

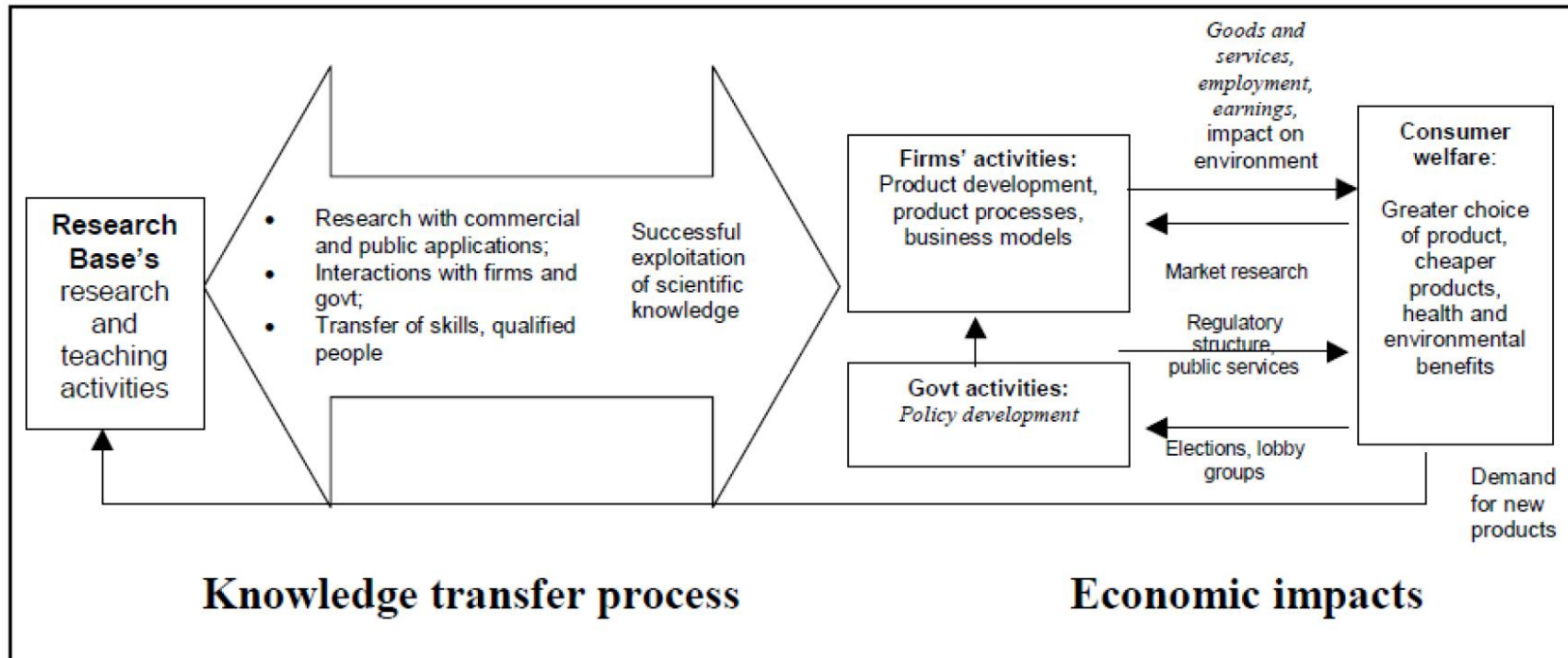
MODELLING TECHNOLOGY TRANSITIONS ASSOCIATED WITH MATERIALS MODELLING

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Motivation



- Inform stakeholders of the options available to quantify economic impacts related to technology transitions.

Qualitative impacts

- More efficient and targeted exploration
- Broader exploration
- Deeper understanding
- R&D strategy development
- Performance optimization
- IP protection for innovations
- Upscaling and market introduction benefits
- Value chain benefits
- Improving collaboration and communication between R&D and production
- Troubleshooting
- Marketing and competitive benefits



*The Economic Impact of
Materials Modelling
Indicators, Metrics, and Industry
Survey*

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**How can we quantify
these impacts?**

Microeconomics vs. Macroeconomics

- **Microeconomics**

- Studies behaviour of individuals and firms in making decisions regarding the allocation of scarce resources and the interactions among these individuals and firms



- **Macroeconomics**

- Studies the performance, structure, behavior, and decision-making of an economy as a whole



Modeling Technology Transitions

- **Microeconomic**

- Technology Evolution
- Technology Maturity

Airborne
Oil & Gas

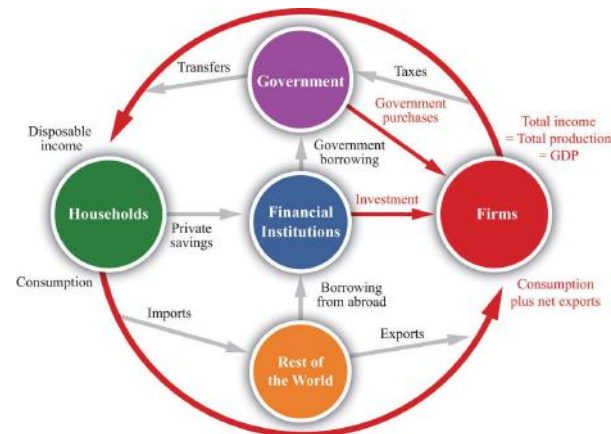


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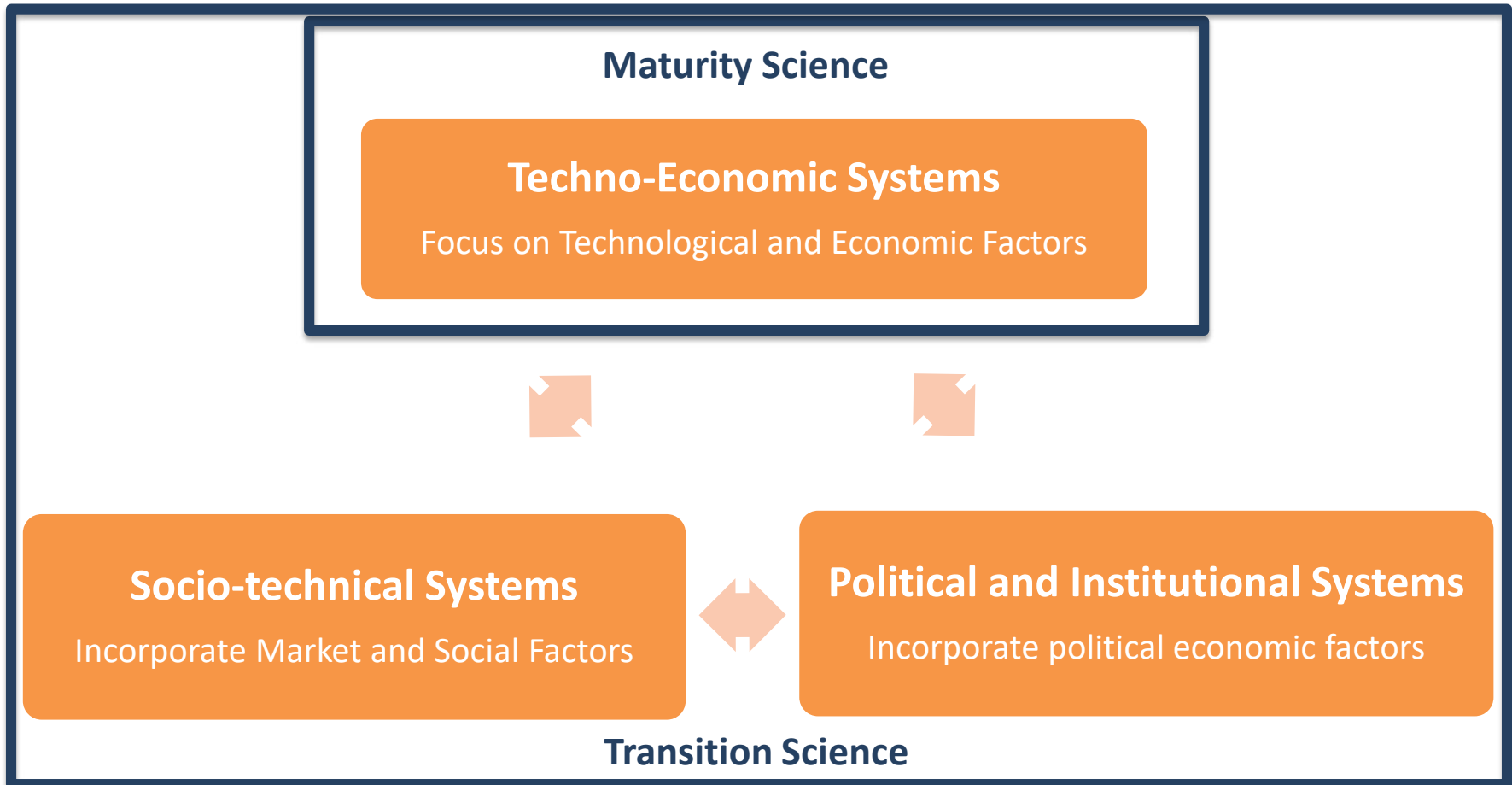


- **Macroeconomic**

- Techno-economic analyses
- Socio-technical analyses



Integrated and Co-evolving Systems Influence Broad Transition To Materials Modelling



What have we learned from modelling energy or sustainability transitions?

- **Must enable quantitative description of the transition**
 - Technology domain
 - Institutional
 - Market
 - Social domains
- **Must account for endogenous factors that drive transition processes, not just external impacts on the system**
- **Traditional optimization modeling (as opposed to systems dynamics) might lead to:**
 - Unintended consequences
 - Inefficient or failed transitions

Consideration and valuation of other impacts of materials modelling?



- **Societal**

- Faster development of more efficient or safer materials
- More/less efficient use of taxpayer dollars to fund research
- Creative destruction



- **Environmental**

- Minimization of material inputs
- Changes in waste or other environmental outputs?

What can EMMC do?

- **Encourage open science** (Sessions 5 and 17)
 - More reliable knowledge
 - More rapid and creative generation of results
 - Broader and more inclusive participation in research process

NASEM (2018)
- **Design and distribute materials modelling infrastructure**
 - Translators (Sessions 3, 6, 9)
 - Marketplaces (Sessions 10, 13, 16)
 - Business decision support systems (Session 15)
- **Combine economic models with stakeholder input to estimate the potential economic impacts of materials modelling** (Plenary Talk 4)
 - Industry or economy-wide scale
 - Potentially incentivizes public and private investment



Reference: National Academies of Sciences, Engineering, and Medicine (NASEM). 2018a. Open science by design: Realizing a vision for 21st century research. National Academies Press. <https://www.nap.edu/catalog/25116/open-science-by-design-realizing-a-vision-for-21st-century>

Thank you!

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