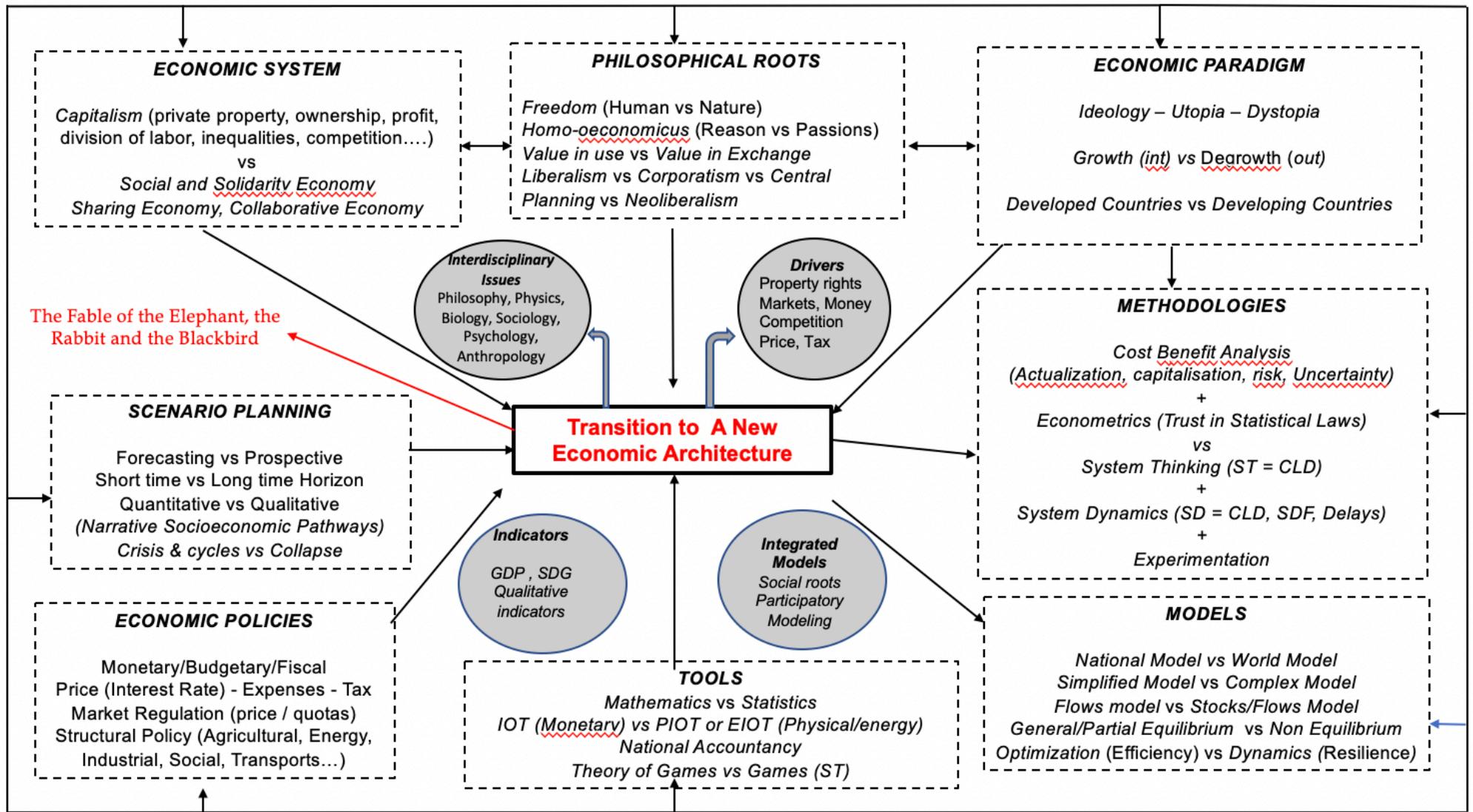


HOW CIRCULAR DYNAMICS REDESIGNS OUR ECONOMIC SYSTEM ?

Drivers and Challenges

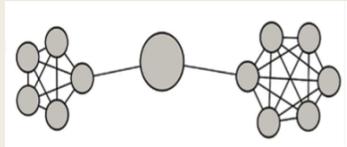
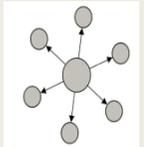
*Arnaud Diemer (UCA, HVL, ERASME)
Jean Monnet Chair on Circular Economy and Industrial Ecology
Observatory of Postgrowth and Degrowth (OPCD)*



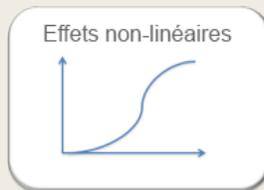
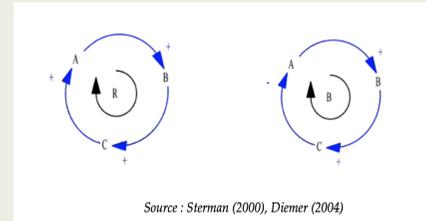
Circular Dynamic

	Drivers	Barriers
Economic	<ul style="list-style-type: none"> - Increased revenue (Giurco et al. 2011) - Lower input costs (Van Beers et al. 2007) 	<ul style="list-style-type: none"> - Operational costs and revenues (Giurco et al. 2011) - Lack of funding (Bacardo et al. 2016; Fang et al. 2011; Li et al. 2015) - Insufficient financial support from banks (Su et al. 2013) - Investments in extended production systems (Van Beers et al. 2007)
Regulations	<ul style="list-style-type: none"> - New pollutant targeted regulations (Giurco et al. 2011) - Strong government engagement (Mathews & Tan 2011; Zhu & Ruth 2014) - Government-initiated policies (Behrens et al. 2012) 	<ul style="list-style-type: none"> - Environmental regulations (Giurco et al. 2011) - Inadequate public tax incentives (Su et al. 2013)
Cooperation	<ul style="list-style-type: none"> - Between stakeholders (Grisoldorfer et al. 2017) - Social ties (Zhu & Ruth 2014) 	<ul style="list-style-type: none"> - Lack of willingness to collaborate (Bacardo et al. 2016) - Lack of cooperation and information sharing (Gibbs & Deutz 2007; Goley et al. 2015) - Lack of trust among locates (Gibbs & Deutz 2007)
Knowledge and technology	<ul style="list-style-type: none"> - Specific knowledge that actors acquire through experience and learning of IS in their system (Booms et al. 2011) - Technical knowledge (Zhu and Ruth 2014) 	<ul style="list-style-type: none"> - Technological challenges (Li et al. 2015) - Lack of technology infrastructure readiness (Costa & Ferrito 2010; Li et al. 2015)
Management	<ul style="list-style-type: none"> - Corporate sustainable focus in the firms (Giurco et al. 2011) - Proactive management (Grisoldorfer et al. 2017) - Lack of top management support (Bacardo et al. 2016; Chi & Yang 2004) 	<ul style="list-style-type: none"> - Cultural changes within firms (Giurco et al. 2011) - Lack of awareness of IS (Bacardo et al. 2016; Chi & Yang 2004) - Lack of top management support (Bacardo et al. 2016; Chi & Yang 2004)
Resources	<ul style="list-style-type: none"> - Availability of resources (Zhu & Ruth 2014) - Staff mobility between different industries (Van Beers et al. 2007) 	<ul style="list-style-type: none"> - Resource scarcity (Giurco et al. 2011)
Location	<ul style="list-style-type: none"> - A facilitator in the system (Behrens et al. 2012) 	<ul style="list-style-type: none"> - Distances between companies (Giurco et al. 2011)

High level of exits



Mediation



Causalities
vs
correlation

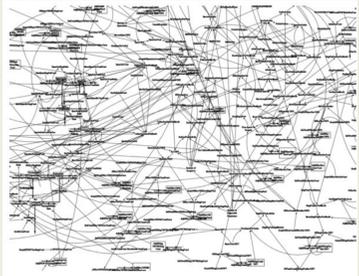
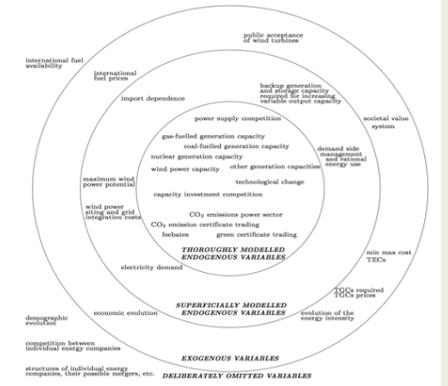
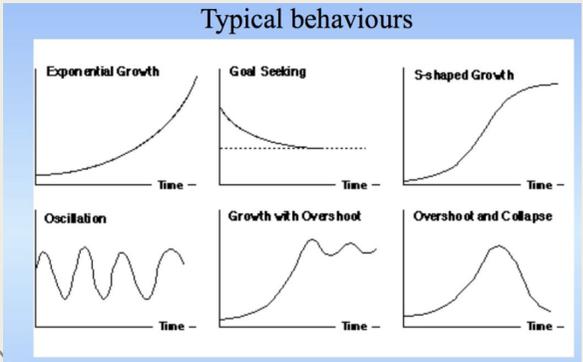
Loops
CLD, SFD

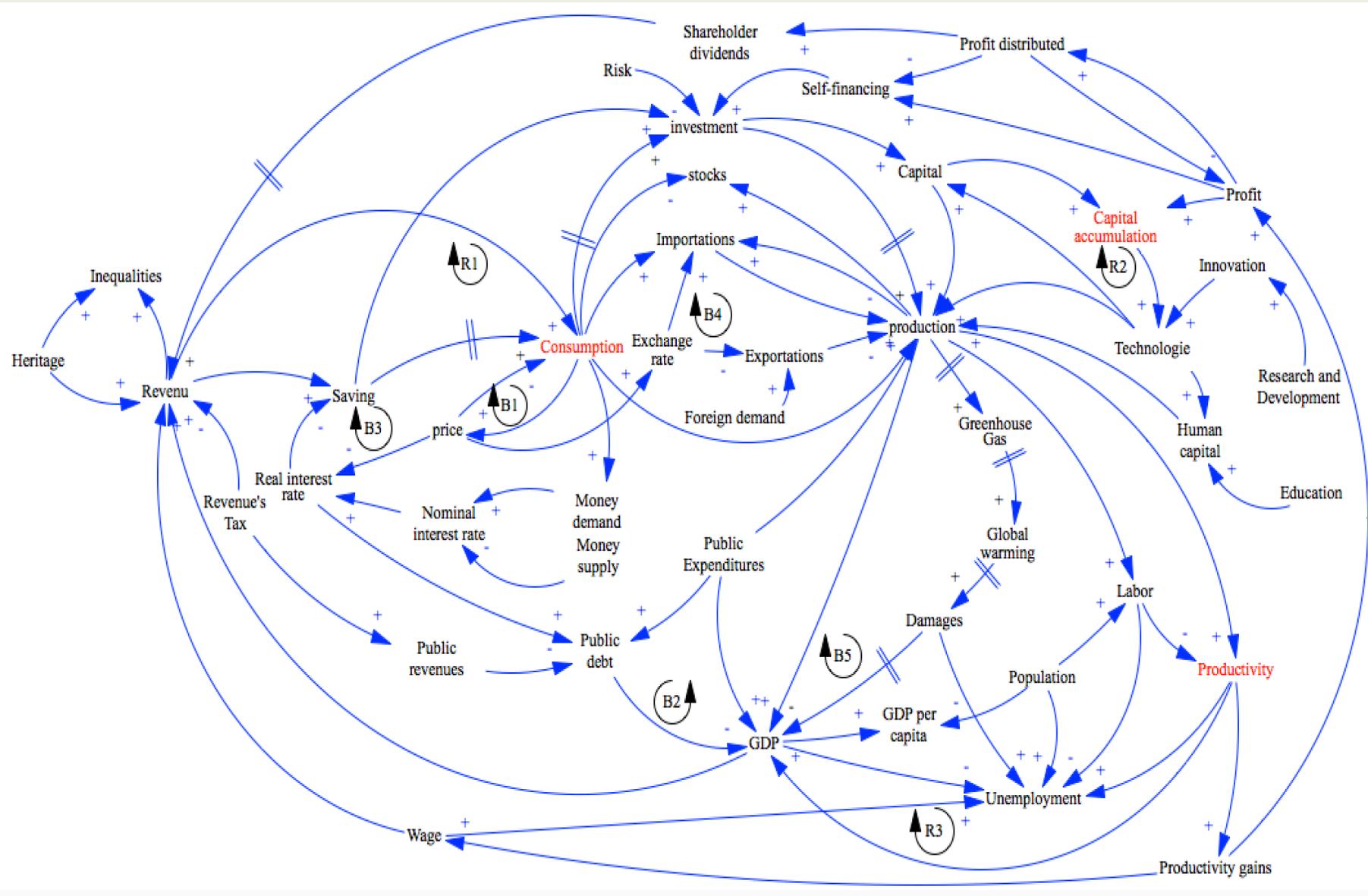
Leverage
Points

Archetypes

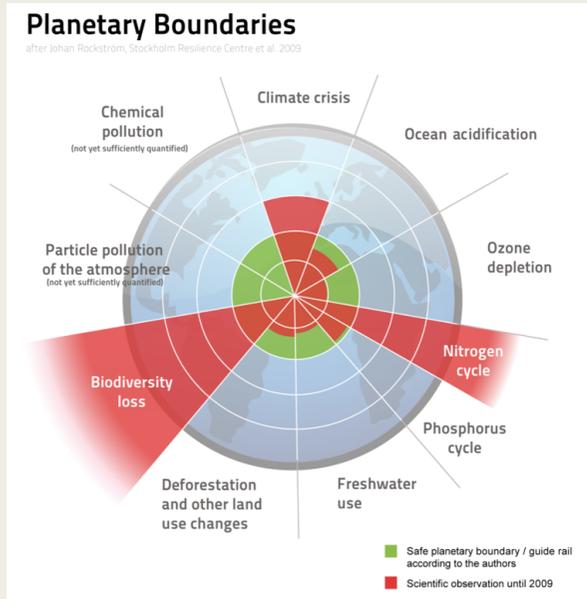
Forest
Thinking

Limits of the
system

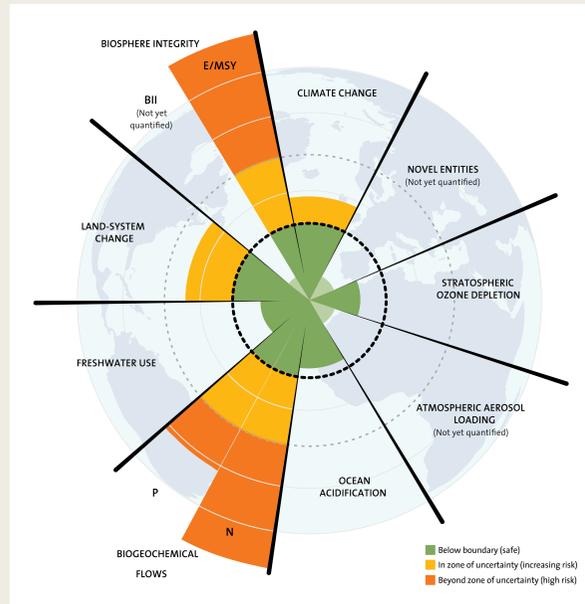




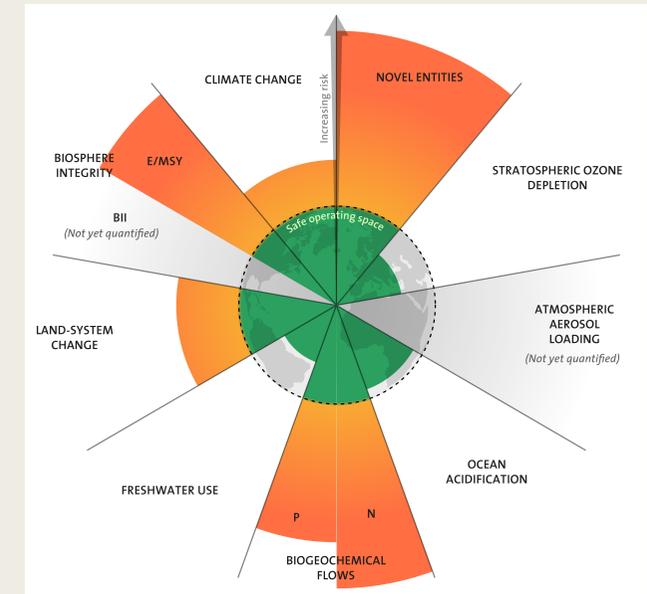
The economic system is embedded in the Planetary Boundaries



Source : Rockström & al. (2009)



Source : Steffens & al. (2015)



Source : Persson & al. (2015)

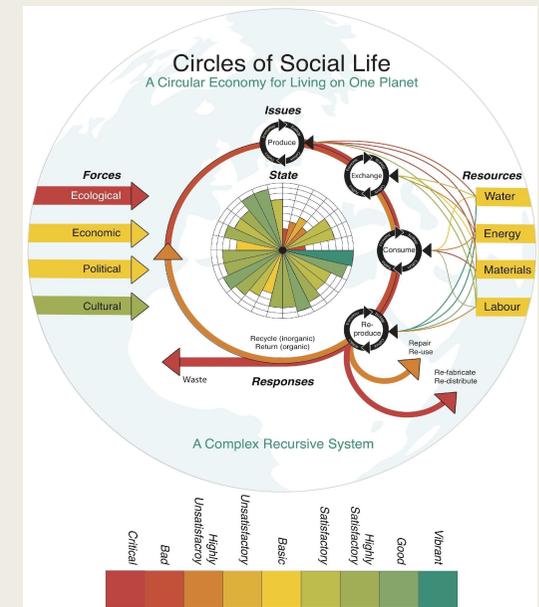
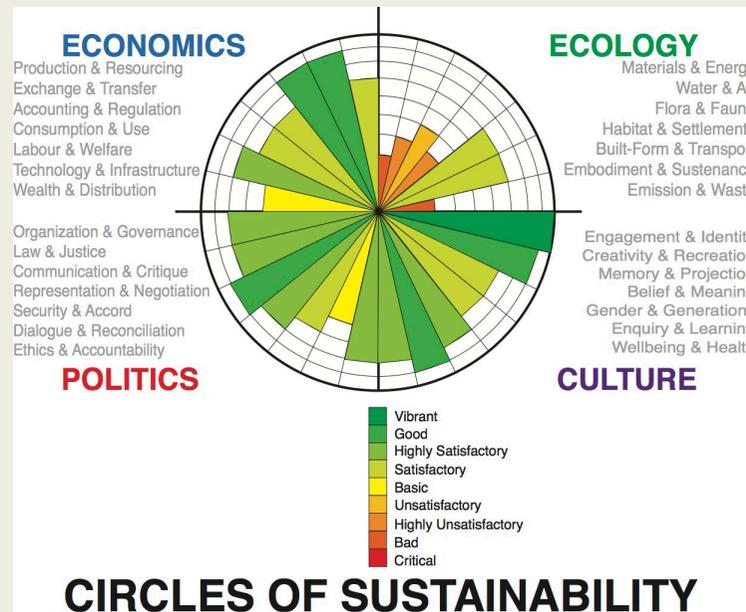
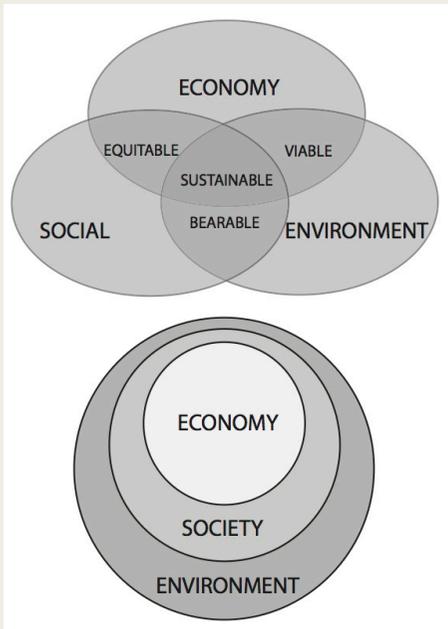
Strong Sustainability



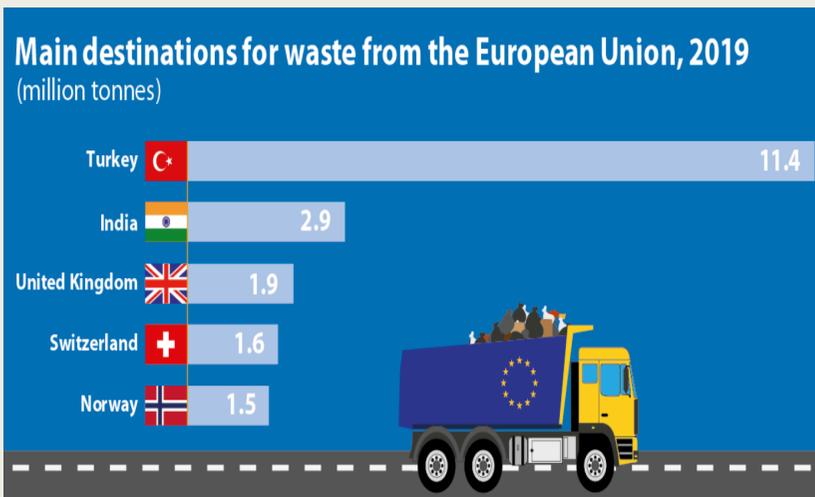
Circles of Sustainability



Adapted for Circular Economy



The circular economy, flows explain us how our economies work



Turkey is the leading destination for EU waste exports (11.4 million tonnes in 2019): three times more than in 2004. EU exports from China have fallen from 10.1 million tonnes in 2009 to 1.2 million tonnes in 2019.

Logistics adjust to geopolitical issues

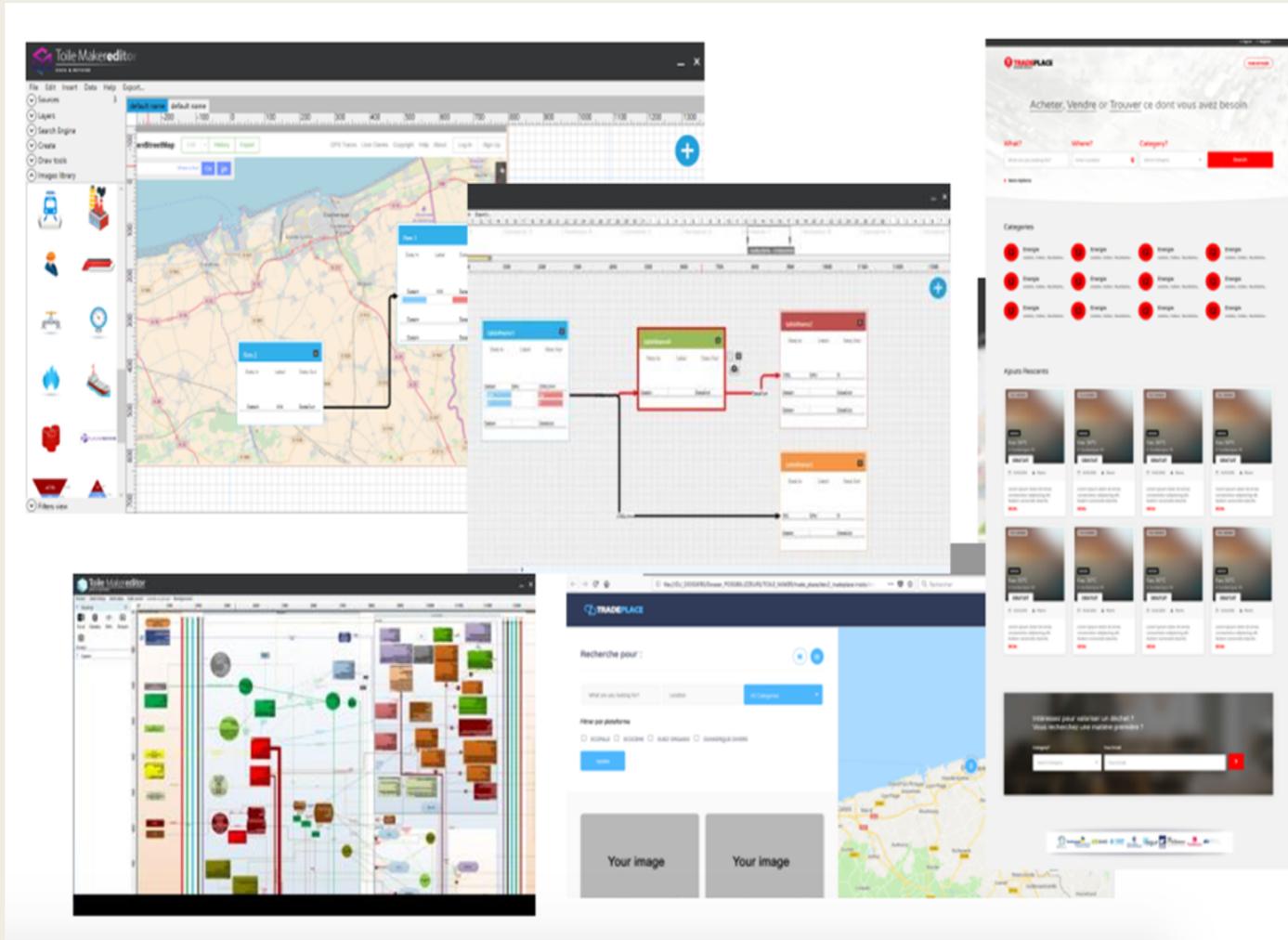


The EU also receives waste from outside the EU. The largest volume of waste was imported from the UK, amounting to 4.0 million tonnes in 2019. This is a decrease of almost 12% compared to 2018, to the lowest level since recording began in 2004

Logistics and waste volume

TOILE MAKER

Mapping the actors and the flows



Energy Toile

Food Toile

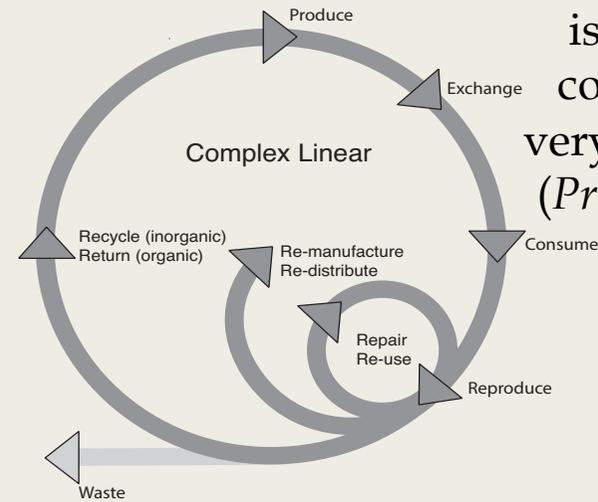
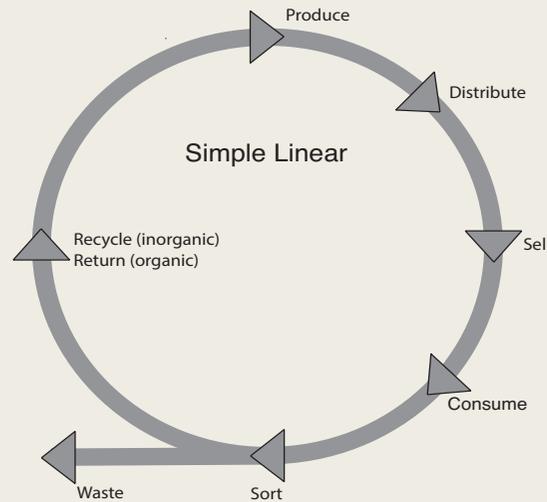
Mobility Toile

Industrial Toile

Water Toile

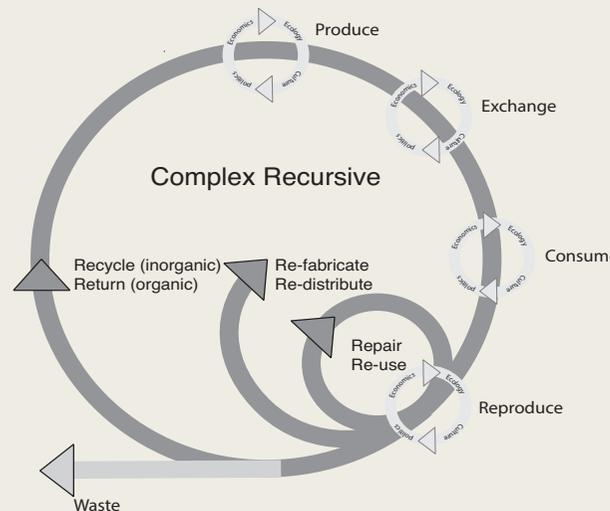
The Three Stages of Circular Economy

The circular economy remains linear
1992 - 2010
(efficiency principle)



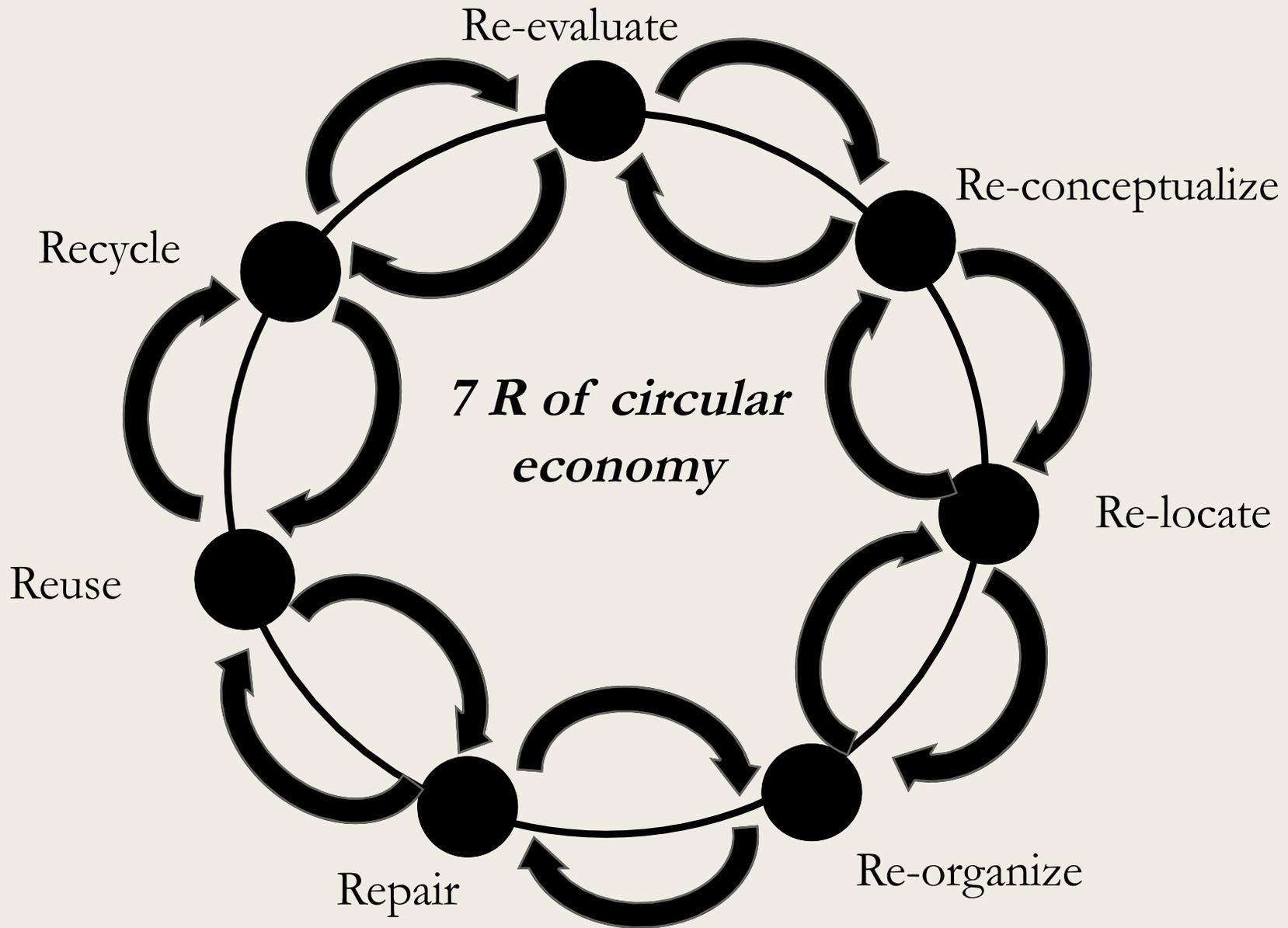
The circular economy is becoming more complex but is still very linear 2010 - 2020
(Principle of resilience)

The circular economy is becoming more complex, with dynamics that are becoming more emancipated
Principles of proximity and cooperation



*Loops are integrated
different supply chains :
Logistics is crucial*

*Food Waste → Energy
PET from Textile → Tires
Tires → Sports Field
Glass → Sand*



Industry 1.0	Industry 2.0	Industry 3.0	Industry 4.0	Industry 5.0	Industry 6.0
<p>Mechanization and standardization of work.</p> <p>Performance focus on human productivity.</p> <p>Introduction of steam in the mechanization of work</p>	<p>Introduction of electricity in the various production processes. Use of assembly lines. No discontinuities in the production</p>	<p>Introduction of computer and automation to rule the industrial process.</p> <p>Use of robots in the production (linear program managed by human)</p>	<p>This is the era of Cyber Physical Systems (CPS) which comprises of smart machines, storage systems and production facilities capable of autonomously exchange information, triggering actions and control each other independently.</p>	<p>Willingness to reinject human beings into industrial production: this is the current worldwide trend, with the creation of intelligent factories, the development of the IoT ("Internet of Things") and collaborative industries.</p>	<p>To involve industry to strong sustainability</p> <p>Sustainability is implemented on the 5 economic functions: extraction, production, exchange, consumption, and waste.</p> <p>System Dynamics is used to open the loops and create global scenarios of circular economy</p> <p>Circular economy is focused on the 7Rs</p>