FAPESP WEEK GERMANY

March 25-26th, 2025

Circular Economy & Social Inclusion
CESIP

FAPESP SÃO PAULO RESEARCH FOUNDATION

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Marly Monteiro de Carvalho

Full Professor – Universidade de São Paulo

Escola Politécnica (POLI-USP) – Production Engineering Department









FAPESP WEEK GERMANY
March 25-26th, 2025

Agenda

FAPESP SÃO PAULO RESEARCH FOUNDATION

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1. About us
2. Circular ecosystems & Social Inclusion
3. Circular decommissioning strategies
4. Final considerations

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Universidade de São Paulo (USP)

FAPESP São Paulo Research Foundation

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43 teaching and research units

324 undergraduate courses

264 Graduate programs

- 4 museums
- 15 collections
- 48 libraries
- 4 hospitals
- 6 specialized institutes

Created on January 25, 1934, USP is the largest research university in Brazil



8 campuses

- São Paulo
- Bauru
- Lorraine
- Ribeirão Preto
- Piracicaba
- Pirassununga
- Santos
- San Carlos

facilities in 15 other municipalities

About 97 thousand students

59.2 thousand undergraduate students

29.4 thousand postgraduate students

8.52 thousand special students

More than **5,18 thousand teachers**

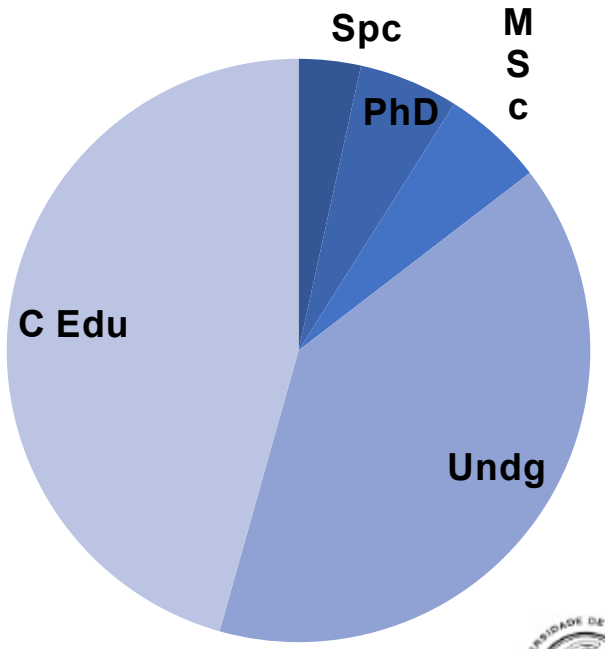
About 12.51 thousand employees technical-administrative

- Top-ranked in Brazil and Latin America (QS, THE, EduRank, among others).

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POLI-USP today

- Students: approx. 12.500 in total
  - Undergraduate
    - 4.970 students
    - 17 engineering programs
  - Graduate
    - 10 MSc programmes (700 students)
    - 9 PhD programmes (690 students)
  - Continued Education
    - 169 courses, with over 5.700 students
    - 18 specialization and MBA-like courses
- Human Resources
  - About 410 faculty members (96,8% with PhD)
  - About 390 non-teaching staff



- Top-ranked in Brazil and Latin America in Engineering and Technology (QS, THE, EduRank, among others).

About us





- Our Sustainability & Circular Economy Lab (SuCE) is a leading research group in Brazil
- A multidisciplinary team of 32 researchers (professors, post-doc, Ph.D., master and undergraduate students)
- Strong collaborations with universities and industry.
- Supported by:

- Partnerships:

	By this Researcher		Worldwide
	Scholarly Output	Field-Weighted Citation Impact	Prominence percentile
Sustainable Development; Environmental Impact Assessment; Circular Economy T.643	10	2.82	99.988

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Publications on CE

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Journal of Cleaner Production
https://doi.org/10.1016/j.jclepro.2018.04.159

Business models and supply chains for the circular economy

Highly Cited

Martin Geissdoerfer [a b], Sandra Naomi Morioka [c], Marly Monteiro de Carvalho [c], Steve Evans [a]

Journal of Cleaner Production
https://doi.org/10.1016/j.jclepro.2017.11.064

The circular economy umbrella: Trends and gaps on integrating pathways

Highly Cited

Aline Sacchi Homrich, Graziela Galvão, Lorena Gamboa Abadia, Marly M. Carvalho

Resources, Conservation and Recycling
https://doi.org/10.1016/j.resconrec.2020.105060

Towards a value stream perspective of circular business models

Graziela Darla Araujo Galvão [a], Aline Sacchi Homrich [a], Martin Geissdoerfer [b c], Steve Evans [b], Paulo Sergio scoleze Ferrer [a], Marly M. Carvalho [a]

Journal of Cleaner Production
https://doi.org/10.1016/j.jclepro.2021.127615

Circular business models for bioelectricity: A value perspective for sugar-energy sector in Brazil

Margareth de C. Oliveira Pavan [a], Dorel Soares Ramos [b], Munir Yones Soares [b], Marly M. Carvalho [a]

Resources, Conservation and Recycling
https://doi.org/10.1016/j.resconrec.2020.104904

Circular business models in the medical device industry: paths towards sustainable healthcare

D. Guzzo [1 2], M.M. Carvalho [3], R. Balkenende [4], J. Mascarenhas [1]

Unpacking the value conversion in a circular business model: exploring the effect of competitive criteria

Graziela Darla Araujo Galvão
Paulo Sergio Scoleze Ferrer
Steve Evans
Marly Monteiro de Carvalho

Business Strategy and the Environment

Circular business model: Breaking down barriers towards sustainable development

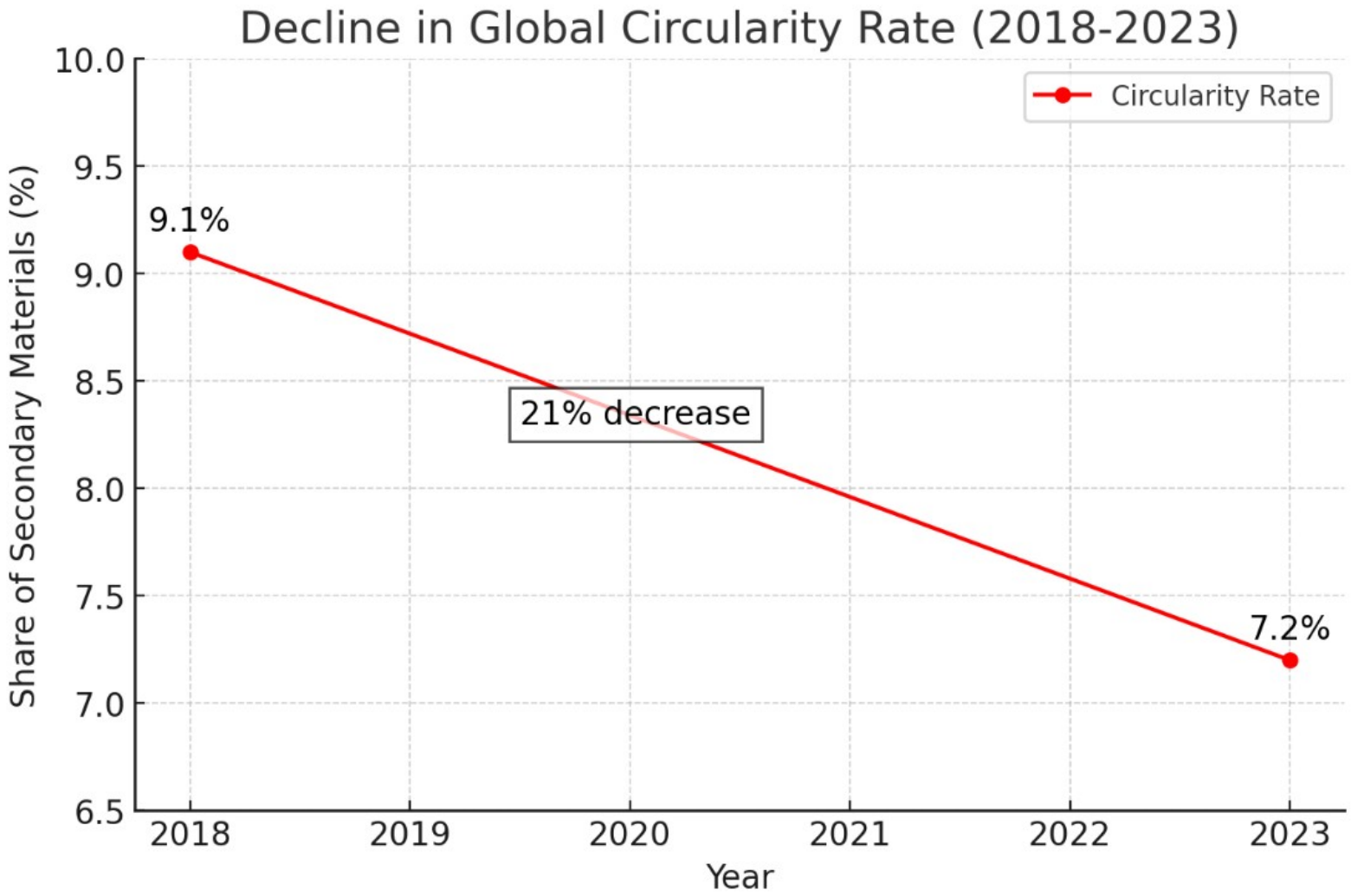
Graziela Darla Araujo Galvão, Steve Evans, Paulo Sergio Scoleze Ferrer, Marly Monteiro de Carvalho

https://doi.org/10.1002/bse.2966

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CE Future Challenge

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The Circularity Gap Report 2024

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1. About us
2. **Circular ecosystems & Social Inclusion**
3. Circular decommissioning strategies
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Circular Economy & Social Inclusion-CESIP

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2020/16011-5 Circular Business Models and Ecosystem: embracing social inclusion perspective (From 2023-2028)

- Supported by: FAPESP FUNDAÇÃO DE AMPARO À PESQUISA DO ESTADO DE SÃO PAULO

- Partnerships:

USP FGV

Aston University

UNIVERSITY OF PORTSMOUTH

MONASH University

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CESIP Theoretical Lenses

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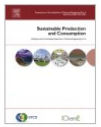
ELSEVIER

Sustainable Production and Consumption

Available online 16 June 2024

In Press, Journal Pre-proof

https://doi.org/10.1016/j.spc.2024.06.009



Enablers for circular ecosystem transformation: A multi-case study of Brazilian circular ecosystems

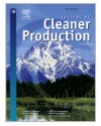
Leonardo Augusto de Vasconcelos Gomes [a], Aline Sacchi Homrich [b], Ana Lucia Figueiredo Facin [c], Lucas Emmanuel Nascimento Silva [a], Danika A. Castillo-Ospina [d], Adriana Hofmann Trevisan [d], Aldo Roberto Ometto [e], Janaina Mascarenhas [d], Marly Monteiro de Carvalho [b]

ELSEVIER

Journal of Cleaner Production

Volume 407, 25 June 2023, 137093

https://doi.org/10.1016/j.jclepro.2023.137093



Crossing actors' boundaries towards circular ecosystems in the organic food sector: Facing the challenges in an emerging economy context

Aline Gabriela Ferrari [a b], Daniel Jugend [a], Fabiano Armellini [b], Sanderson César Macedo Barbalho [c], Marly Monteiro de Carvalho [d]

ELSEVIER

Journal of Cleaner Production

Volume 256, 20 May 2020, 120260



Review

The governance of collaboration for sustainable development: Exploring the "black box"

Diego Vazquez-Brust [a c], Roberta Souza Piao [b], Mary Fernanda de Sousa de Melo [b], Rodrigo Trotta Yaryd [b], Marly M. Carvalho [b]



Applying the Ecosystem Lens

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CESIP Theoretical Lenses

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Journal of Cleaner Production
https://doi.org/10.1016/j.jclepro.2023.137340

How is the circular economy embracing social inclusion?

Roberta Souza Piao [a], Ticiana Braga de Vincenzi [b], Ana Lucia Fernandes da Silva [b], Maria Clara Chinen de Oliveira [b], Diego Vazquez-Brust [c], Marly Monteiro Carvalho [b]

sustainability
MDPI

Exploring BoP Generations through Business Model Innovation Lens: A Review and Framing

Mariana Voros Fregolente * and Marly M. Carvalho

https://doi.org/10.3390/su151712817

Corporate Social Responsibility and Environmental Management

Barriers toward circular economy transition: Exploring different stakeholders' perspectives

R. Souza Piao, T. B. Vincenzi, D. A. Vazquez-Brust, N. Yakovleva, S. Bonsu, M. M. Carvalho

https://doi.org/10.1002/csr.2558



Stakeholders, Social Justice & Social Inclusion perspectives

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CESIP Working Packages

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- **Circular Ecosystems & Business Models**
  - Identifying **new business models** for circularity
  - Engaging stakeholders and **collaborative networks in the ecosystem**

- **Socially Inclusive Circular Business Models**
  - Addressing **social impacts** of circular transitions
  - Developing strategies for **inclusive economic participation**

- **Barriers & Drivers to Scaling Circular Economy**
  - Understanding **financial, technological, and policy barriers**
  - Exploring **mechanisms to accelerate adoption**

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CESIP Methods

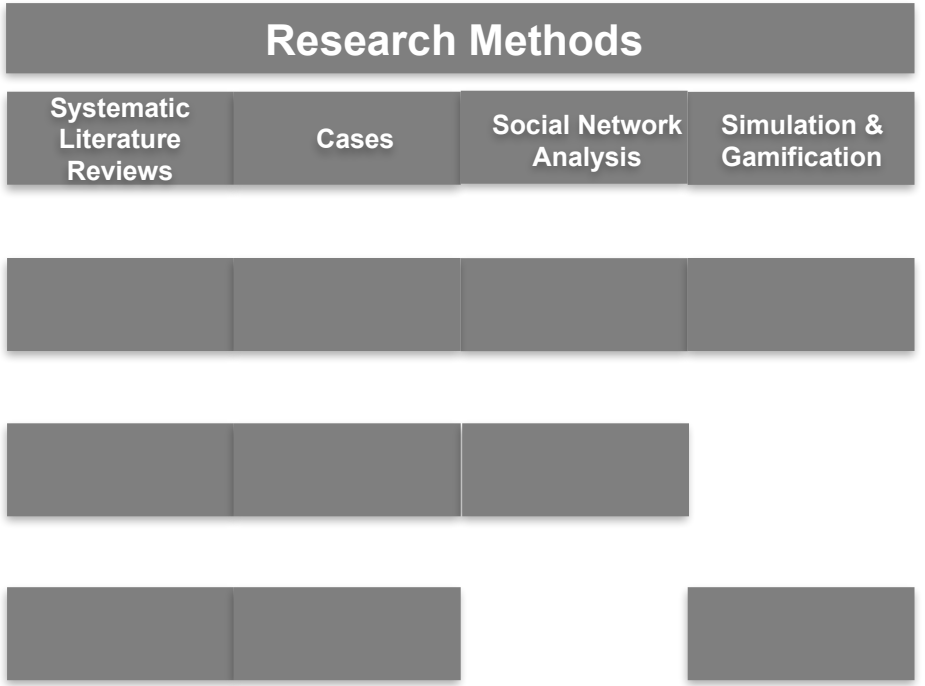
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Working Packages

WP1:Business Ecosystems and Circular Business Models

WP2: Socially Inclusive Circular Business Model

WP3: Barriers and Drivers to Scale Circular Business Models



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CESIP Sectors

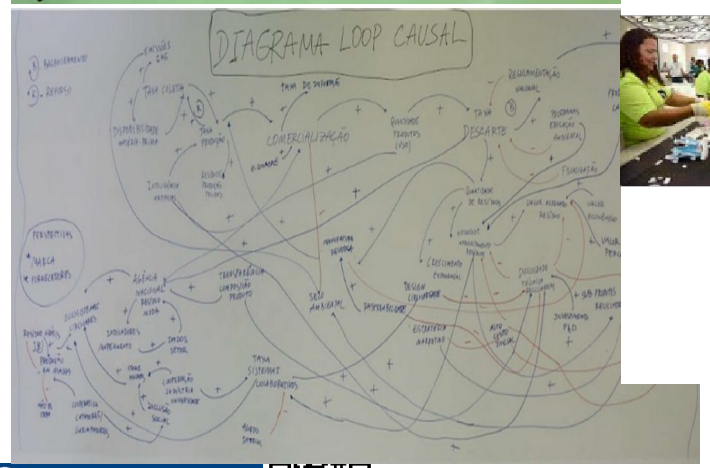


Participatory approach

Map, analyze, and promote circular ecosystems incorporating social inclusion

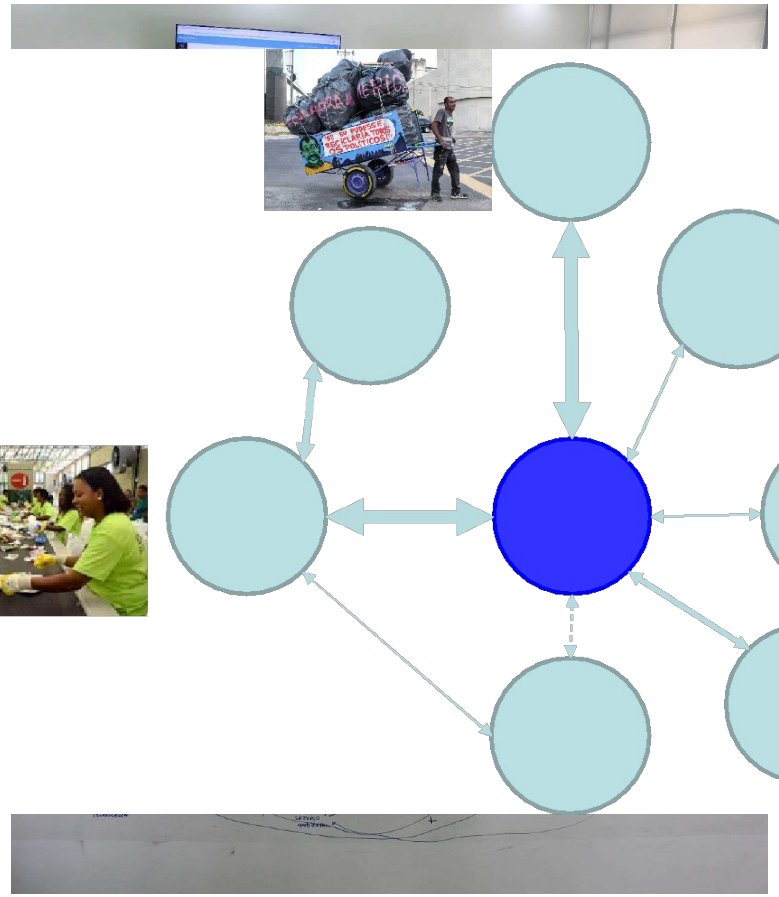
Fashion





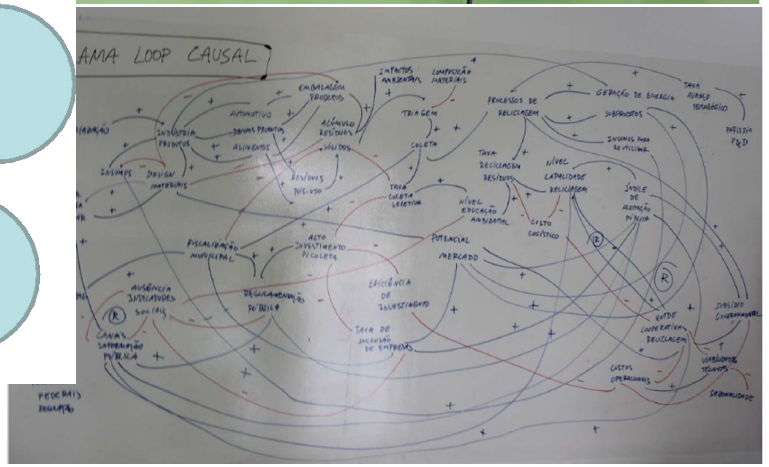


Electronics



Urban Ecosystems





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1. About Us
2. Circular Ecosystems & Social Inclusion
3. **Circular Decommissioning Strategies**
4. Final Considerations

Deutsche Forschungsgemeinschaft

Project HSE.1

Circular decommissioning strategies for current and future FPSO

Coordinator: Prof. Marly Monteiro de Carvalho

OFFSHORE TECHNOLOGY INNOVATION CENTRE

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Dynamic Decommissioning Panel - Brazil

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Filters:

TYPE OF ACTIVITY: All

ENVIRONMENT: All

R$ 70.2 billion

INVESTMENT [R$]

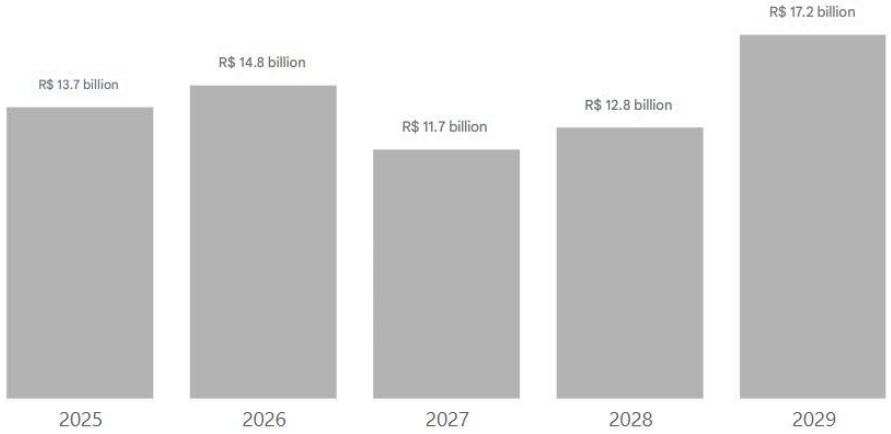
3773

WELLS TO BE DECOMMISSIONED

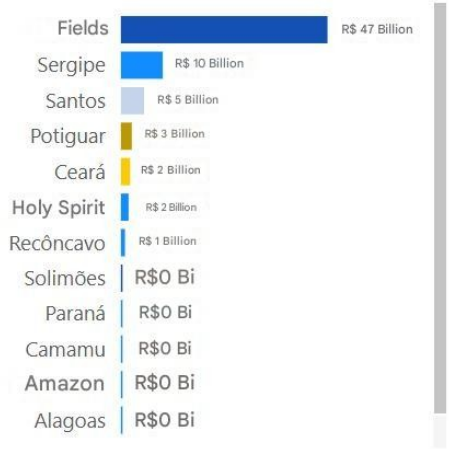
Investment by activity



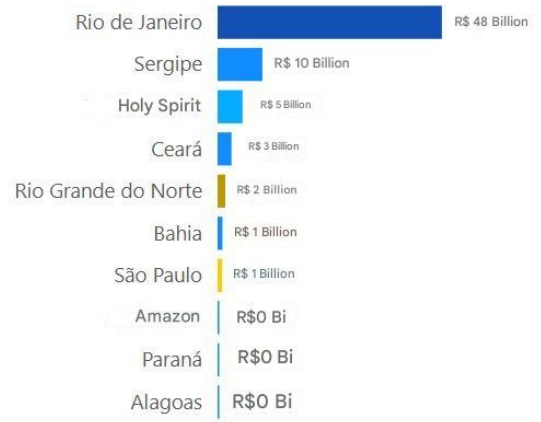
Investment per year



Investment by basin



Investments by state



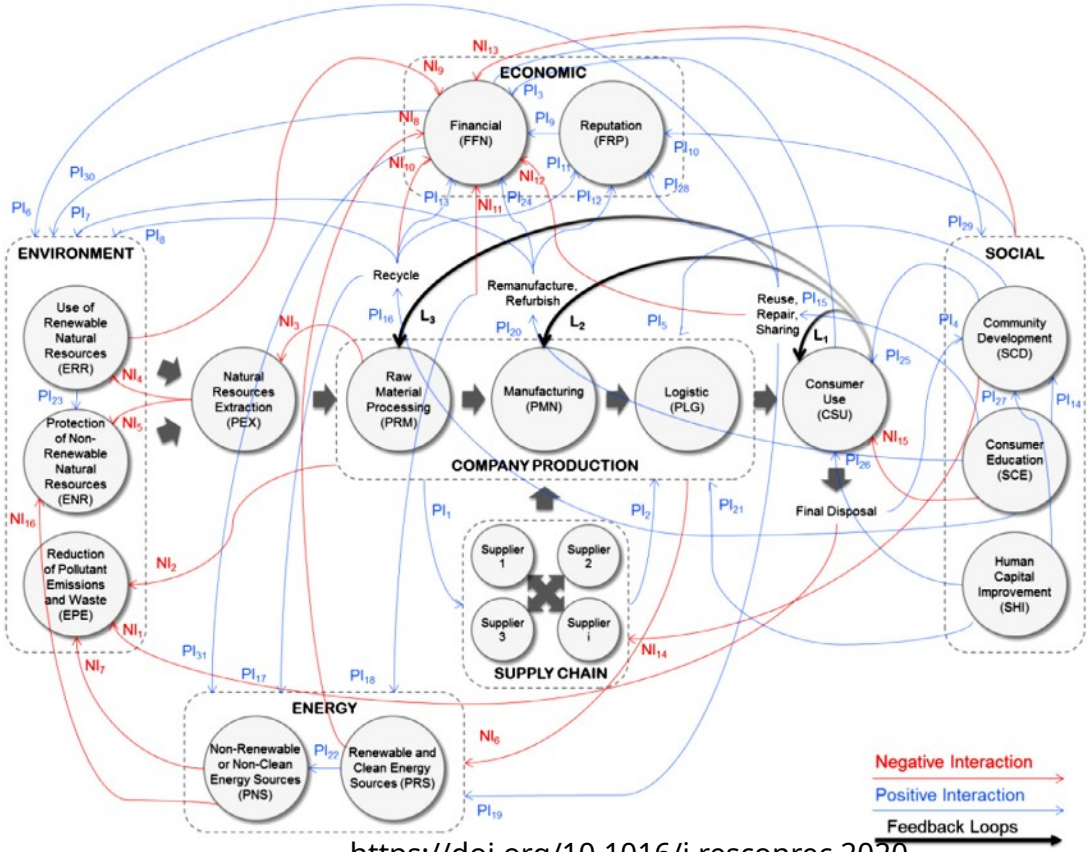
The data presented in this Panel are extracted from the Annual Work Program (PAT), sent by the Contractors and are subject to variations due to the submission of new revisions.

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OTIC HSE1-Main Objectives

❖Main Objectives

- ✔ **Define and implement Circular Decommissioning Strategies**
- ✔ **Develop an offshore circular design framework**
- ✔ **Develop a Virtual Decommissioning System.**
- ✔ **Duration: 48 months**



FPSO - Floating Production, Storage, and Offloading unit

https://doi.org/10.1016/j.resconrec.2020.105060

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OTIC HSE1-Working Packages

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❖WP1 - Circular decommissioning strategies for current FPSOs

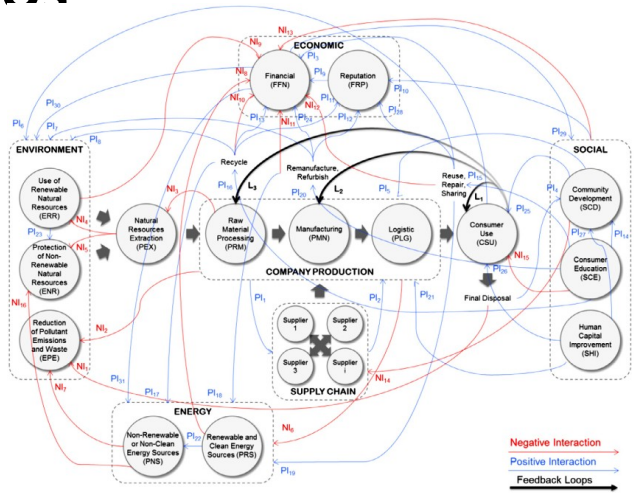
G1 - Scenarios Development - Develop circular decommissioning scenarios for existing assets.

G2 - Offshore circularity index – Assess Alternatives, developing an offshore circularity index for supporting decision-making.

G3 - Gamification – Develop a virtual environment for exploration of different alternatives.

*** Coupling with an FPSO inventory, digital model and monitoring system (WP3, DT1 and DT4)**

Decommissioning scenarios relying on existing assets.





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OTIC HSE1-Working Packages

❖WP2 - Circular Design Framework

G1 - Offshore circular design framework.

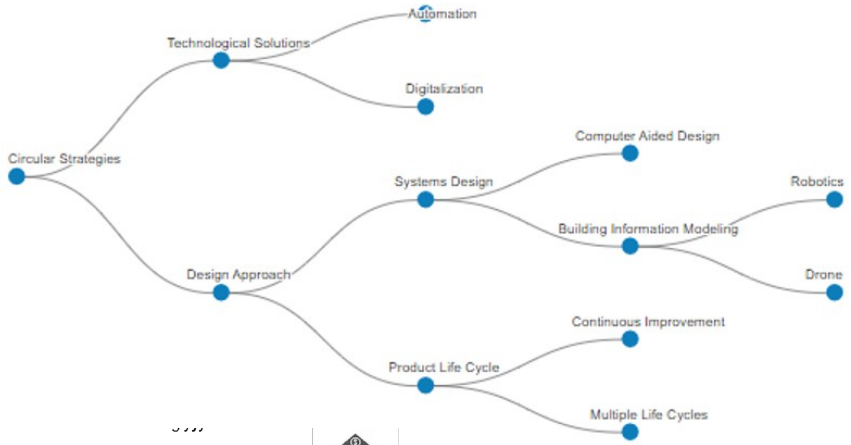
1. Develop a conceptual circular design framework considering the whole FPSO lifecycle (BoL, MoL, and EoL).
2. Assess the design for decommissioning and modular systems options, considering decomposability, substitutability, recombinability, and standardization of interfaces.

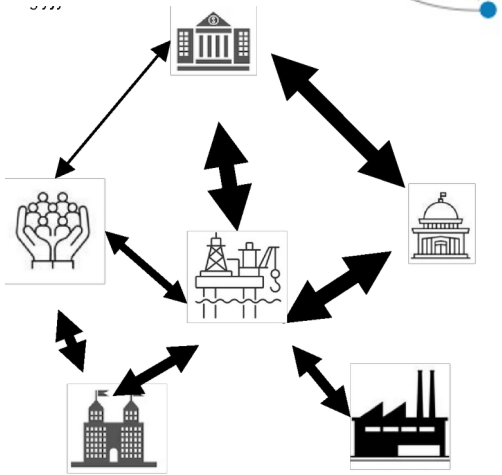
G2 - Map and engage key stakeholders in offshore ecosystem.

3. Map and engage key stakeholders from a circular design perspective in the Oil & Gas industry.
4. Evaluate synergies and complementarities under the circular perspectives from Oil & Gas industry, energy (wind farms, waves & current), and other industries, and services.

* Coupling with an digital model (WP3)

Offshore circular design framework for future FPSO





OTIC HSE1-Working Packages

❖WP3 - Develop a virtual assessment module of decommissioning alternatives relying on a multicriteria decision-making model

1. Visit decommissioning sites.
2. Inventory of facilities: wells; top side, and subsea facilities and equipment.
3. Development of a virtual assessment module.
   - Coupling with an FPSO digital model.
   - Coupling with the real-time monitoring system.
   - Coupling with design module coupled and the multicriteria decision-making model based on the circularity index.

Decommissioning decision-making tool relying on a real case.



Agenda

1. About Us
2. Circular Ecosystems & Social Inclusion
3. Circular Decommissioning Strategies
4. **Final Considerations**

Final considerations

➢ Exploring Collaboration in the Circular Economy

✔ Key Sectors:

- Fashion Circular Ecosystems
- Electroelectronic Circular Ecosystems
- Urban Circular Ecosystems
- Decommissioning Circular Ecosystems

✔ Core Topics:

- Circular, Innovation, Business, Service & Entrepreneurial Ecosystems
- Circular Design, Sustainable & Social Innovation
- Social Inclusion and Climate, Environmental, & Social Justice
- Socio-Technical Transitions in Circular Economy





Thank you!
Danke!
Questions?

RESEARCHERID

ORCID

Acknowledgements:

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