SUSTAINABLE RESOURCE MANAGEMENT IN EUROPEAN STEEL SUPPLY CHAINS

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CONTEXT

A DECISION SUPPORT TOOL

INSIGHTS FOR THE EUROPEAN STEEL INDUSTRY

POLICY SUGGESTIONS FOR THE EUROPEAN COMMISSION

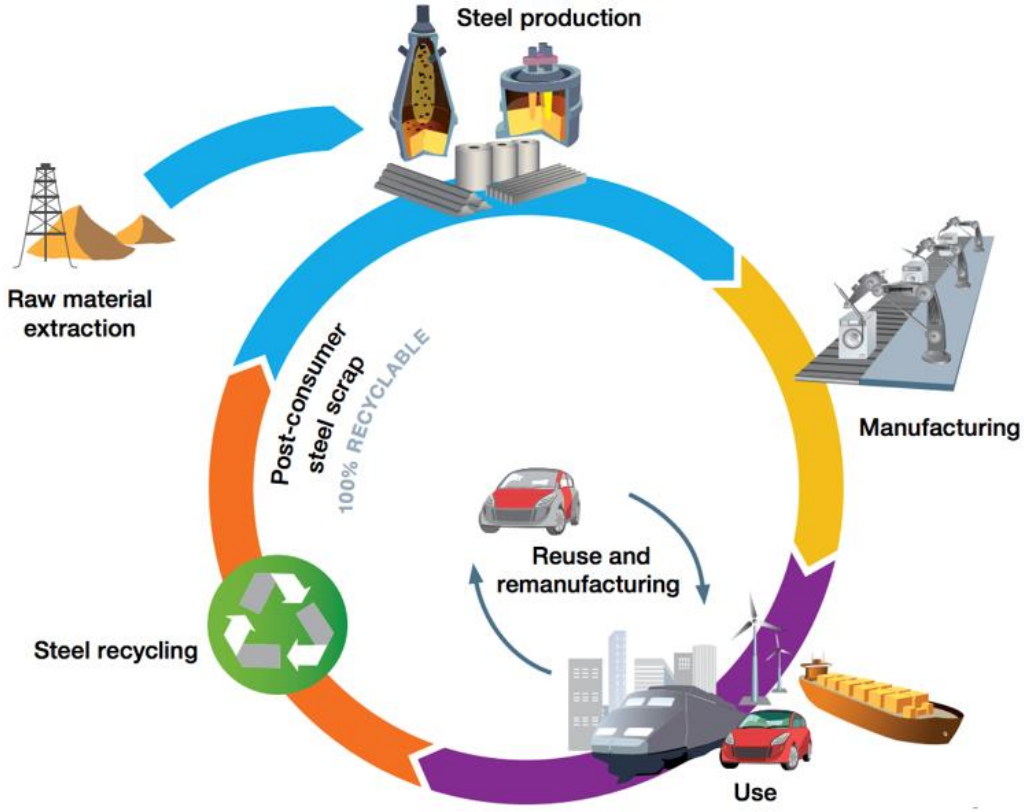
RECOMMENDATIONS FOR FUTURE RESEARCH

PUBLICATION #1:

INTEGRATING LIFE CYCLE ANALYSIS INTO SYSTEM DYNAMICS: THE CASE OF STEEL IN EUROPE

OVERVIEW

- INTRODUCTION
  WHY LCA AND SD?
- QUESTIONS
- CASE STUDY
- METHODOLOGY
  DESIGN, MODEL, DATA & RUNS
- RESULTS
- CONCLUSIONS
- NEXT STEPS



WHY LCA AND SD?

OPPORTUNITIES FROM LITERATURE + SWOT ANALYSIS:

SD > LCA (FLEXIBILITY):
- CIRCULARITY
- LONG-TERM PERSPECTIVE
- MACRO ANALYSES POTENTIAL

LCA > SD (OBJECTIVE REPRESENTATION):
- STAKEHOLDER INVOLVEMENT
- RELIABILITY FOR MICRO ANALYSES
- APPLICATION ACROSS MANAGERIAL LEVELS

EUROPE + CIRCULAR ECONOMY, VIA LCA

BRING SD CLOSER TO INDUSTRIAL ECOLOGY

QUESTIONS & CASE STUDY

1. CAN THE INTEGRATION OF LCA INTO SD REPRODUCE THE RESULTS OR BEHAVIORS PREVIOUSLY OBSERVED IN STUDIES THAT USED LCA OR SD INDEPENDENTLY?

2. WHAT POTENTIAL BENEFITS DERIVE FROM THIS INTEGRATION TOWARD DECISION-MAKING ON THE BIOPHYSICAL ASPECTS OF LONG-TERM MATERIALS SOURCING?

CASE STUDY

BOUNDARY: **WORLDSTEEL EU28 (84%)**

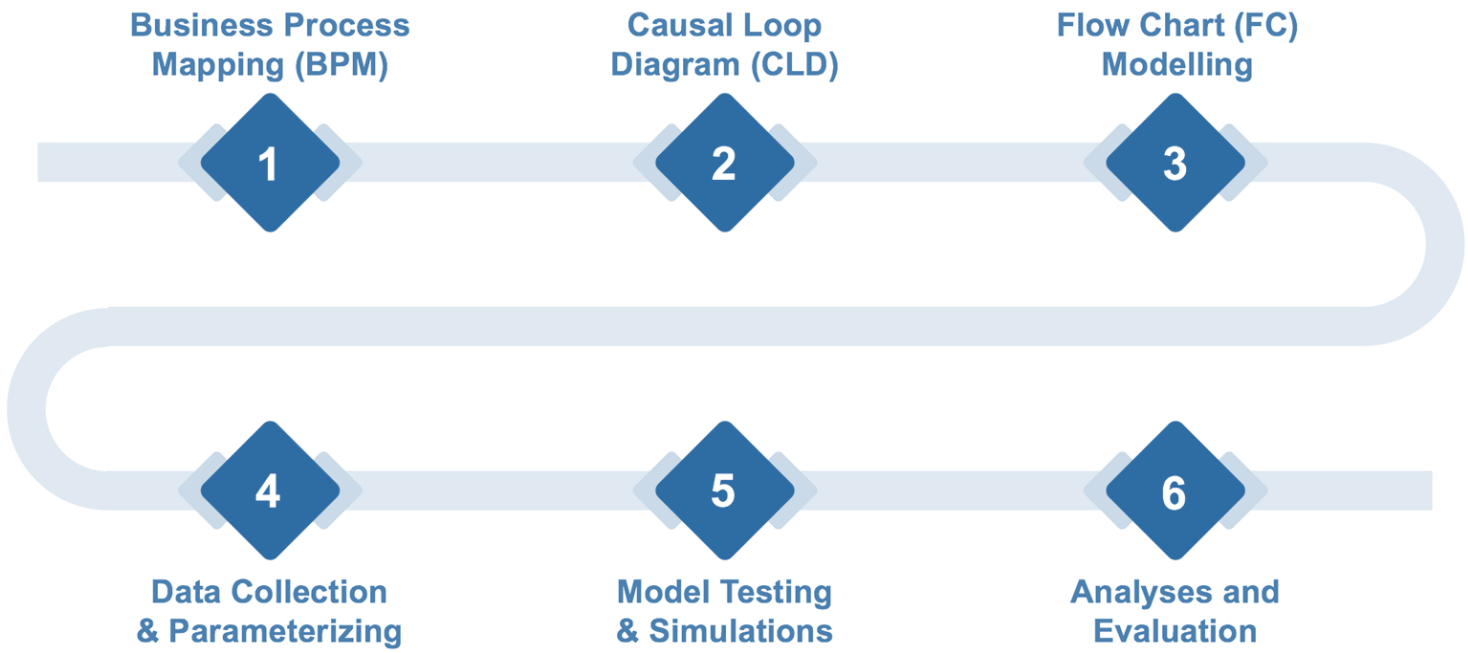
APPROACH: **CRADLE-TO-CRADLE**

STANDARD: **ILCD & ISO**

FUNC.UNIT: **1 TON OF STEEL**

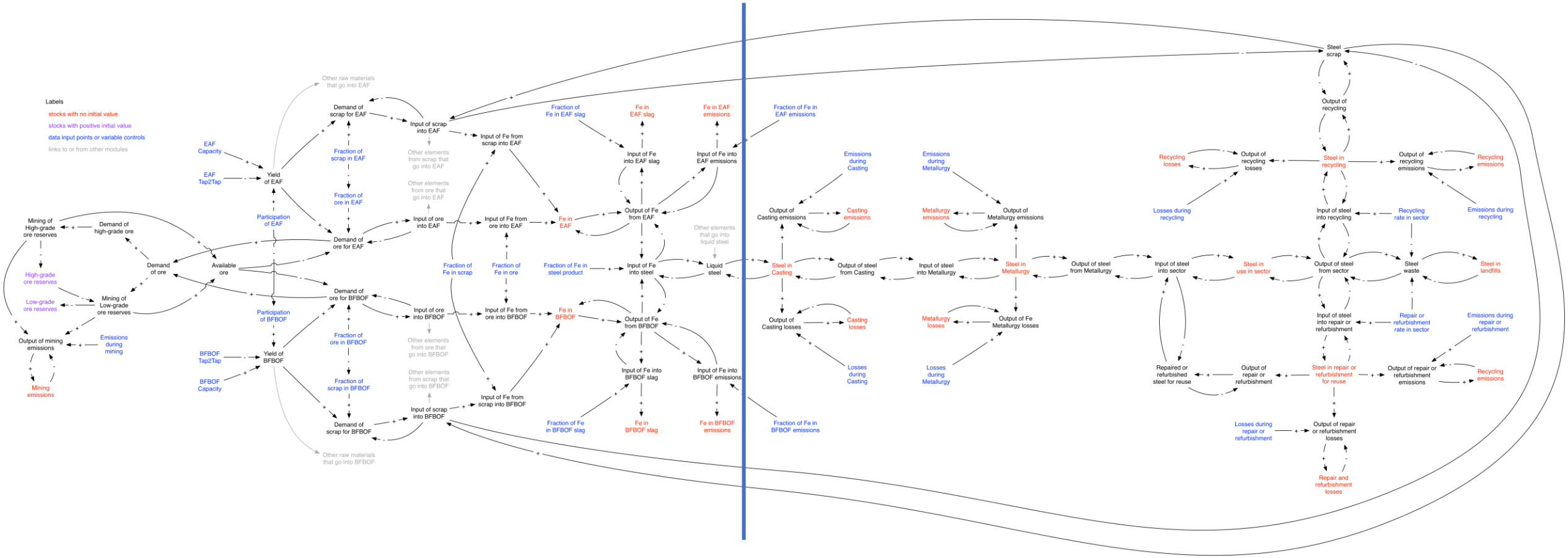
METHODOLOGY: DESIGN

MODULAR • ESCALABLE • BIOPHYSICAL

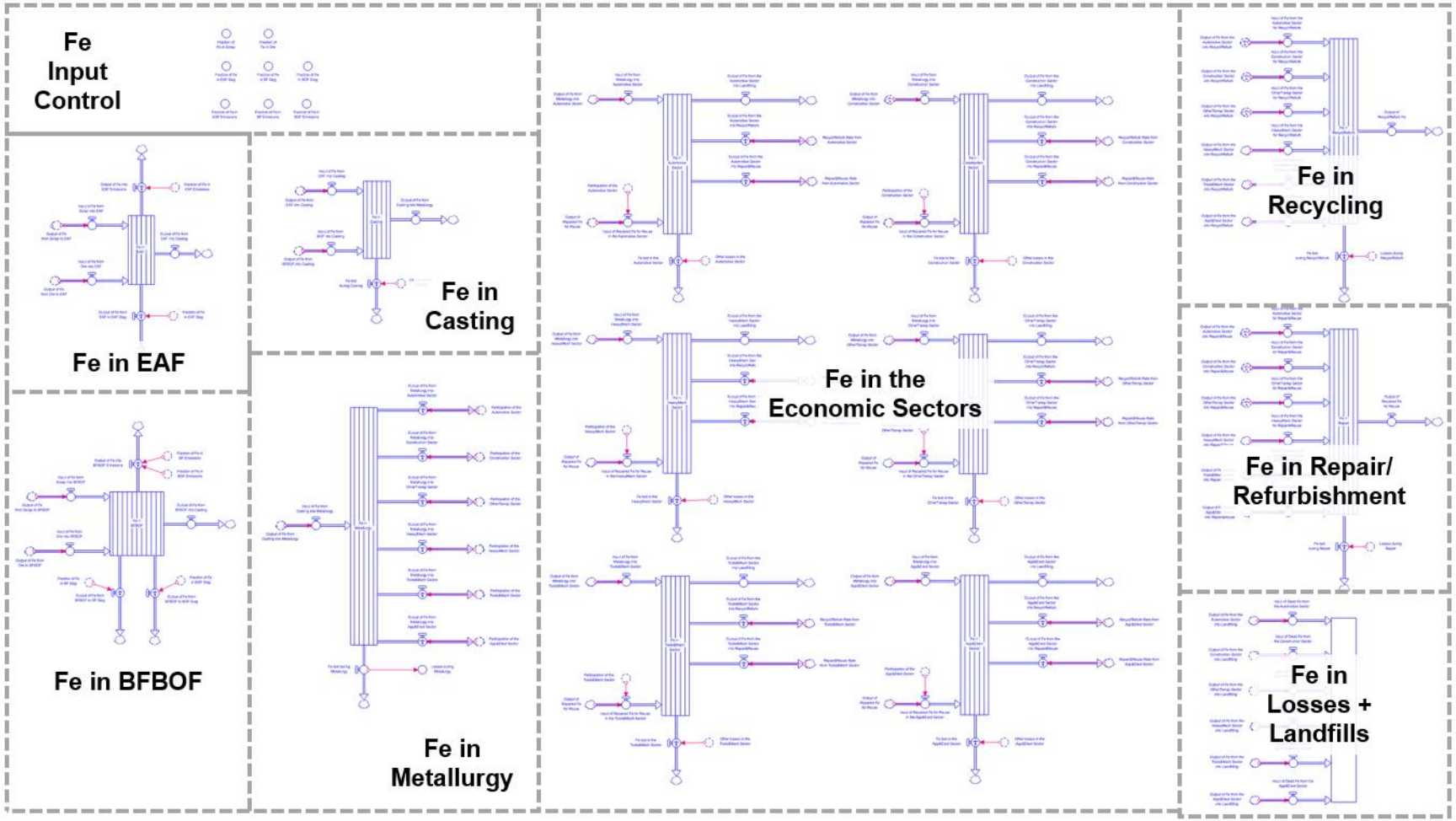


METHODOLOGY: MODEL (CLD)

PUSH/PULL DYNAMICS • LEVELS OF AGGREGATION • 20 MODULES



METHODOLOGY: MODEL (FC)



METHODOLOGY: DATA & RUNS

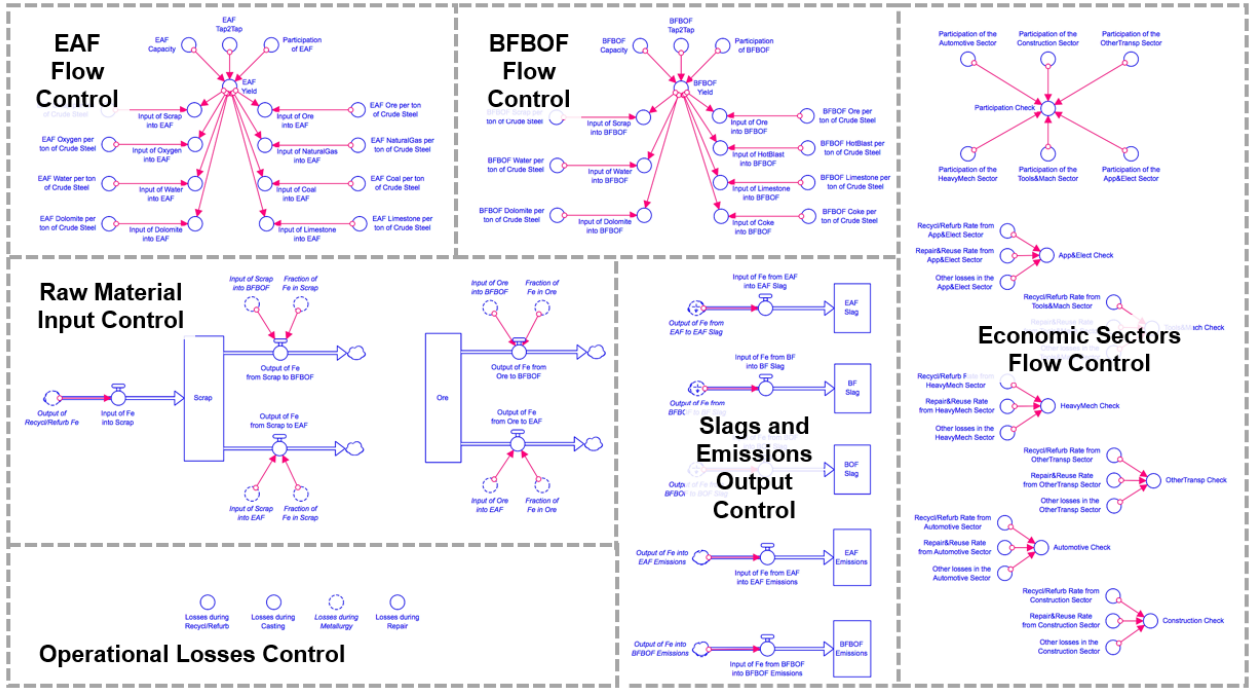
DATA SOURCES: **(e.g.) WORLDSTEEL, EUROSTAT, EUROFER, EUROSLAG, RREUSE, NFDC, BIR, WSSTP**

BASE RUN: **200 YEARS, UNS30400**

RUN A: **6 MOST PRODUCED**

RUN B: **LINEAR BFBOF TO EAF**

RUN C: **A + B**

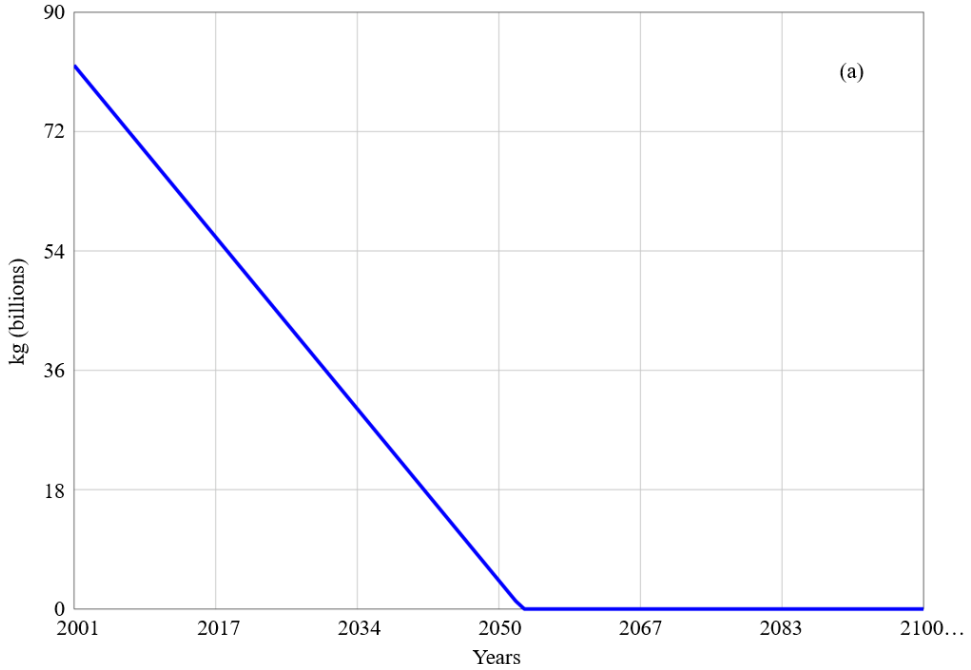


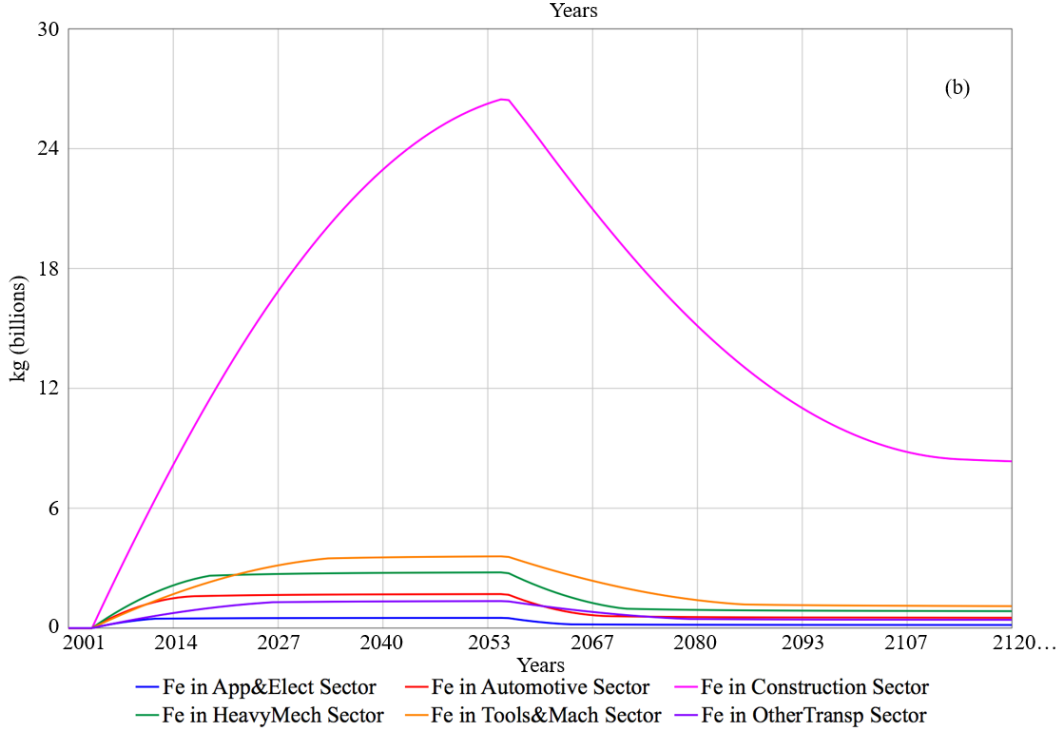
RESULTS (QUESTION 1)

BIOPHYSICAL DEPLETION OF HIGH-GRADE ORE
SVERDRUP & RAGNARSDOTTIR (2014)

SUPPLY CHAIN RESOURCE RETENTION
ASIF ET AL. (2015)
NUSS & BLENGINI (2018)

IRON AS A BOTTLENECK FOR EUROPEAN STEEL ECONOMY
ANSARI & SEIFI (2012)





RESULTS (QUESTION 1 CONT.)

CO_2eq EMISSIONS: 837,41kg/FU_{EAF} & 2.255,39kg/FU_{BFBOF}
BURCHART-KOROL (2013)

SLAG GENERATION: 121,17kg/FU_{EAF} & 459,84kg/FU_{BFBOF}
RENZULLI ET AL. (2016)

EMISSIONS COMPOSITION
WORLDSTEEL LCI (2017)

RESULTS (QUESTION 2)

SD CONTRIBUTED TO LCA:

CIRCULARITY
(MINOR) GATE-TO-CRADLE DYNAMICS VISIBILITY INCREASE

LONG-TERM PERSPECTIVE
(MAJOR) TIMESPAN INCREASE + ENDOGENOUS FEEDBACKS & DELAYS

MACRO ANALYSES POTENTIAL
(MAJOR) MULTIPLE PRODUCTS + READY FOR MARKET DYNAMICS

RESULTS (QUESTION 2 CONT.)

LCA CONTRIBUTED TO SD:

STAKEHOLDER INVOLVEMENT
(MAJOR) OBJECTIVE REPRESENTATION, PRECISE ACCOUNTING

RELIABILITY FOR MICRO ANALYSES
(MINOR) GRANULARITY INCREASE

APPLICATION ACROSS MANAGERIAL LEVELS
(MAJOR) ONE MODEL FROM SHOPFLOOR TO MANAGING BOARD

CONCLUSIONS

- SUCCESSFUL INTEGRATION
- LCA'S CONTRIBUTIONS WERE MORE TANGIBLE THAN SD'S
- NO DETRIMENTAL METHODOLOGICAL INTERFERENCES, BUT…
  LCA'S INDICATORS NEED MORE WORK (e.g. ReCiPe, IPCC GWP)
- REMINISCENT OF MFA AND INDUSTRIAL METABOLISM

NEXT STEPS

- OTHER TCE'S AS DRIVERS
- RENEWABLE ENERGY SOURCES FOR THE EAF OPERATIONS
- SUBSTANCE REINTRODUCTION INTO BIOSPHERE
- MARKET DYNAMICS
- SUPPLY CHAIN INTEGRATION

THANK YOU

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