A Global Vision for Bioeconomy – an International Delphi-Study

Ulrich Hamm, German Bioeconomy Council

A Global Vision for Bioeconomy – An international Delphi Study

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Our Understanding of Bioeconomy

Knowledge-based production and utilization
of biological resources
to provide products, processes and services
in all economic sectors
within the framework of a sustainable economic system

German Bioeconomy Council (GBC)

Main Tasks

1. Advising policy → **Delphi Study** on promising research fields
2. Societal dialogue about bioeconomy
3. International networking → **Delphi Postbox**

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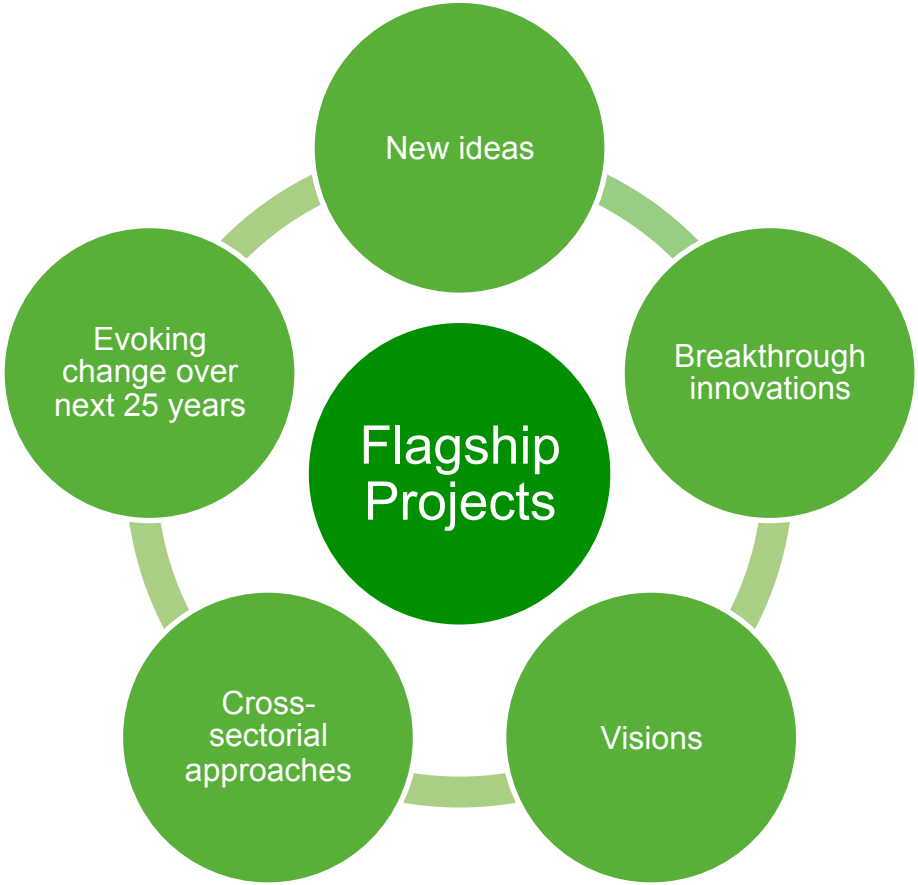
What are we looking for?



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Delphi Study: Approach

- Development of “flagship projects” by Council
- Collecting expert views & ideas
- Assessment of ideas by experts
- Creation of international think tank and network

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Delphi Study Design

Survey among a panel of experts - Assessments in 2 rounds

Round 1:

- Request for project ideas
- Assessment & comments on 4 initial “flagships”

Round 2:

- Feedback on Round 1 results
- Assessment & comments on initial & new “flagships”

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Sampling

Identifying of experts via

- Bioeconomy councils and clusters worldwide
- Scientific publications with keyword “bioeconom…”
- Bioeconomy-related industry experts
- Civil society organizations (NGOs)

Delphi Study Participation

	Round 1	Round 2
Invited experts	2,274	292
Completed questionnaires	292	167
Response rate	12.8 %	57.2 %

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Global Participation

1. Geography

- Residence: 49 countries, all continents (Round 1)
- Job location : 38 countries, all continents (Round 2)
- **However: Strong bias towards Europe and especially Germany**

2. Age

- Major group: Senior professionals between 50 and 59 years

Professional Background of Participants

Science and research	**65 %**
International & governmental agencies	12 %
NGOs	6 %
Industry & industry associations	5 %
Policy	2 %
Others	10 %

1. Bioprincipled City – Key Aspects

Bio City - © weiming.com.cn

Urban planning	• closed material & energy cycles • cascading use of natural resources • combined living & working spaces & biotopes • green spaces provide ecosystem-services
Architecture	• bio-inspired design solutions • biobased building materials
Urban production	• green industrial production in cities • fresh food from urban farming

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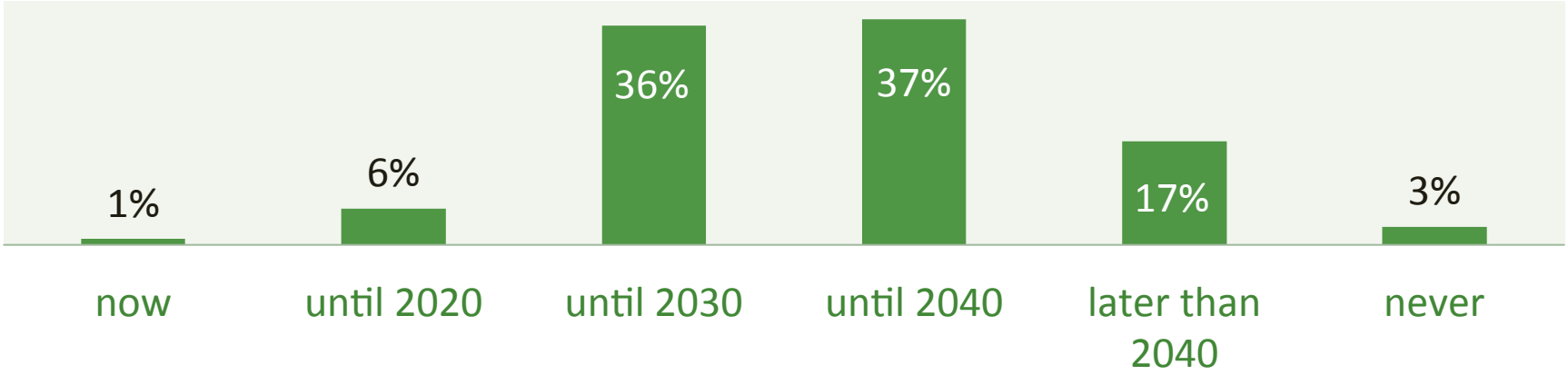
1. Bioprincipled City – Assessment

Relevancy Score 74 %

Desirability Score 91 %

Feasibility - Time Horizon



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1. Bioprincipled City

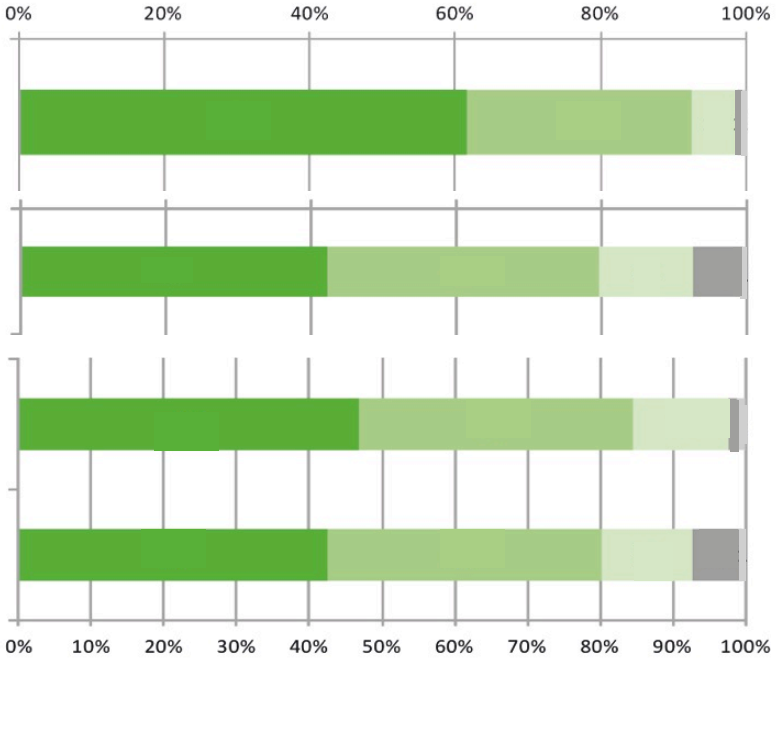
Bio City - © weiming.com.cn

Urban planning: closing material loops, cascading use, zero-waste

Green industry production in cities

Architecture: design solutions using bioprinciples

Biobased materials for building



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2. Artificial Photosynthesis – Key Aspects

Renewable energy (hydrogen)	• bacteria and algae enable efficient production • replacement of fossil fuels
Biofuel cells & biobatteries	• energy supply on industrial scale • powering small devices
Hydrocarbon (sugar, starch)	• feedstock for chemical industry • basis for food production

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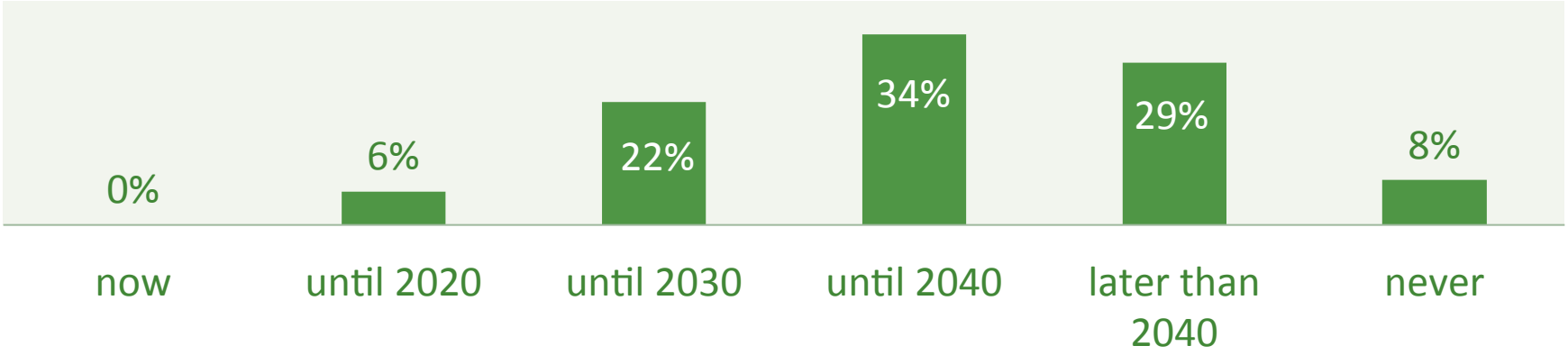
2. Artificial Photosynthesis – Assessment

Relevancy Score 61 %

Desirability Score 74 %

Feasibility - Time Horizon



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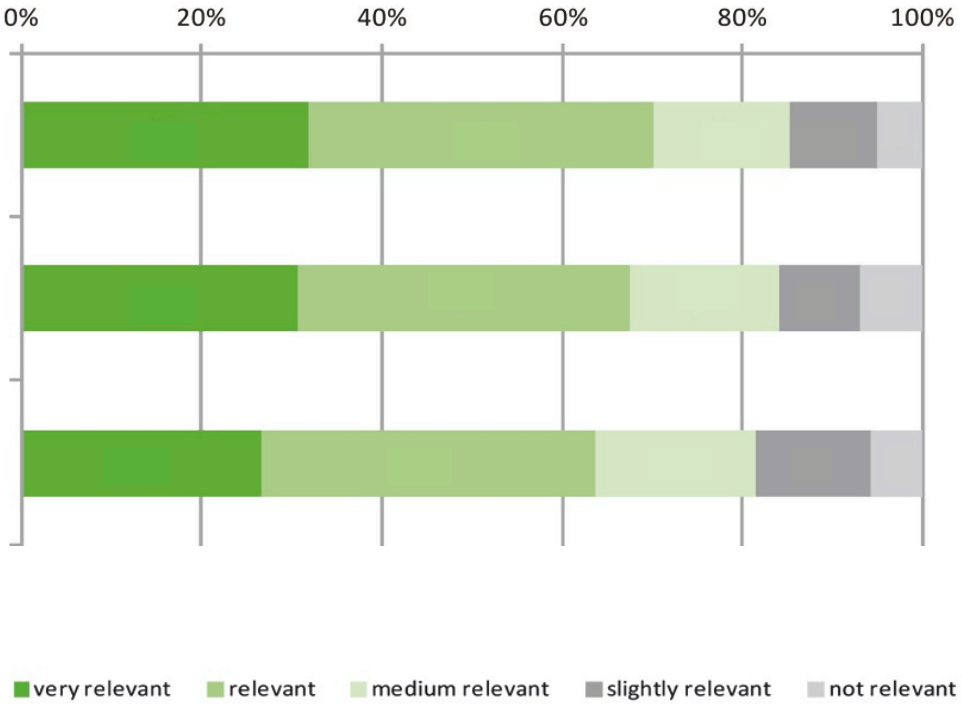
2. Artificial Photosynthesis

Efficient production of hydrogen as renewable energy source

Hydrogen (produced via AP) replaces fossil fuels

Biofuel cells and batteries supply energy on industrial scale



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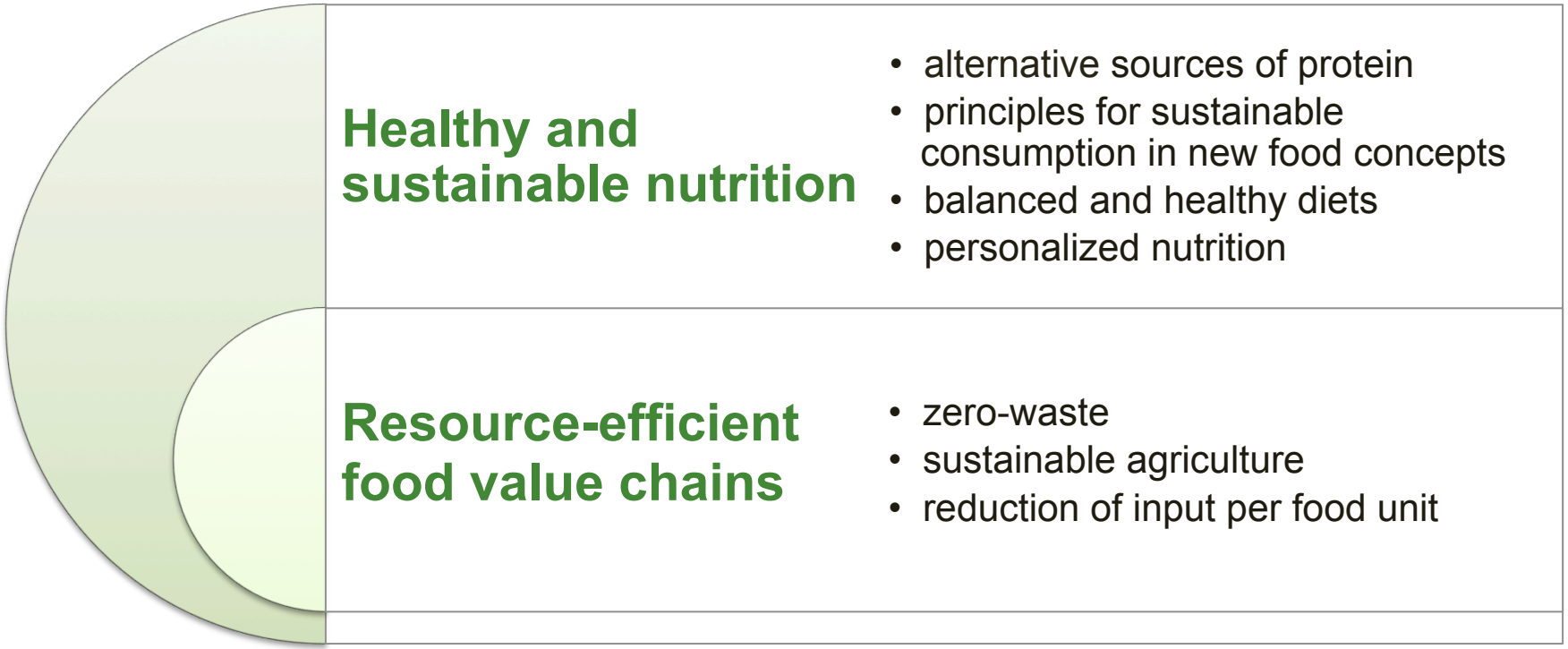
3. New Foodsystems – Key Aspects



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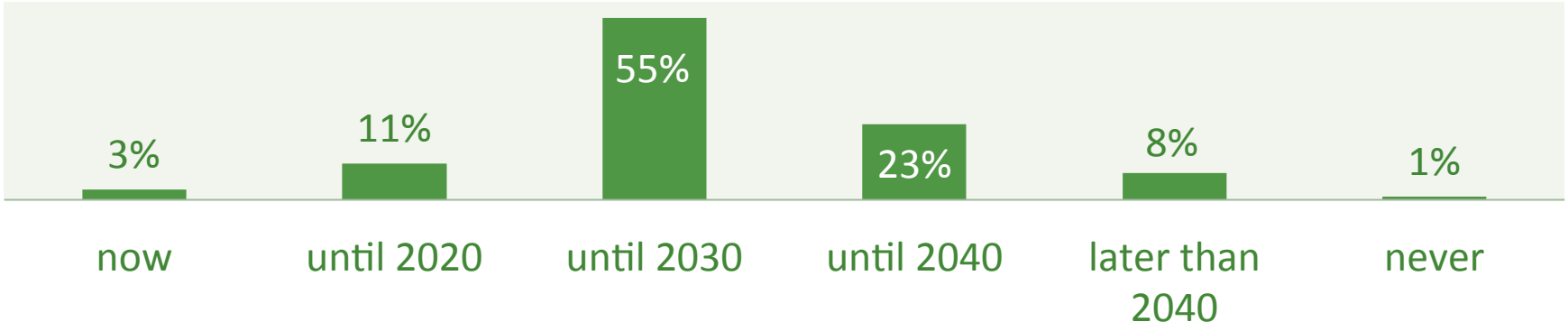
3. New Foodsystems

Relevancy Score 79 %

Desirability Score 94 %

Feasibility - Time Horizon



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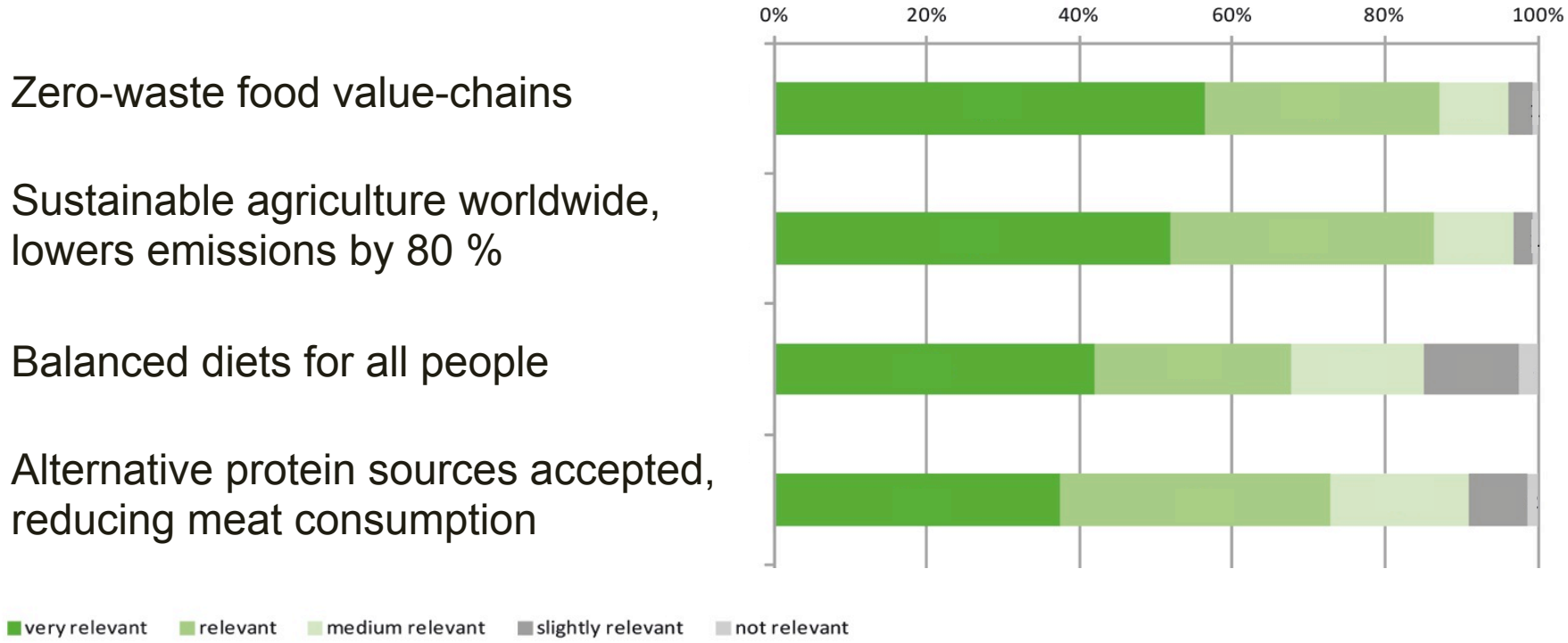
3. New Foodsystems

Zero-waste food value-chains

Sustainable agriculture worldwide, lowers emissions by 80 %

Balanced diets for all people

Alternative protein sources accepted, reducing meat consumption



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4. Global Governance – Key Aspects

Global Governance - © diplomaticourier.com

Worldwide policy mechanisms

- monitoring food security & eco-system performance
- trade in biobased products &services
- investment in ag. & biobased industries
- sharing knowledge and technologies

Global agreement principles & standards

- intellectual property rights
- managing biosafety and biotic risks
- sustainability of biomass production, trade & use
- biotechnology & synthetic biology
- sustainable consumption of biobased products

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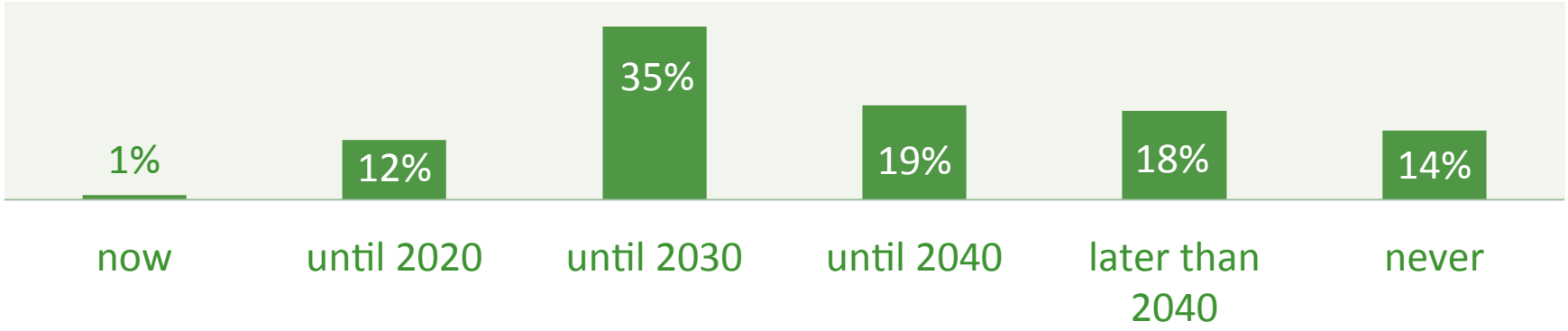
4. Global Governance – Assessment

Global Governance - © diplomaticourier.com

Relevancy Score 70 % **Desirability Score 82 %**

Feasibility - Time Horizon



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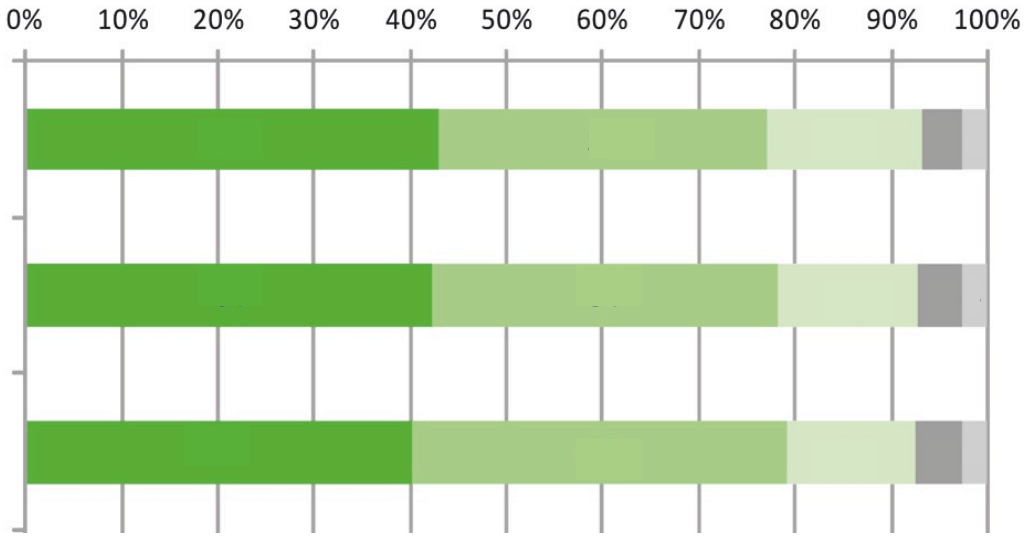
4. Global Governance

Global Governance - © diplomaticourier.com

Sustainability criteria for industrial use of biomass

Sustainability criteria for production & trade of biomass

Mechanism for monitoring & ensuring food security



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5. Sustainable Marine Production – Key Aspects

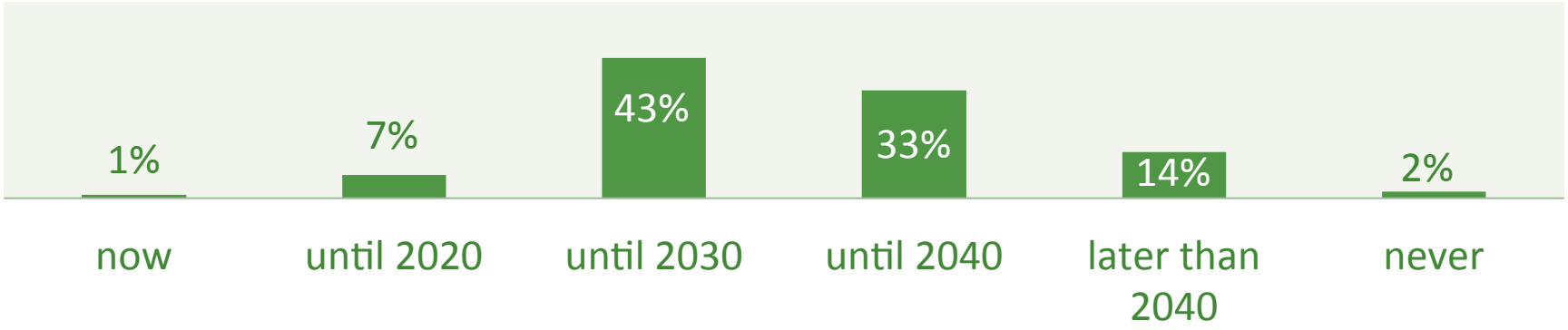
Seafarms as additional biomass producers	• environmentally-friendly cultivation • complementing fading yields of marine fishery • algae as a source for food, feed and fine chemicals
Sustainable production	• application of bioprinciples • application of monitoring, modeling and simulation tools • treating marine littering and filtering plastics

5. Sustainable Marine Production – Assessment

Relevancy Score 73 %

Desirability Score 90 %

Feasibility - Time Horizon



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6. Biorefineries 4.0 – Key Aspects

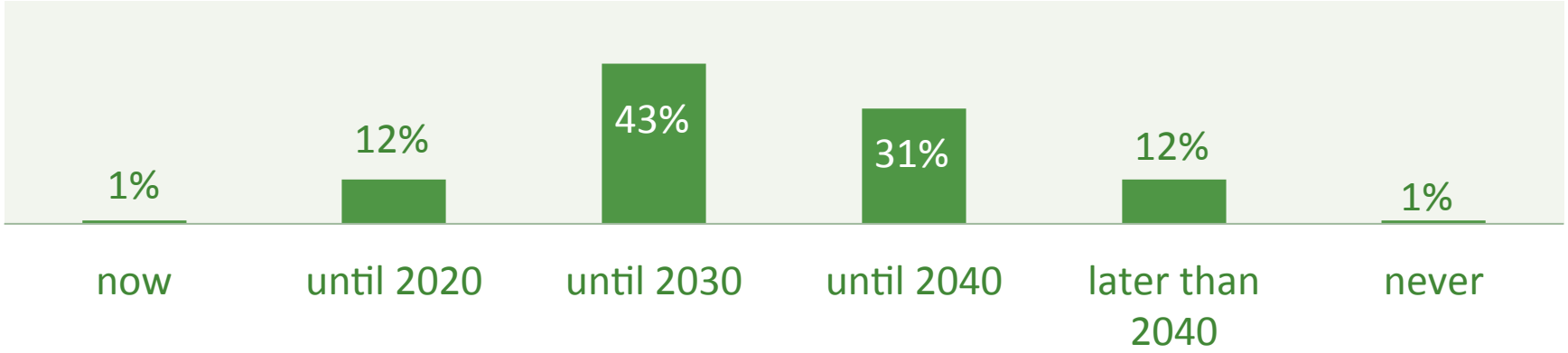
Biorefineries of the fourth generation	• own industrial sector • converting carbon-containing waste • energy-efficient processes • residues as feedstock • “green” & zero-waste
Avoiding negative externalities	• saving land for food • zero-waste circular economy

6. Biorefineries 4.0 – Assessment

Relevancy Score 75 %

Desirability Score 92 %

Feasibility - Time Horizon



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7. Developing Consumer Markets – Key Aspects

Education & training

- bioeconomy education at school
- training for entrepreneurs, engineers, farmers
- product life-cycle cost via apps/labels

Citizen & consumer involvement

- two-sided communication systems
- participative approaches in policy
- contribution to sustainability projects
- collaboration in product development

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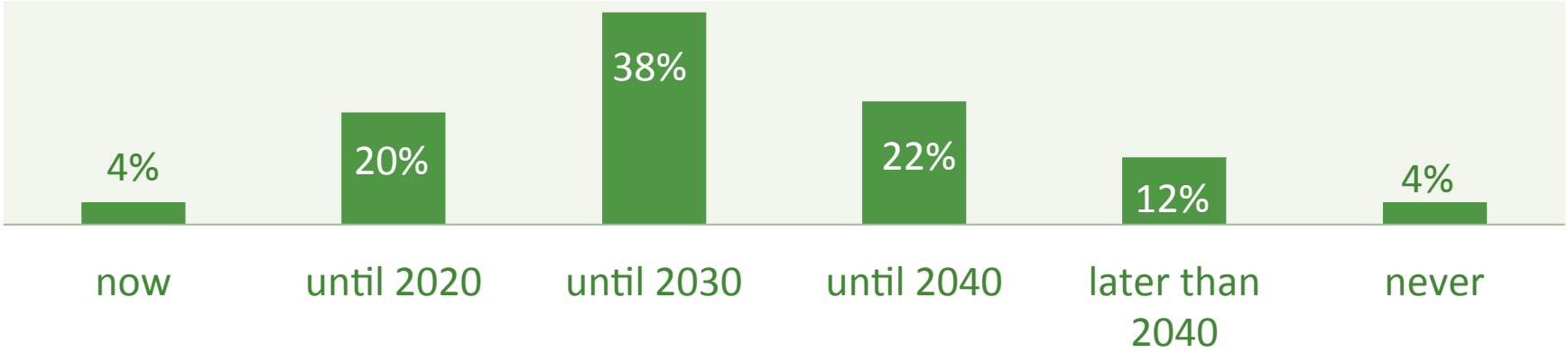
7. Developing Consumer Markets – Assessment

Relevancy Score 67 % **Desirability Score 80 %**

Feasibility - Time Horizon



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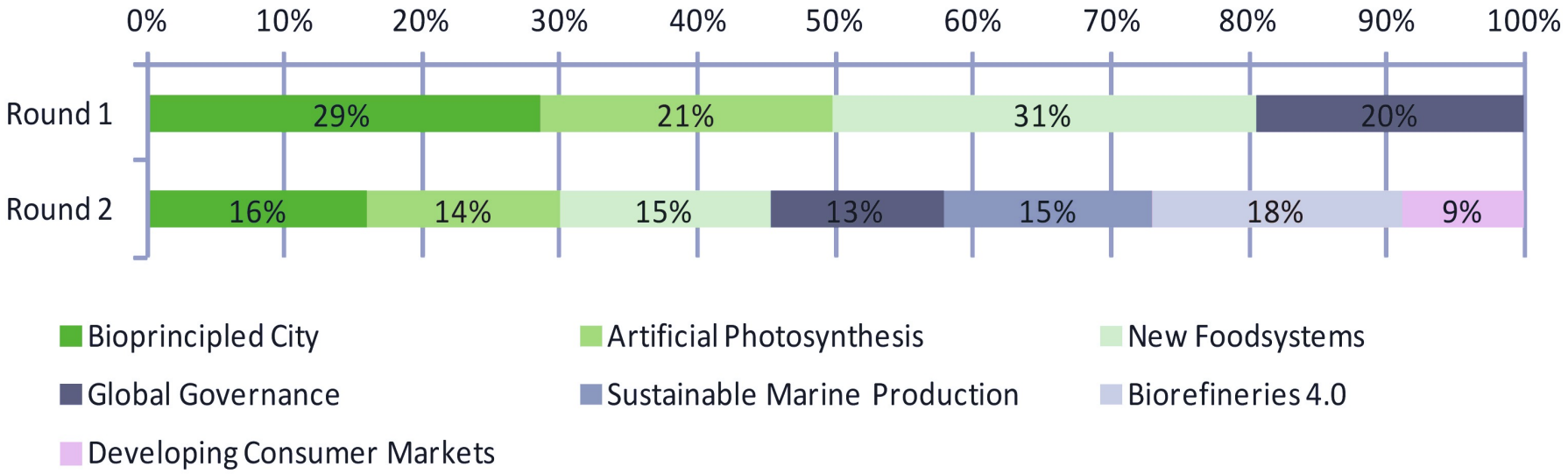
Priority Projects – Where would you invest?



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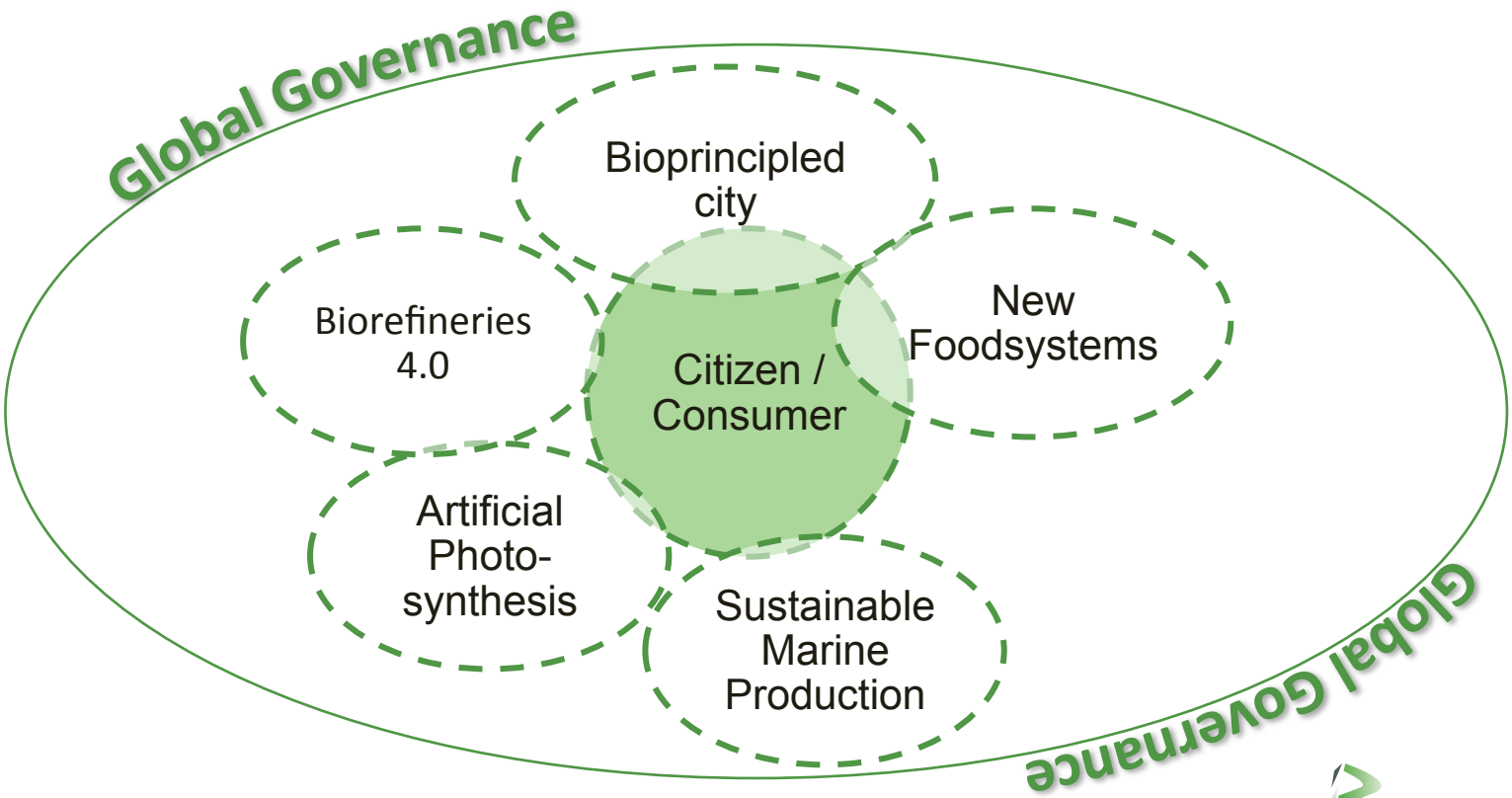
Conclusion: Need for Complementary Projects



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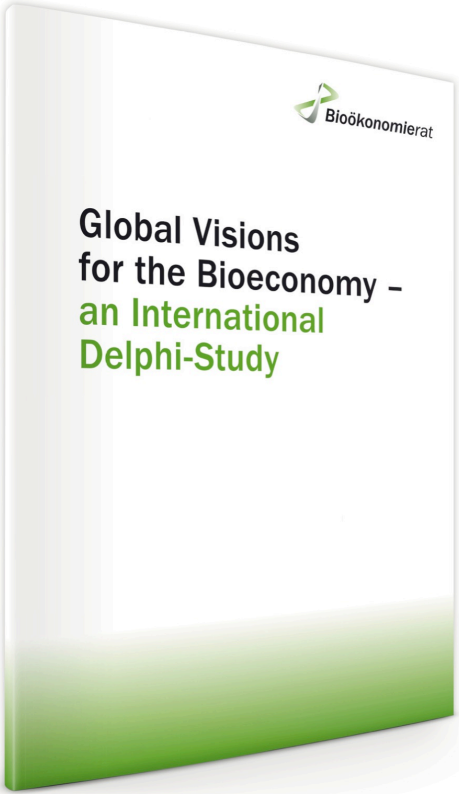
Interested in collaborating?



Delphi Postbox
Ground Floor, Foyer B 02

Please leave your business card and indicate flagship project

Or register online:
www.gbs2015.com/resources

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