From European Strategy to Regional Implementation: A methodology for Deploying the Bioeconomy at Territorial Level

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European Commission

European Context

Draghi report: Domestic productive capability crucial for competitiveness and also for safeguarding European values (incl. sustainability and Europe's social model)

Governance mismatch at the spotlight

Dimension	Production capability accumulation process	Governance and Policy in EU countries
Time horizon	Long-term (one or more decades)	Short- to medium-term horizons (policy cycle ~ electoral cycle)
Scope of change	Systemic: macro-economic / socio-technical	Fragmented across ministries/departments, levels of governance (EU, national, regional/local)
Direction of causality	Typically demand-led (c.f. economic history) which is also *predictable*	Industrial policies typically focused on the supply-side (R&D/innovation, investment, skills, …)
	Rare occasions of supply-led change (e.g. emergence of a general purpose technology) are unpredictable	Typically uncoordinated with demand-side policies: subsidies and regulations handled by sectoral ministries/departments such as agriculture, energy, mobility, waste, health

JRC Project ‘System Dynamics for System Innovation’

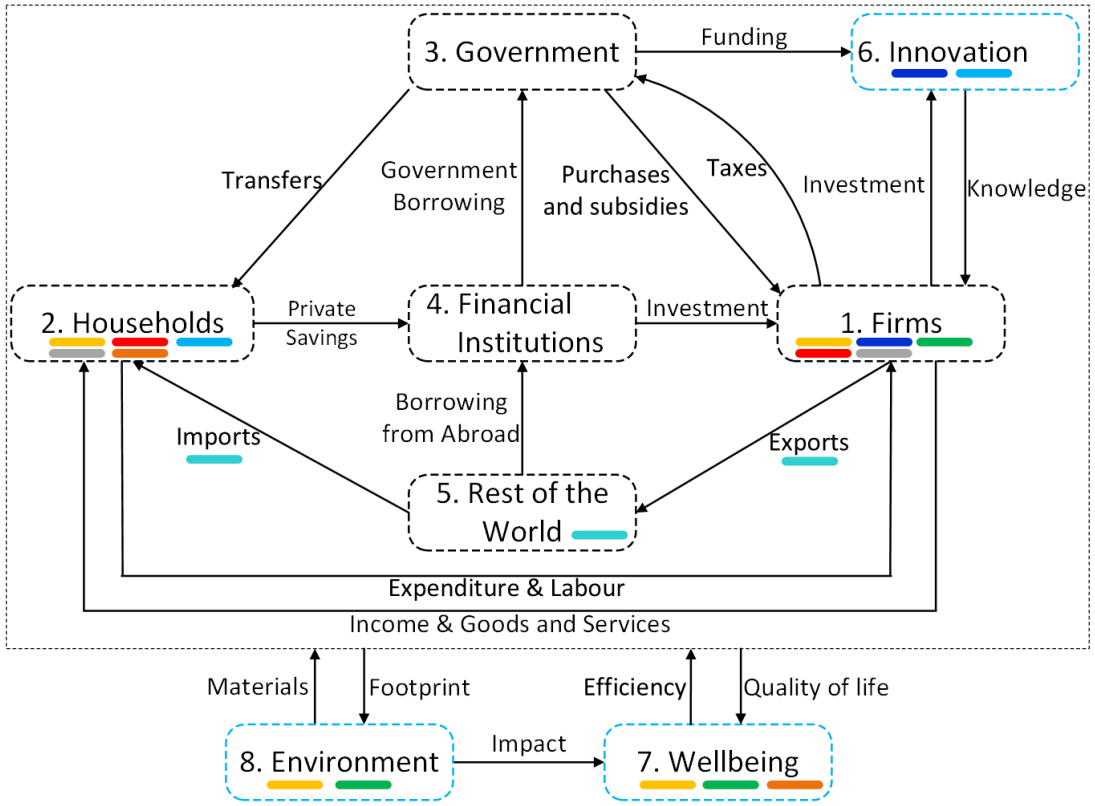
Objectives (2025-2026)

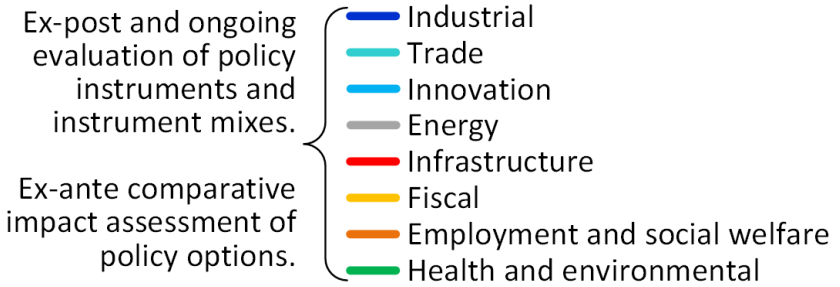
- Develop a computer simulation model of system innovation suitable for evaluating policy synergies and sequences across domains and levels of governance **(POLYTRoPOS Macroeconomic model)**
- Develop a participatory system dynamics modelling methodology (**Participatory System Dynamics Modelling-PSDM**) for place-based *interactive policy modelling*
- Develop a data methodology and metrics infrastructure (**POLYTRoPOS Data Workbench**) for the cost-effective empirical calibration of the model to distinct policy applications in specific territories & production systems

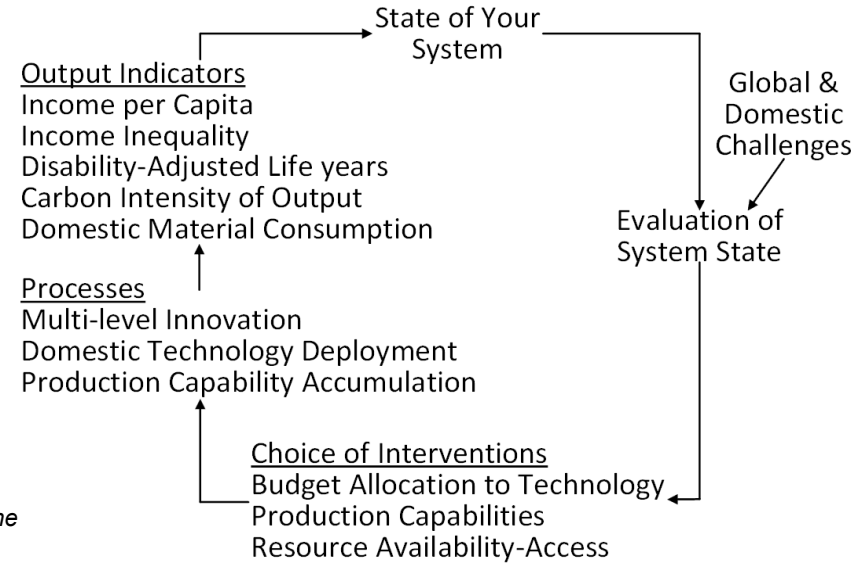
Trailblazing applications

- National level: Sweden (Green industrial transition), Partner: Vinnova
- Regional level: Navarra (Bioeconomy), Partners: SODENA, INTIA, OREKAN

POLYTRoPOS macroeconomic model of productive transformations

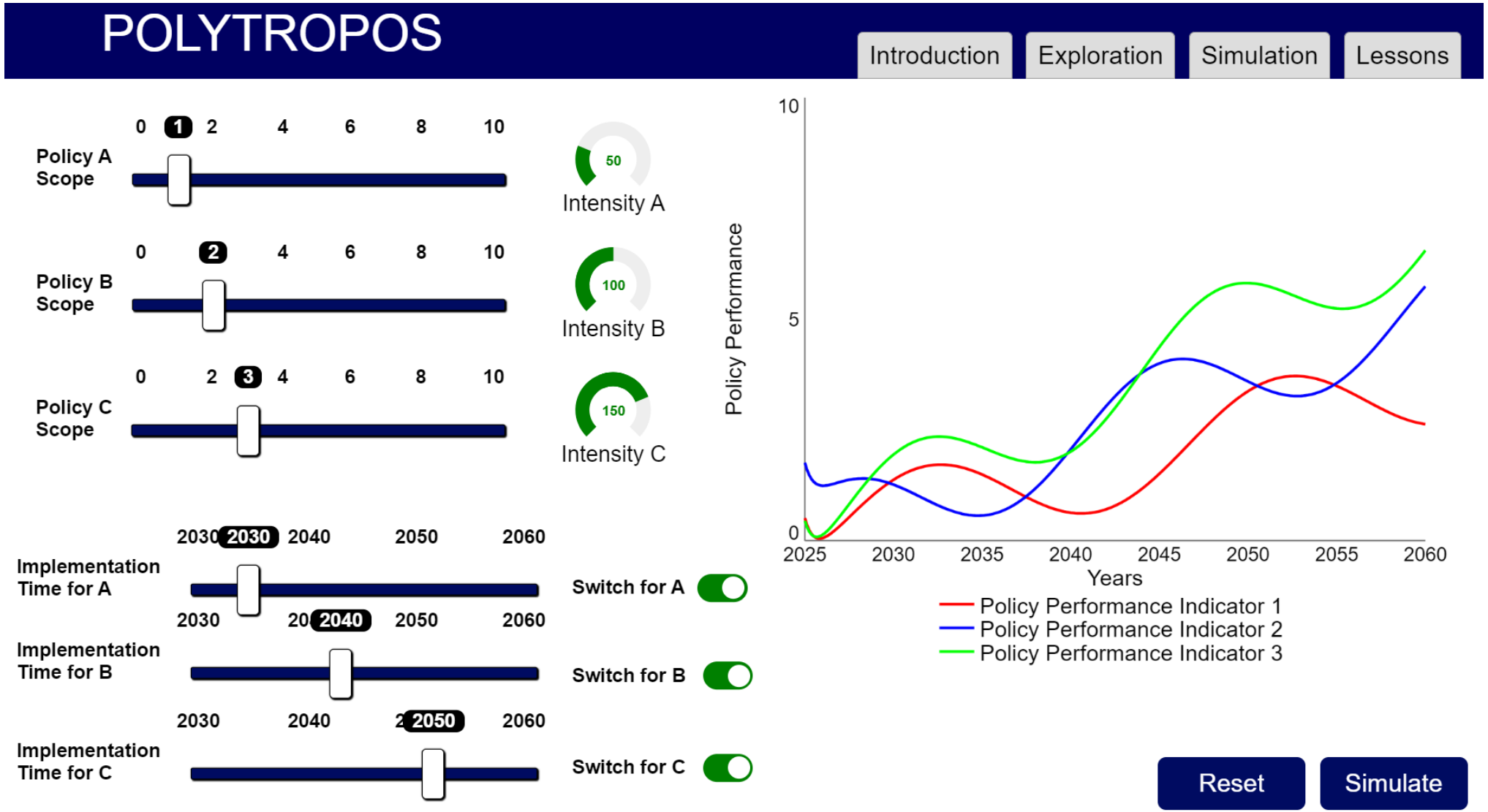






- Pontikakis, D., Papachristos, G., Janssen, M., Norlen, H. and Miedzinski, M., *System Dynamics for System Innovation - First steps in the development of a system dynamics computer simulation model of system innovation*, Publications Office of the European Union, Luxembourg, 2025, https://data.europa.eu/doi/10.2760/6207769, JRC143019.
- Pontikakis, D., Papachristos, G., Janssen, M., Miedzinski, M. and Norlen, H., *Addressing capability failure in demand-led industrial transitions*, Publications Office of the European Union, Luxembourg, 2024, https://data.europa.eu/doi/10.2760/9562090, JRC139240.

Interactive policy modelling with POLYTROPOS



Interactive policy modelling: reconciling ambition with constraints

PSDM engages stakeholders & problem owners in the modelling process

We combine *PSDM* with a *theory-based and empirically calibrated macro-model of productive transformations*

Contributions

- *PSDM*: context-specific insights, interventions
- *Macro-model*: a scientifically valid and empirical tool to test **ambition** against **resource** and **capability constraints**

Policy questions we can answer

The difficult questions about the bioeconomy sector in Navarra (and the EU)

- How much will it cost? How long will it take?
- What kind of outcomes can we expect in terms of regional growth, employment, but also depletion or restoration of natural capital and changes in quality of life?

Serves to compare and contrast possible futures for the region

- What are plausible future scenarios? Which of those are desirable? Feasible?
- What are the trade-offs and synergies between the economy, environment and citizen wellbeing?

Invites dialogue and search for (policy) solutions

- Cover a much greater part of the policy ‘possibility space’ than traditional methods do

Invite deeper questions

- What if we align resources across regional ministries and sequence them over time?
- What if we collaborated with another region?
- What would happen if companies were convinced to invest (crowd in) alongside public investments?
- What would happen if the national government aligned national instruments with our strategy, legislated favourably or used public procurement to create a lead market for our products?

JRC Pilot in Navarra

Why Navarra / Bioeconomy

- Leading European region with vibrant production & innovation system
- Navarra possesses fairly extensive set of policy competences in a multi-level political economy
- Interest to develop the bioeconomy in Navarra by our partners

What for

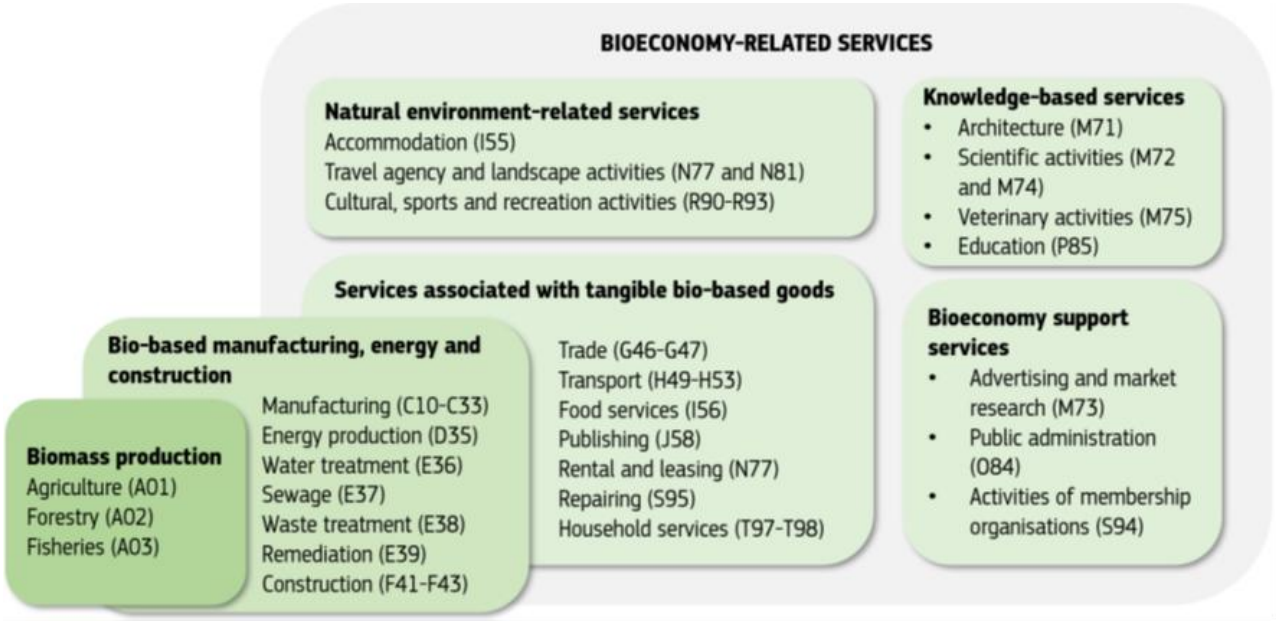
- Develop first regional version of POLYTRoPOS macro-model
- Pilot PSDM methodology at regional level
- Advance systems thinking and raise awareness among stakeholders
- Offer strategic insights to policy makers on the transformation of the bioeconomy in Navarra

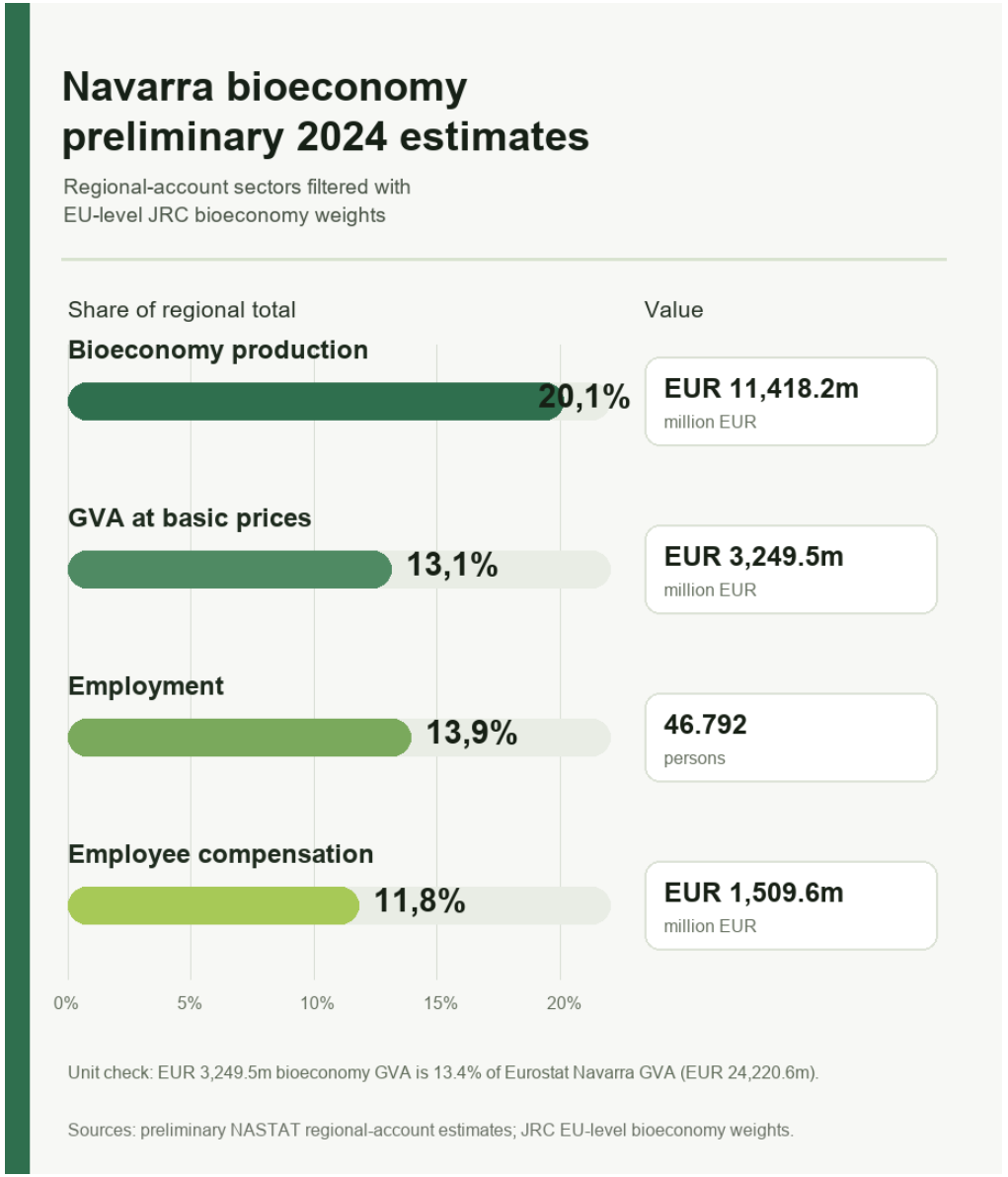
How

- Qualitative research (PRISMA desk study)
- PSDM: Workshops to engage actors across the system, develop shared understanding
- Interactive modelling: Simulations of policy impacts, both counterfactual and prospective

Navarra's bioeconomy

- Bioeconomy as a broad system:





PRISMA background report: Review of Navarra's policy documents through the lens of transformation

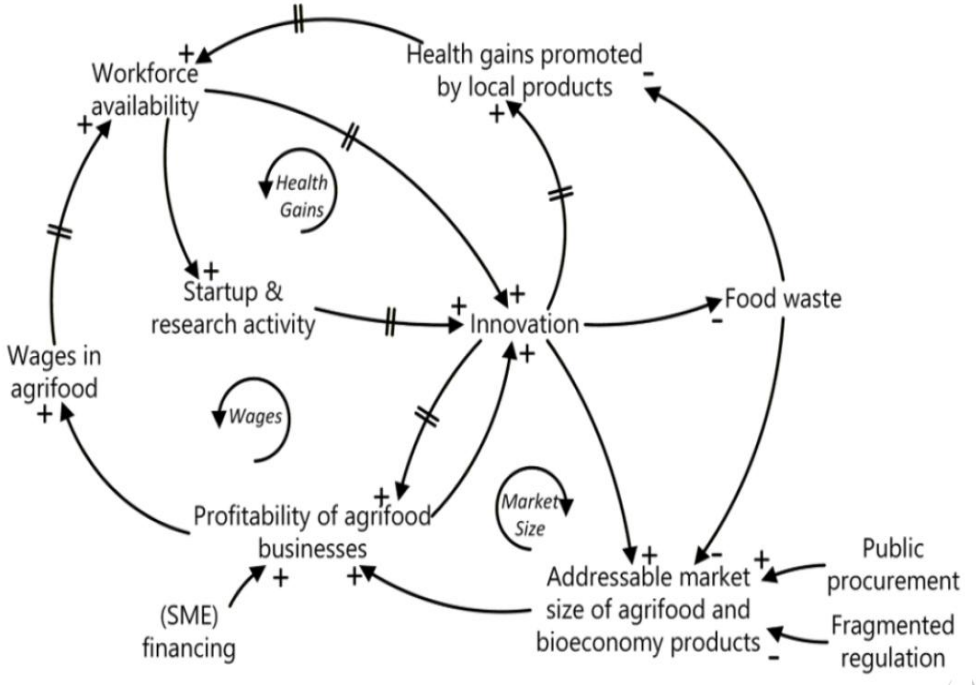
Opportunities for transformation

- Generational renewal and strengthening of green jobs
- Scaling up circular practices (sustainable packaging, waste recovery)
- Promotion of the circular bioeconomy and industrial diversification (bioplastics, biorefineries)
- Use of green public procurement and innovative financial instruments
- Integration of R&D, training and entrepreneurship in rural SMEs

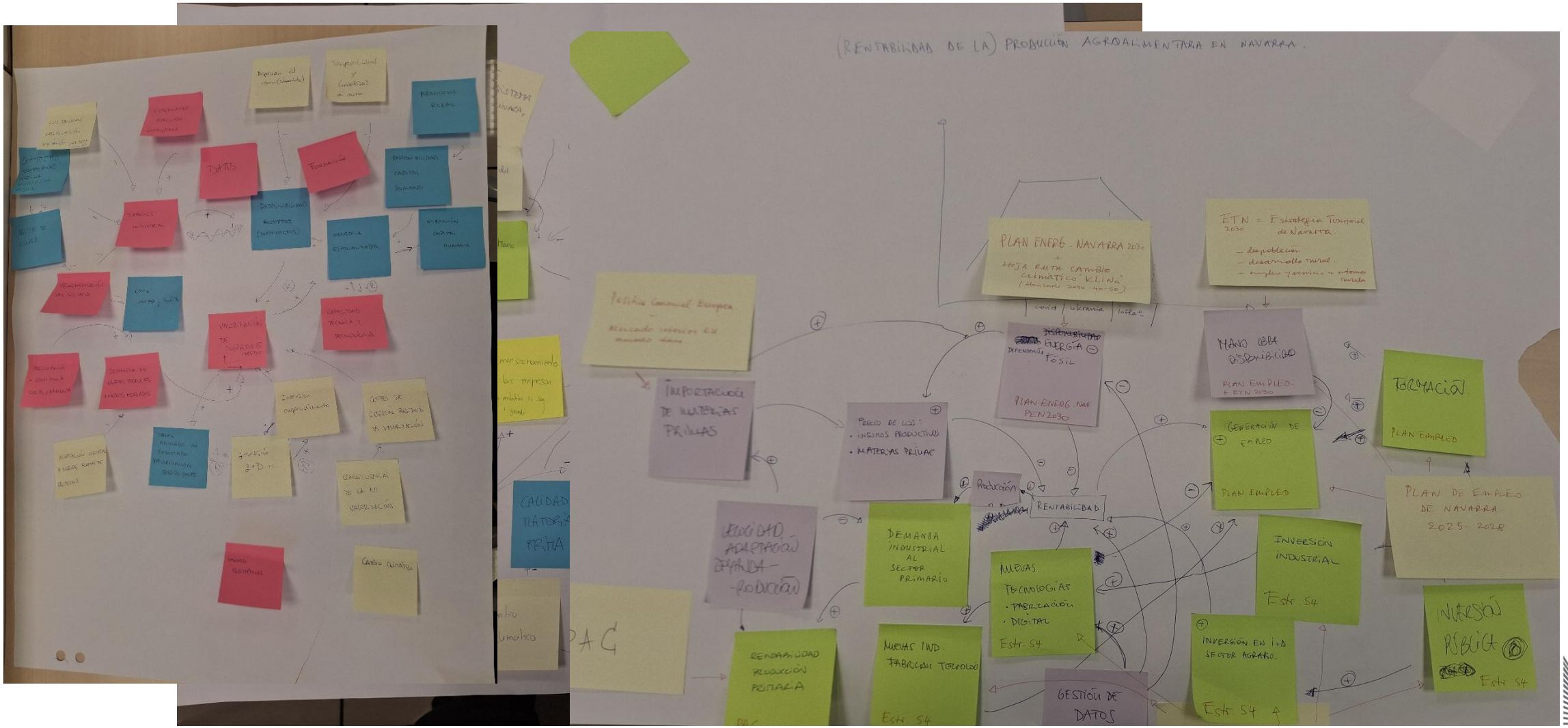
Shared vision 2030–2050

- Competitiveness and quality employment
- Territorial cohesion and rural resilience
- Sustainability and social well-being

Causal loop diagram from documents



17 October 2025 Workshop – Participatory Modelling



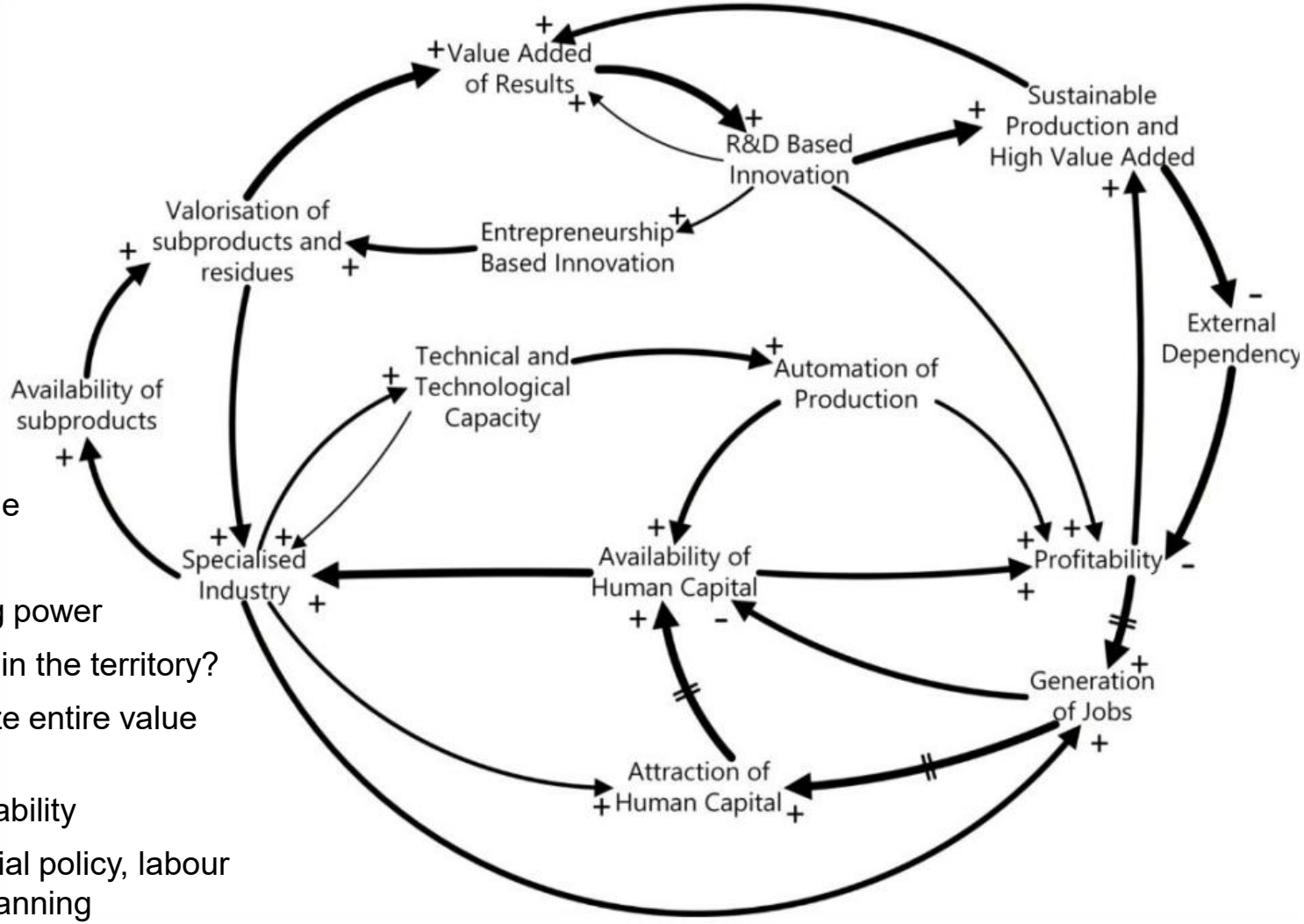
17 October 2025 Workshop – Participatory Modelling

Participation (22 participants)

- Public administration (regional government)
- Public agencies/Technical bodies
- Universities and research institutions
- Technology and innovation centres
- Agricultural and sectoral organizations

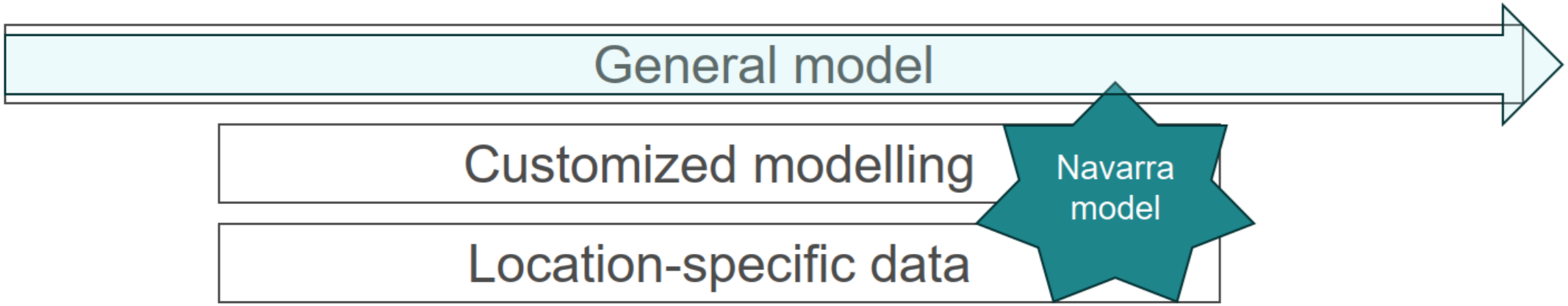
Main results

- Byproduct availability as a competitive advantage
- Talent as an engine and potential constraint
- Value added walks hand in hand with bargaining power
- How much of the automation dividends will stay in the territory?
- Low profitability of primary sector can de-stabilize entire value chains
- Ecosystem services are essential to maintain stability
- Integrated **governance** and **data** across industrial policy, labour policy, territorial planning, climate and energy planning



Next steps

- Definition and measurement of the bioeconomy for Navarra (*semi-structured interviews, data analysis*)
- Calibrate general model with regional data
- Adaptation of the general model to include specific dynamics: residues/byproducts, industrial symbiosis…
- Modelling of policy structures and re-calibration of the general model
- Interactive modelling workshops with policy makers and stakeholders to develop strategic policy scenarios and simulate their impact



Thank you

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