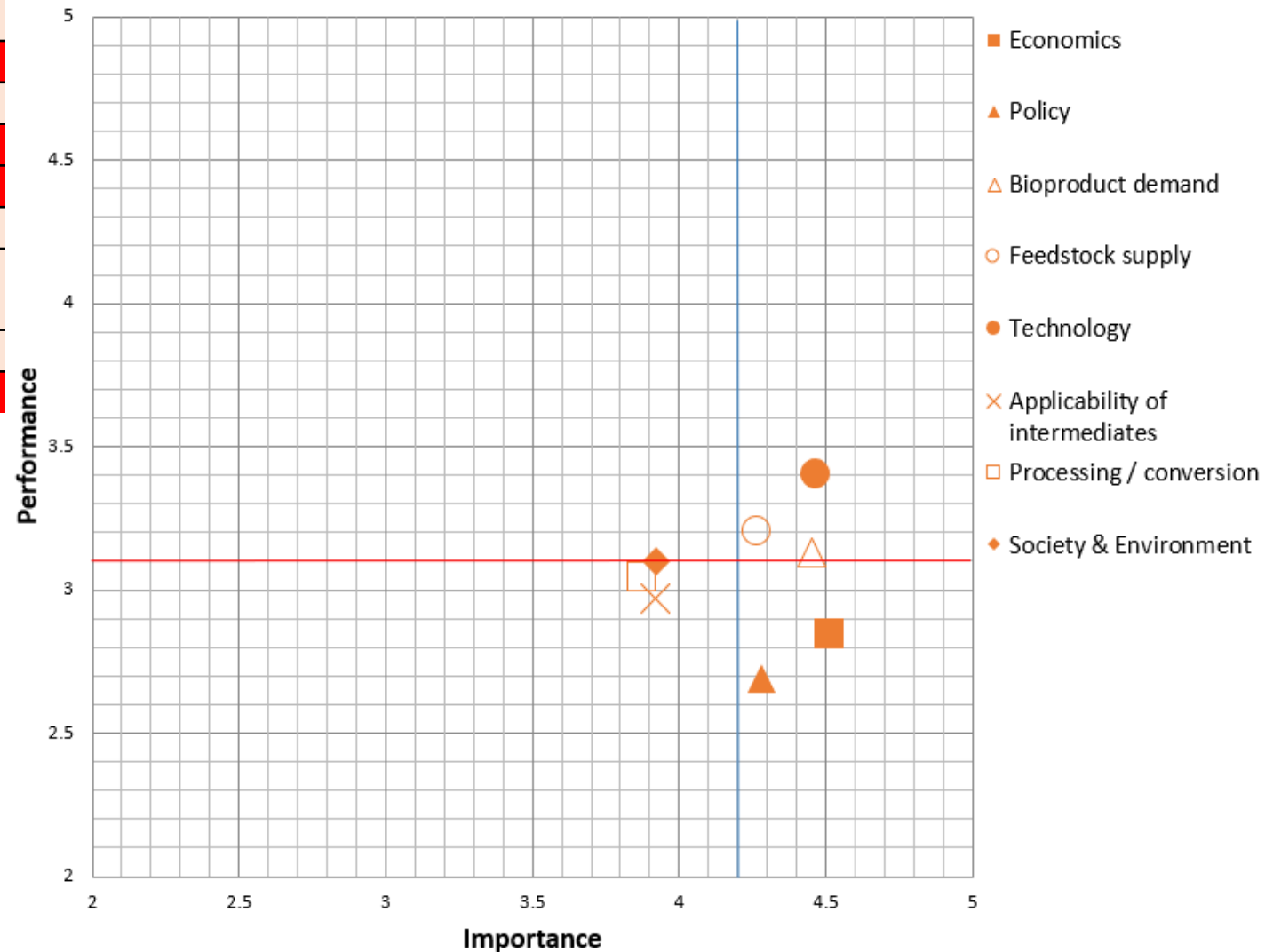
# Results

359 international experts in the field of biorefinery research were contacted, 70 experts replied



# Lignocellulosic Biorefineries

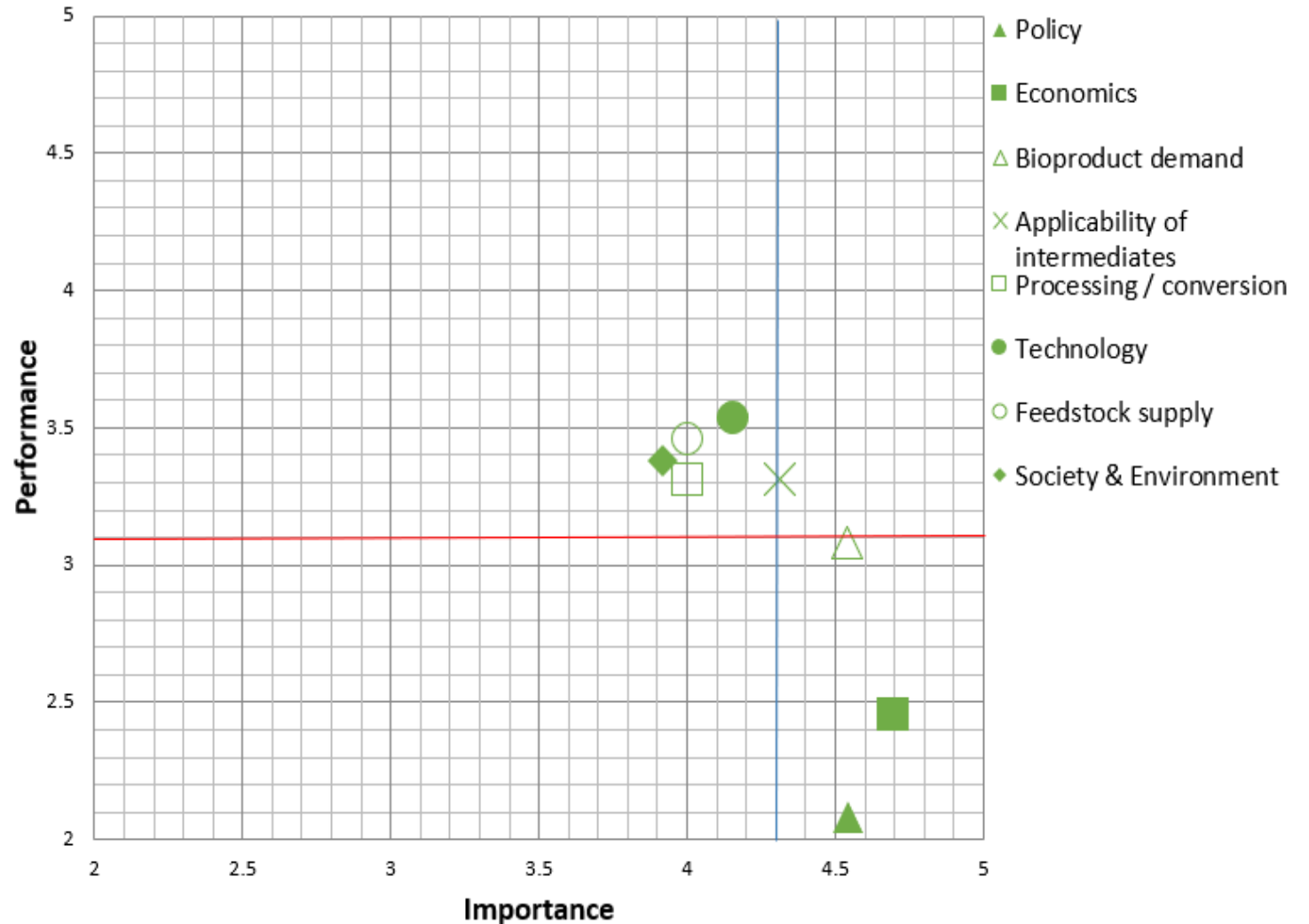
	Economics	Policy
Economics		
Policy		
Bioproduct demand		
Feedstock supply		
Technology		
Applicability of intermediates		
Processing / conversion		
Society & Environment		





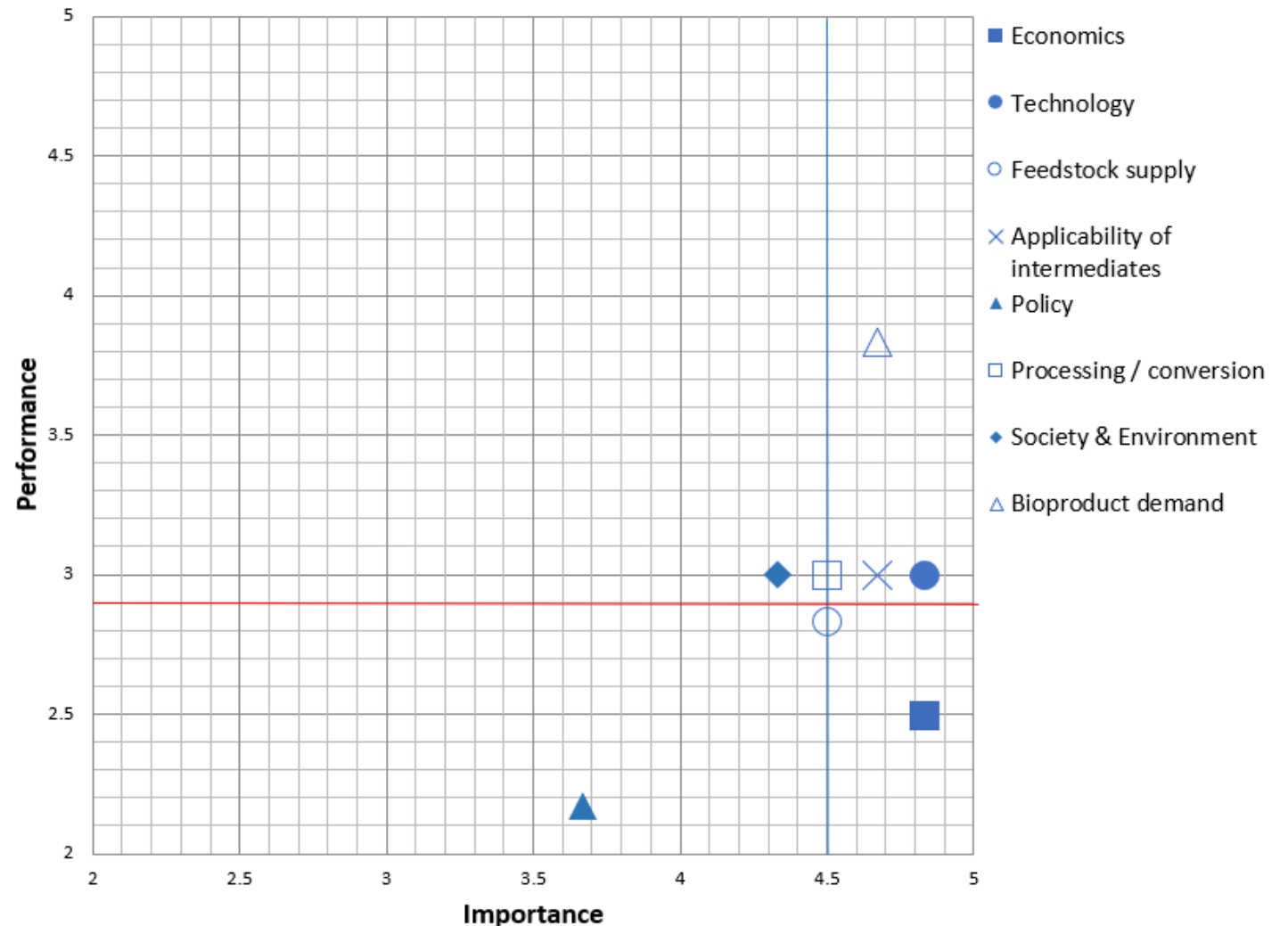
# Green Biorefineries

	Economics	Policy
<b>Economics</b>		
<b>Policy</b>		
Bioproduct demand		
Feedstock supply		
Technology		
Applicability of intermediates		
Processing / conversion		
Society & Environment		



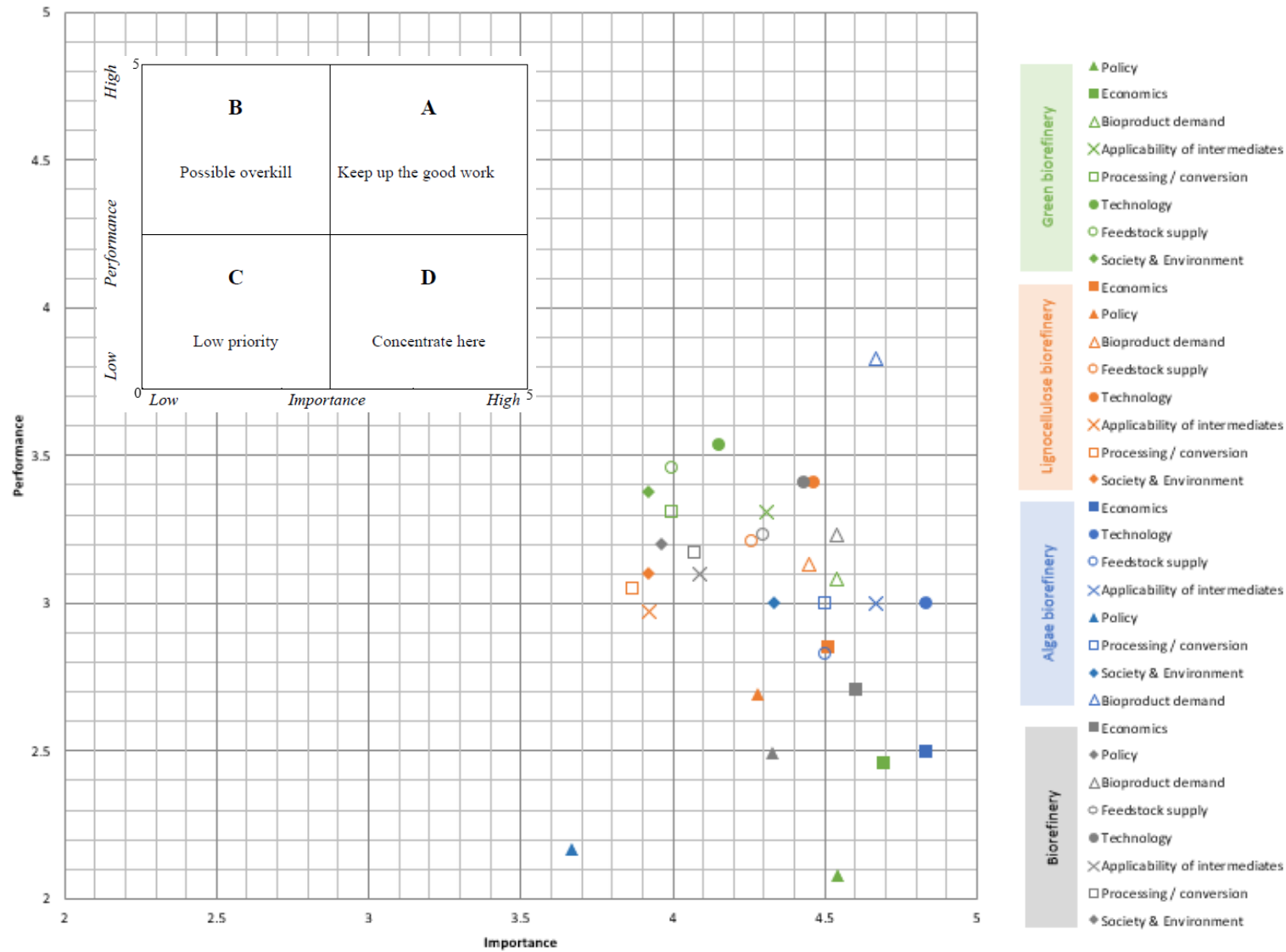
# Algal Biorefineries

	Economics	Feedstock supply
<b>Economics</b>		
<b>Technology</b>		
<b>Feedstock supply</b>		
Applicability of intermediates		
Policy		
Processing / conversion		
Society & Environment		
Bioproduct demand		



# Conclusion

- Importance of policies is rated high but performance to support broad commercialization is rated relatively low.
  - Policies as lever for the other factors and dimensions of commercialization
- Need to transform market environment for biorefineries to be commercially successful:
- Polluter-pays-principle
  - CO2 taxation
  - ...



→ The study will go on!

In case you would like to participate as biorefinery expert in our next survey contact:

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Thank you!



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