

# InSGeP

## Market analysis and stakeholder consultation

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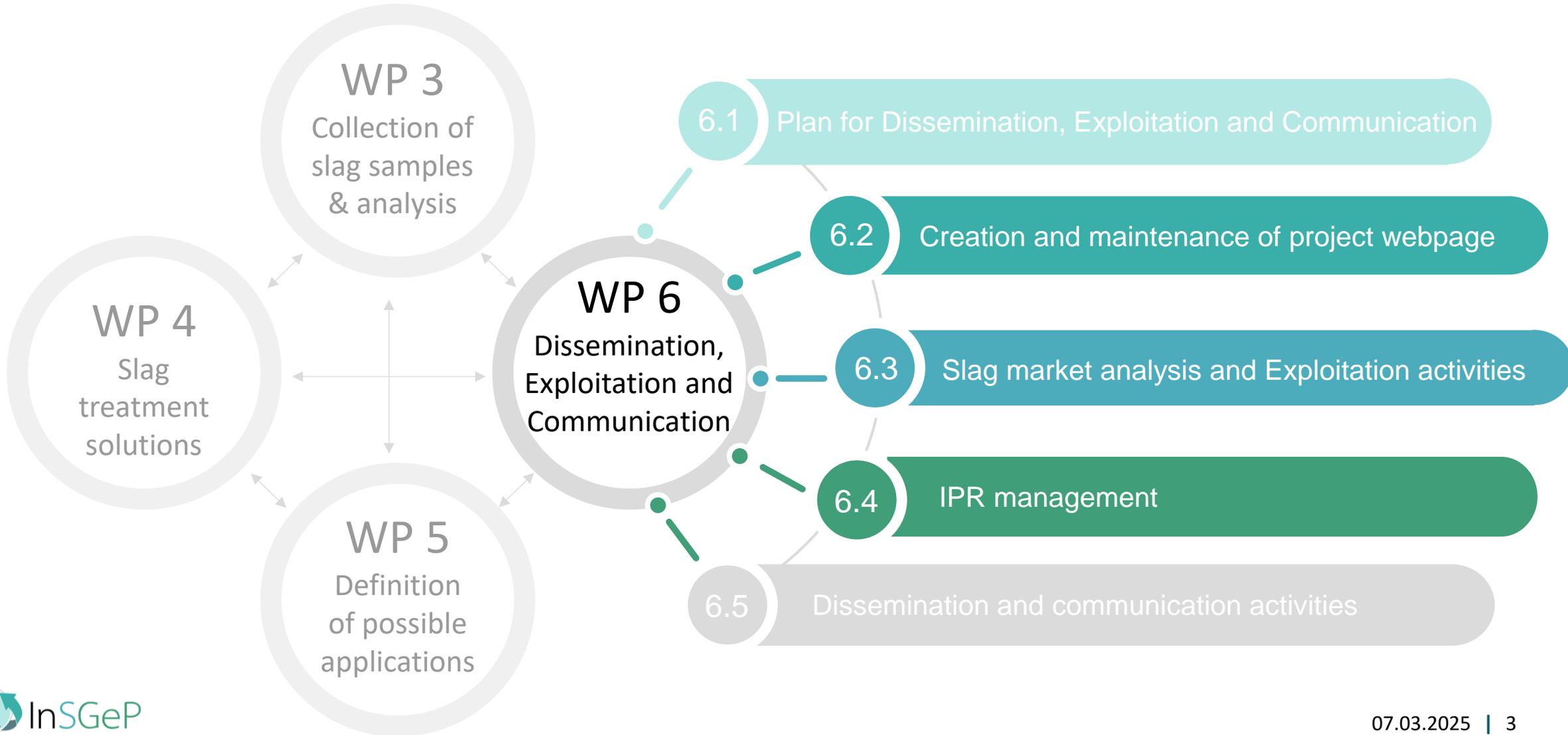
Parinaz Seifollahzadeh, K1-MET

05.03.2025

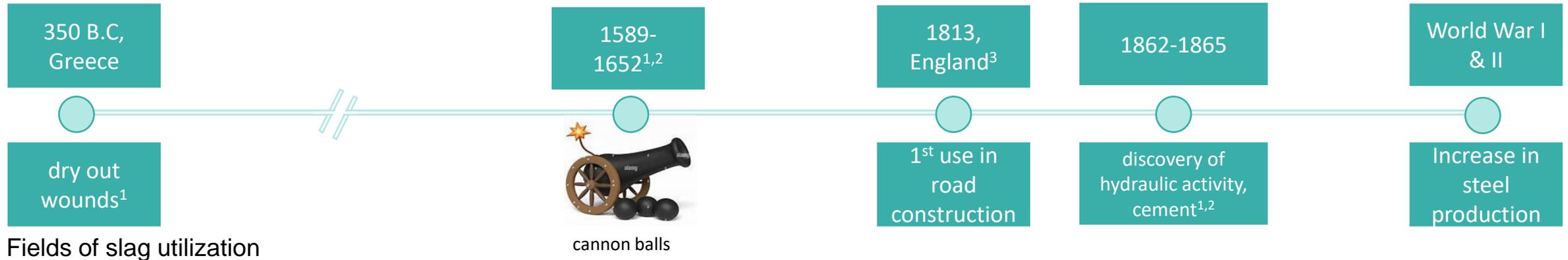
1<sup>st</sup> InSGeP workshop - Investigations of Slags from Next Generation Steel Making Processes



## WP6 – Dissemination, Exploitation and Communication

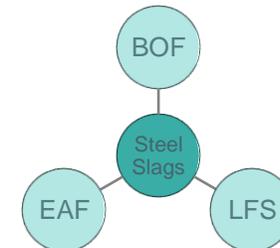


## Types of slag available on the market & Fields of slag utilization



- Fields of slag utilization
- a. Cement/Concrete: BF slag to substitute primary material to decrease CO<sub>2</sub>-emission
  - b. Road construction: minor usage of BF slag, BOF, EAF and ladle furnace slag depending on regional regulations
  - c. Agriculture and soil amendment: BF, BOF and ladle furnace slag, again regulations concerning hazardous elements are important
  - d. Metallurgical use (internal recycling): mostly BOF slag, but pay attention to build up of phosphorous
  - e. Other applications: e.g. marine fertilizers, 3D printing and more

\*BF: Blast furnace slag  
\*BOF: Basic oxygen furnace slag  
\*EAF: Electric arc furnace slag  
\*LFS: Ladle furnace slag / Secondary metallurgical slag



# Slag utilization in different parts of the world

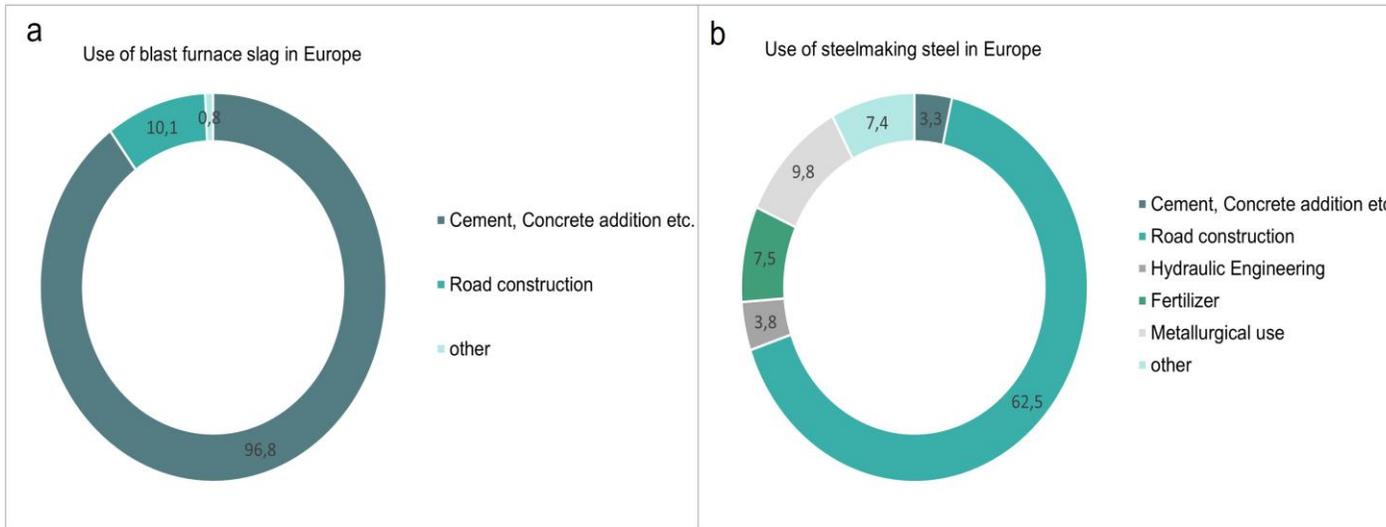
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- a. Europe
- b. USA
- c. Japan:
- d. China:

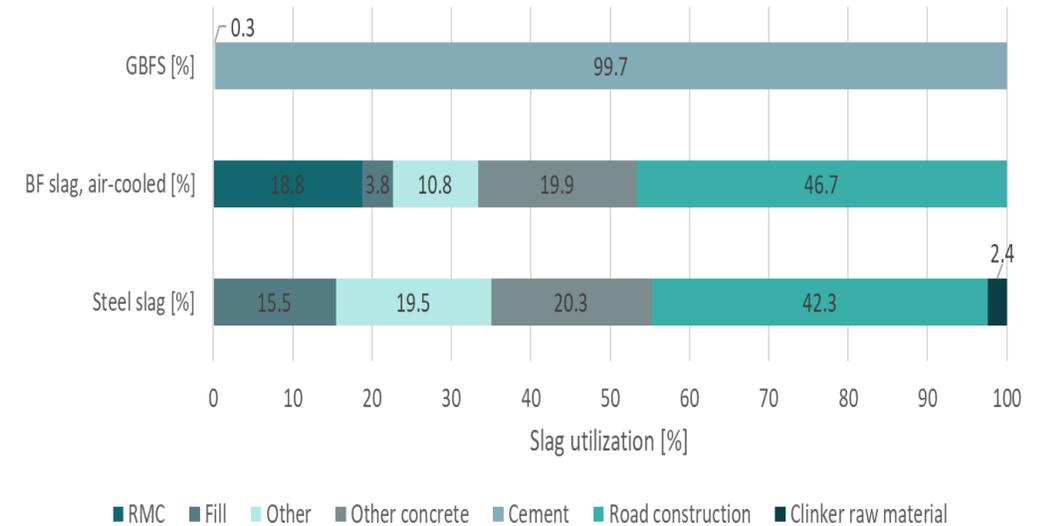
# Slag utilization in different parts of the world

## Europe, USA

The recycling rate of blast furnace slag in Europe is quite impressive ~ 99%<sup>5</sup>



Utilization of BF slag (a) and steel slag (b) in [%] in Europe (2023)<sup>1</sup>



Recycling of slag in the United States (2016)<sup>4</sup>

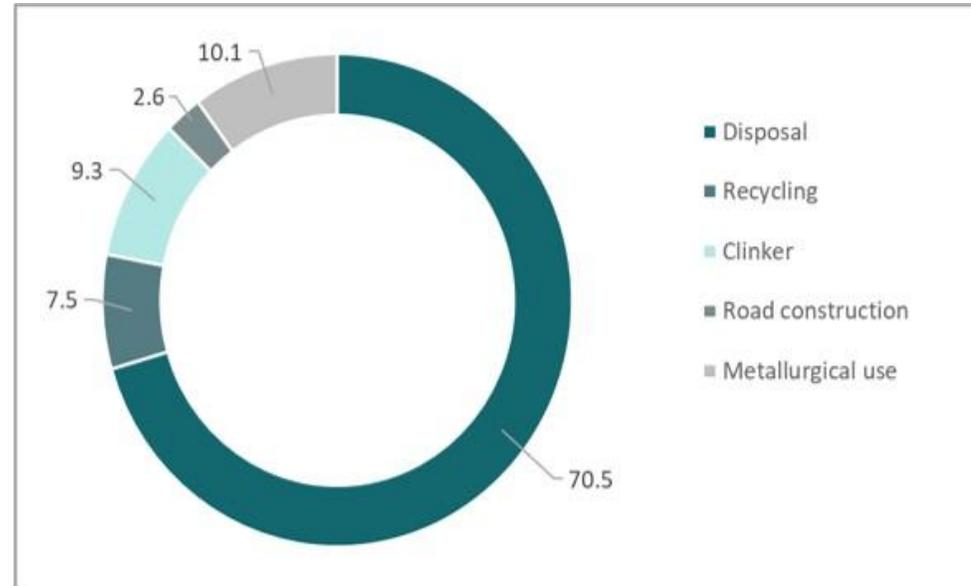
1. EUROSLAG, Online: [www.euroslag.com](http://www.euroslag.com) (accessed on 16 February 2024).
4. Harder J.: Valuable by-products: Slag recycling, in *recovery Recycling Technology Worldwide*, 2,2020, 2020.
5. <https://www.recovery-worldwide.com/en/artikel/slag-recycling-3528047.html>

- GBFS: Granulated Blast Furnace Slag
- RMC: Rigid Metal Conduit

# Slag utilization in different parts of the world

## China

Till 2017 mostly landfilled  
but rapid development



Overview of valorisation of steel slag in China (2017)<sup>6,7</sup>

6. Harder J.: Valuable by-products: Slag recycling, in: recovery Recycling Technology Worldwide, 2,2020, 2020.

7. Guo, J., Bao, Y., and Wang, M.: Steel slag in China: Treatment, recycling, and management. Waste management, 78, 318-330, 2018.

# Slag utilization in different parts of the world

## Japan<sup>8</sup>

In Japan, the BF slag achieves a recycling rate of 100 %

Slag type		Applications
BF slag	Air-cooled slag	Road base course material Coarse aggregate for concrete Cement clinker raw material (replacement for clay) Raw material for rock wool Calcium silicate fertilizer
	Granulated slag	Raw material for Portland BF slag cement Blending material for Portland cement Concrete admixtures Raw material for cement clinker (replacement for clay) Material for civil engineering works, ground improvement material (backfill material, earth cover material, embankment material, road subgrade improvement material, sand compaction material, ground drainage layers, etc.) Fine aggregate for concrete Calcium silicate fertilizer Soil improvement



Air-cooled slag



Granulated slag

Slag type		Applications
Steel slag	Converter slag, EAF slag	Aggregate for asphalt concrete
		Base course material
		Material for civil engineering works, ground improvement material (material for sand compaction piles)
		Raw material for cement clinker
		Fertilizer and soil improvement



Converter



Electric arc furnace



Steelmaking slag (converter slag)

# Stakeholder survey

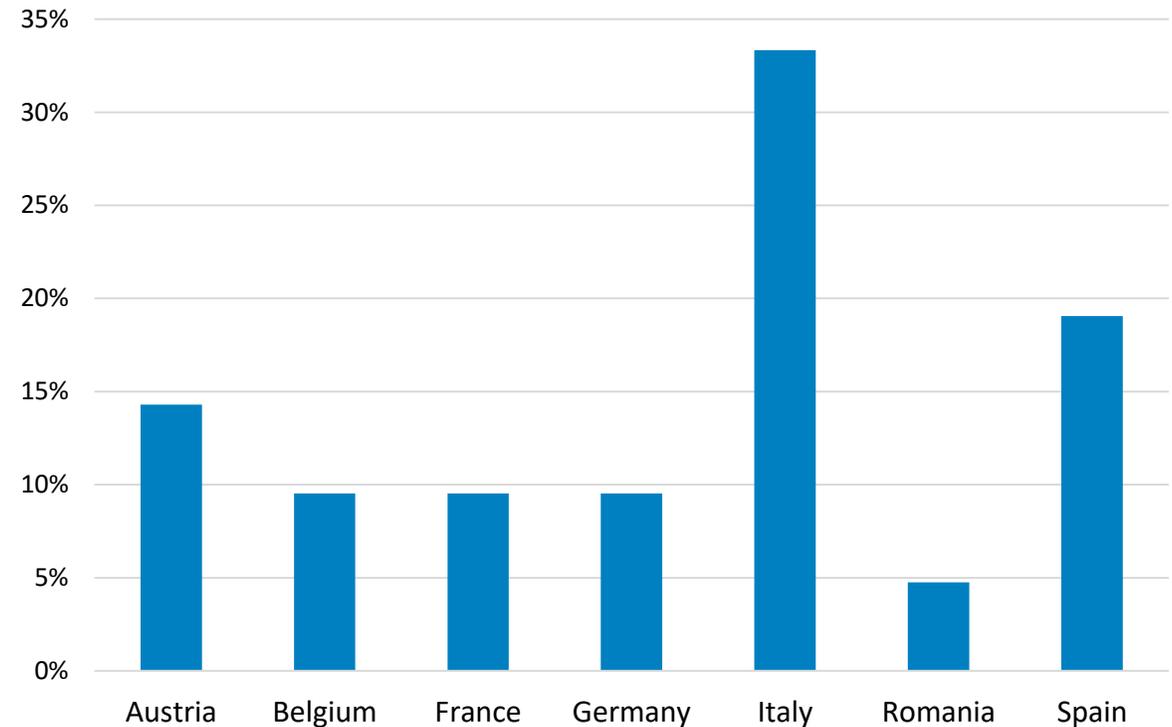
## Trends and developments

37 participants started the survey of which

- 36 participants (97 %) agreed and
  - 1 participant (3 %) disagreed
- to the confidentiality disclaimer

Stakeholder groups:

- Slag processor
- Slag user
- Steel producer
- Scientific community
- Government & regulatory body 

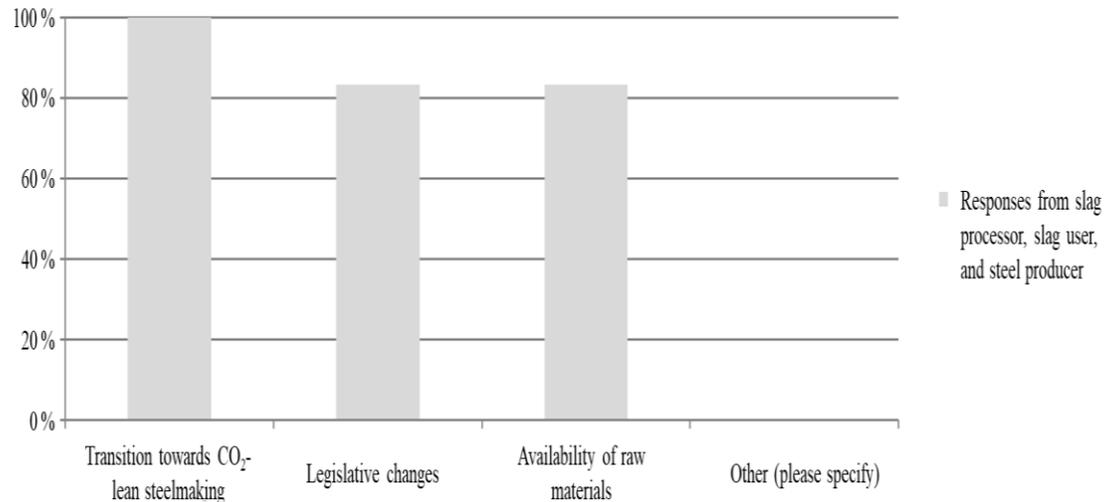


Allocation of participants by country

# Stakeholder survey

## Trends and developments

Are there emerging trends or developments that could significantly impact the market?



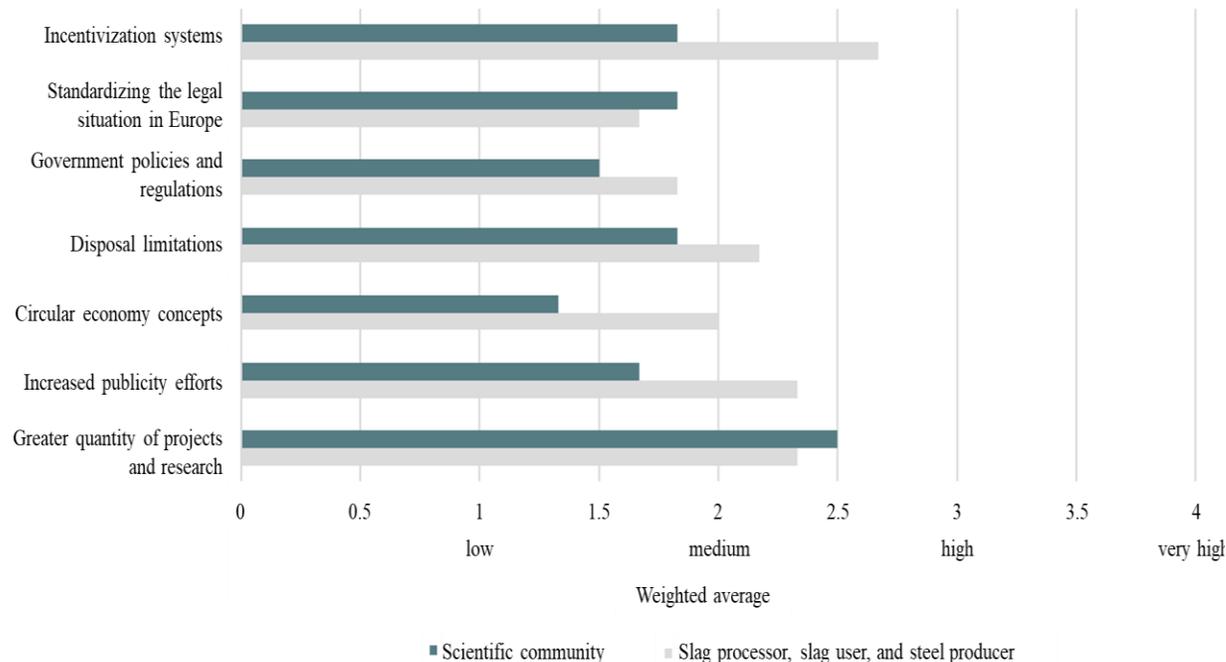
Emerging trend or developments on the slag market

**How stakeholders envision the future of slag utilization in their industries:**

- Almost everyone agrees that the transition towards CO<sub>2</sub>-lean steelmaking and the legislative situation have an influence
- Slag processors, slag users and slag producers aim at the reuse of slag within their own production process
- They want to Proceed with the handling of the slag as a product and offer it to the market
- Higher value applications making greater use of the slags' potential as technical material (including CO<sub>2</sub> capture potential and hydraulic properties of the slags)
- Utilization of EAF slag as an artificial aggregate to replace raw material (e.g. basalt)
- Utilization of steel slag in cement process to replace Ordinary Portland Cement (OPC)
- Utilization of white slag as additives for cements and mortars
- Utilization of black slag to replace gravel and basalt

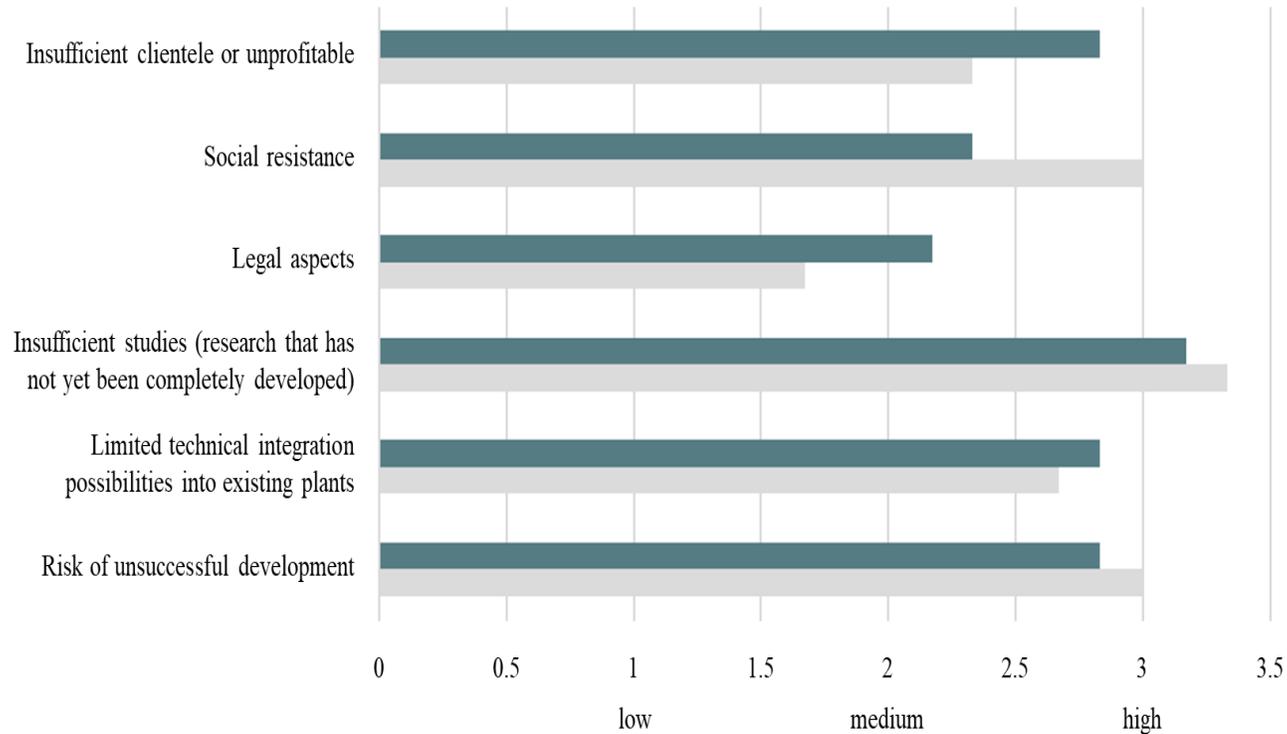
## Drivers influencing the growth of the slag market

How do you evaluate the impact of the following methods on enhanced slag utilization?



- Although the group consisting of slag processors, slag users, and steel producers opted for the implementation of incentive systems, the scientific community deems it necessary to undertake more projects and research.
- Scientific community predicts development of novel application, adaptation of slag utilization to new steel production routes
- Demand for building material rises a more slag is needed for cement and road construction
- Increasing awareness for environmental sustainability makes slag even more needed
- Governments enforce circularity and sustainability
- More research a more ways to utilize slag

Identification of key drivers influencing the slag market



Challenges and market barriers

- Risk of spending money on unsuccessful developments
- Environmental limitations and regulations due to chemical compounds
- Lack of awareness concerning the possibilities for the usage of slag
- Varying quality of slag is a problem for industries utilizing slag
- Instability of prices due to economic situation and raw materials
- Integration into existing plants should be possible

# InSGeP

## Market analysis and stakeholder consultation

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