

# Advanced Frugal Innovation (AFI)

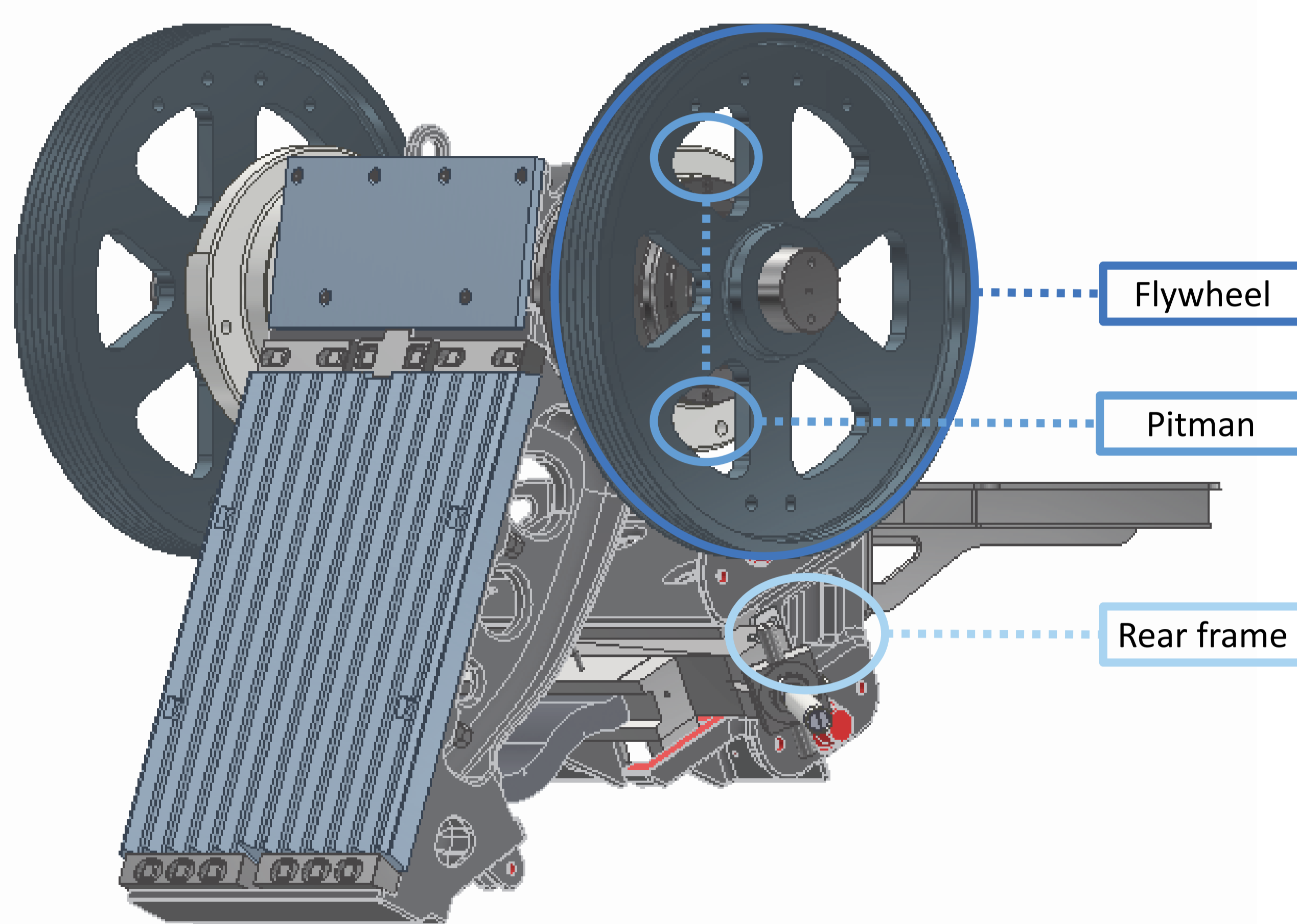
Institute for Economic and Cultural Geography  
Leibniz University Hannover



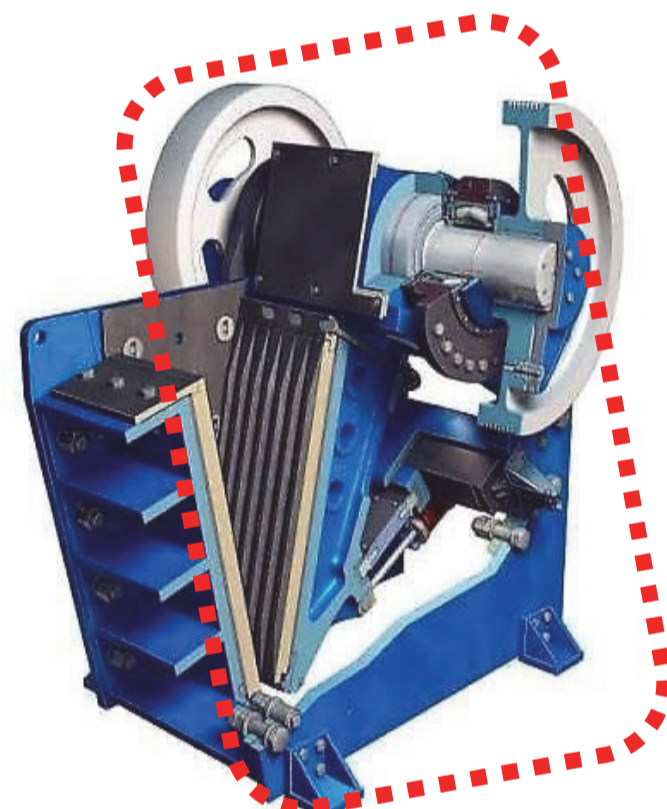
## What is an Advanced Frugal Innovation (AFI)?

1. Focus on core functionalities through frugal product design principles, ensuring the highest technical standards
2. Minimization of the resource input along the product life cycle
3. Significant reduction in product price, leading to better affordability for consumers
  - *Characteristics of environmental and social innovations, enabling sustainable transformation*

## Example: Frugal Industrial Grade Jaw Crusher [A. Krishnan & B. C. Rao]



Jaw Crusher Component	Original Weight	Material Savings by FoF	Approx. Cost Savings
Flywheel (2x)	~ 1.250kg	8 % (~ 100 kg)	~ \$75
Pitman frame	~ 2.900 kg	7 % (~ 203 kg)	~ \$245
Rear frame	~ 1.200 kg	30 % (~ 350 kg)	~ \$420
Total	~ 22.000 kg	3 % (~ 660 kg)	~ \$740



**110 kW Jaw Crusher: 22 tons, ~\$36.000**

By frugalizing these few components, 3% of the total weight are saved!  
Much more can be achieved by redesigning further bulky components!

## Projects

*Pathways to Sustainability Based on Advanced Frugal Innovation: Innovation Generation and Innovation Scaling under Resource Constraints (AFRIN)*

Duration: 2024 – 2027

*Frugal Engineering and Advanced Frugal Innovation*

Duration: 2022 – 2023

*Implementation conditions for frugality in innovation processes*

Duration: 2020 – 2023

## Factor of Frugality (FoF): $F^S$

Savings from a Rigorous Design:

Factor of Safety

S

Additional Schemes for Savings

F - S

MS<sub>1</sub>  
Simple Design

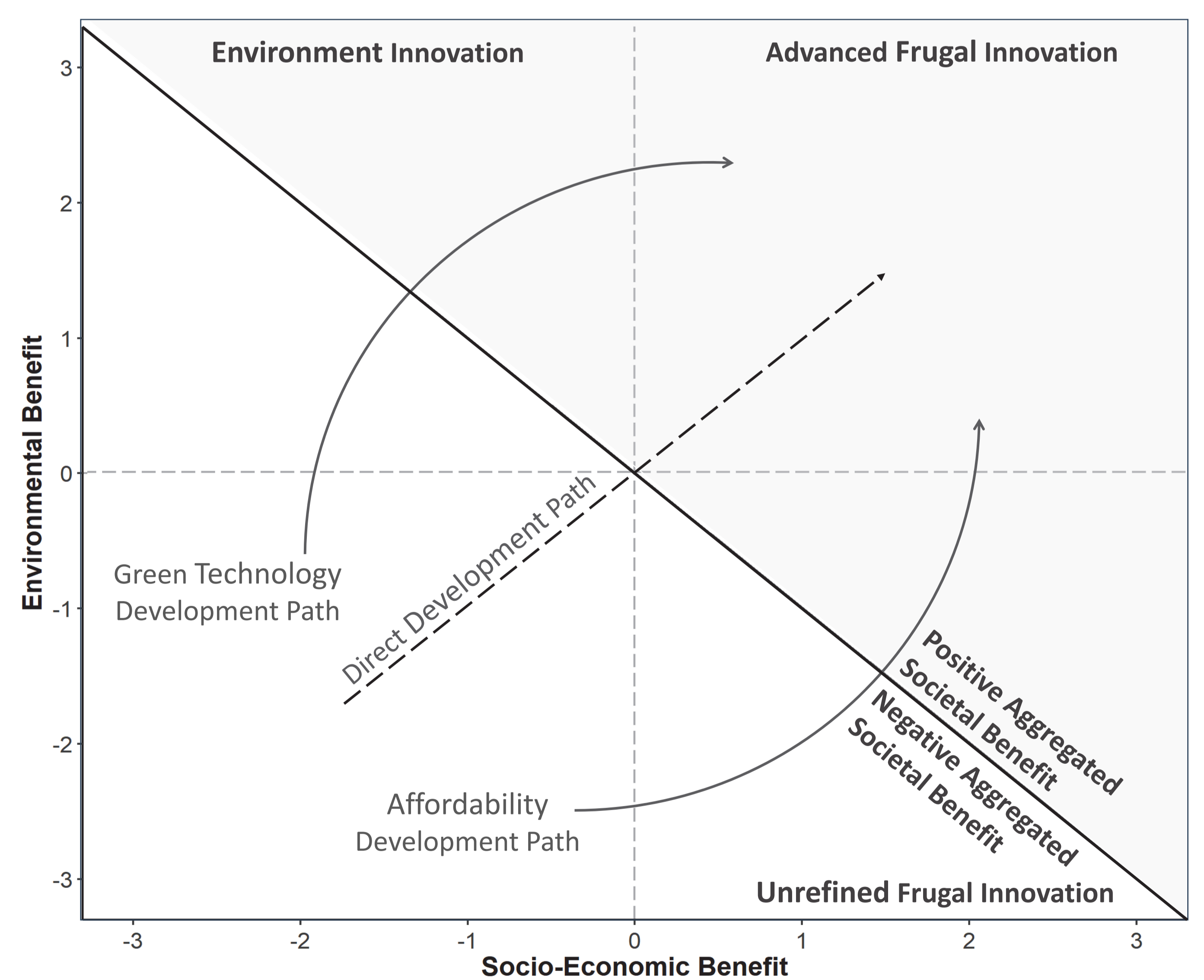
MS<sub>2</sub>  
Manufacturing

MS<sub>3</sub>  
Materials

MS<sub>4</sub>  
Biomimetics

MS<sub>5</sub>  
4R Mechanism

## Development Paths

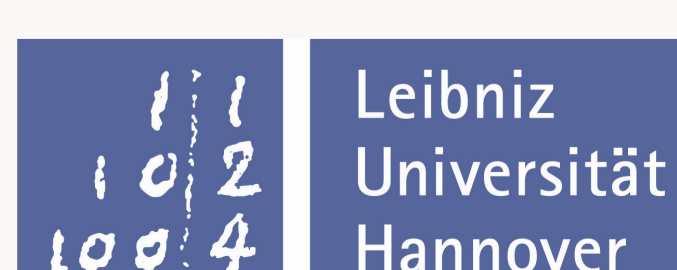


Leibniz University Hannover  
– Institute for Economic and Cultural Geography

Prof. Dr. Ingo Liefner  
E-Mail: [liefner@wigeo.uni-hannover.de](mailto:liefner@wigeo.uni-hannover.de)

Dr. Julian Barnikol  
E-Mail: [barnikol@wigeo.uni-hannover.de](mailto:barnikol@wigeo.uni-hannover.de)

Leon Worbs  
E-Mail: [worbs@wigeo.uni-hannover.de](mailto:worbs@wigeo.uni-hannover.de)



Indian Institute of Technology Madras  
– Department of Engineering Design

Prof. Dr. Balkrishna C. Rao  
E-Mail: [balkrish@iitm.ac.in](mailto:balkrish@iitm.ac.in)  
[frugalengineering@gmail.com](mailto:frugalengineering@gmail.com)

Aditya Krishnan  
E-Mail: [ed19s011@smail.iitm.ac.in](mailto:ed19s011@smail.iitm.ac.in)



**IIT MADRAS**  
Indian Institute of Technology Madras

Stellenbosch University  
– Department of Industrial Engineering

Prof. Dr. Sara Grobbelaar  
E-Mail: [ssgrobbelaar@sun.ac.za](mailto:ssgrobbelaar@sun.ac.za)

Fisiwe Hlophe  
E-Mail: [24181781@sun.ac.za](mailto:24181781@sun.ac.za)

Carlton Matingo  
E-Mail: [22186700@sun.ac.za](mailto:22186700@sun.ac.za)

