"Research and innovation in agriculture: beyond productivity?"

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Strategy

- keep it broad
- …
- looking for “contaminations”
- …
- and inspiration for future research

Outline

- Background
- Objectives
- Areas of inspiration/challenges
  - a) bioeconomy etc.
  - b) sustainability etc.
  - c) entrepreneurship etc.
  - d) Life Cycle Assessment etc.
- Discussion and future research
- Conclusions

Background

- Food needs, climate change, resources etc.
- Productivity well stablished concept in economics
- Research as a key determinant & different methods to evaluate the connection, but:
  - sometimes not very robust+data limitations
  - challenges to productivity as an objective (e.g. environmental and social concerns)
- Further future challenges….

Objective

- Discuss the link between research, innovation and productivity in agriculture
- in the light of selected emerging economic and policy concepts
- mainly, but not exclusively, linked to the development of the bioeconomy

- Not only productivity measurement!
- Agriculture in context

Bioeconomy/1

- Def. “encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries...”
- Use of:
  - wide range of sciences (life sciences, agronomy, ecology, food science and social sciences)
  - enabling and industrial technologies (biotechnology, nanotechnology, information and communication technologies (ICT), and engineering)
  - local and tacit knowledge

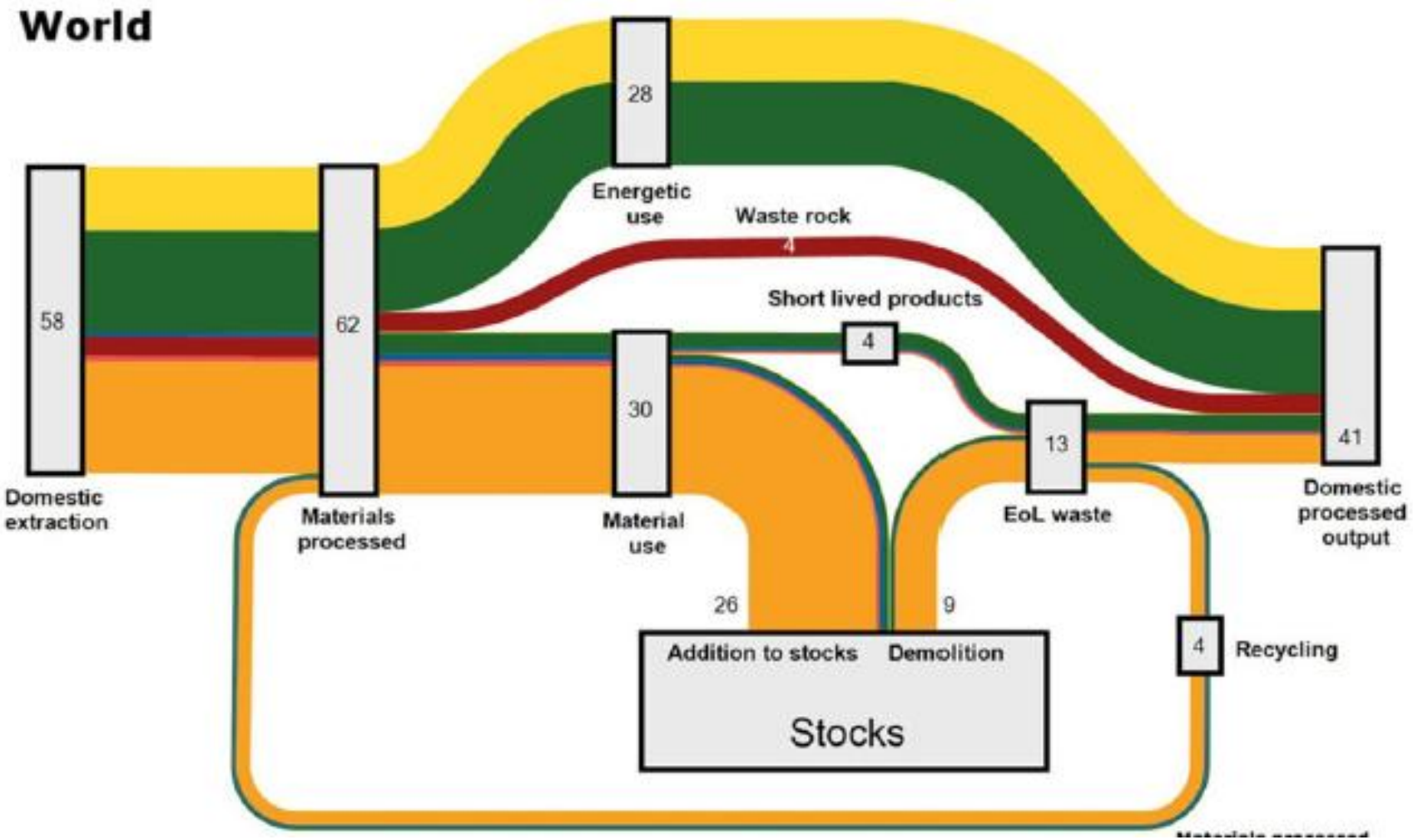
Bioeconomy/2

- Key issues:
  - Interlink among different fields of science+non-research knowledge
  - new sectors (bioenergy, biotechnology,…)+new connection across sectors
  - breaking down of biomass into components+re-composition of final products
    - ->Nature of production, (predictability of) pathways of research impact, lags
  - resource efficiency: focus on limiting resources (land, water,…)
  - biorefinery: ordered use of biomass & connection across different stages

Bioeconomy & circular economy/1

- Def. rely less on external raw material and more on re-use of resources that are already in the system
- Key issues:
  - Only external resources are really newly used->Focus on degree of circularity as an indicator
  - Biomass potentialy internal to the circular economy (but depends on circularity of input->effects of circularity of different raw materials)
  - Economics of resources: costs of recycling vs. scarcity costs of external resources
  - Relevance of scale for evaluation (the higher, the closer?)

Circular economy/2



Source: Haas et al., 2015

Sustainability, vulnerability, resilience, ecosystem services...

- Def…. Omissis
- Key issues:
  - Enlarge scope of research & effects (enviromental, social, …)
  - Attention to dynamics & uncertainty
  - Lean towards potential rather than performance

  - But… contrast between concepts and data (e.g. ES)
  - + functional connection + monetary evaluation problems…

Entrepreneurship

- Concept includes alertness to profit opportunities, risk-taking and aspiration, efficiency
- Key issues:
  - Growing weight in discussion about innovation
  - Circular relationship with research:
    - expressing needs
    - selection of promising ideas
    - active role in making an innovation successful
  - Growing focus on specialised “entrepreneurship of innovation” (spin-off, brokerage, ….)
  - Science towards “just” providing a knowledge base to entrepreneurial visions?

Entrepreneurship and….

- Evolving complexity of property rights on innovation:
  - more sophisticated distribution of benefits & incentives
  - enterprise as dynamic bundle of contracts looking for “food” (amoeba enterprise again??)
- Social innovation and market creation:
  - public procurement
  - social construction of preferences, prices, etc…
- Ecoinnovation etc.:
  - concept of relative improvement of productivity of natural resources

Life Cyle Assessment

- Assessment method focusing on impacts generated by each unit of product (or better functional units) along its life cycle from "craddle to grave”
- Basis on a compilation of the inventory of input and outputs, notably with reference to key resources (e.g. energy, water) or pollutant (e.g. GHG, nitrogen).
- But also way of looking at problems->product life cycle/chain perspective
- Widespread use suggested (e.g. H2020)
- Paradigm for the future???

Life Cyle Assessment

- Key issues:
  - Interpretation as reverse measure of productivity?
  - Linking detailed technologies to global issues through product life cycle?
  - Several non-trivial assumptions and problems:
    - availabilibity of locally relevant data
    - boundaries of the system, unit, etc.
    - interpretation (importance, geographical location of impacts)
    - ..
  - Ongoing cross-fertilisation with:
    - new issues: LCA in circular economy
    - other methods: LCC, LCA&MCA, LCA&SWOT, LCA&DEA, ….

Discussion: (some) major points

- Inflation of keywords but also important signals:
  - Performance->Potential
  - Impact->Pathways
  - Matching global&detailed+global&local
- Data!
- Stronger focus on multi-scale functional proxies?

Discussion: Directions for future research

- better representations of goods and technologies:
  - input and output as bundles of attributes (compounds)
  - potential from combination
- better understanding the role of (changing) actors and institutions:
  - entrepreneurship in research, knowledge exploitation and social construction of successful technologies
  - new business models
  - new connections with consumers
  - new role and design of policies
- investigation of new potential evaluation tools:
  - contamination among existing tools could be a pathway, e.g. LCA
  - but may be, it is time for some more radical innovation
  - effects and mechanisms

Conclusions

- Strong demand of economic analysis and practical solutions for the evaluation of research impacts
- Productivity important again (focus on scarcity), but challenges on:
  - scope
  - pathways
- (additional) challenge for researchers:
  - getting more involved in the agriculture and bioeconomy innovation system...
  - ...without getting lost in circularity!

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THANK YOU VERY MUCH

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