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Workshop 3.2
"PI Systems"

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UNIVERSITY OF APPLIED SCIENCES UPPER AUSTRIA

This work has been funded by the State of Upper Austria as part of the research program 'FTI Struktur Land Oberösterreich'

Introduction: PI Systems

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Photo: Mercedes-Benz

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Introduction: PI Systems

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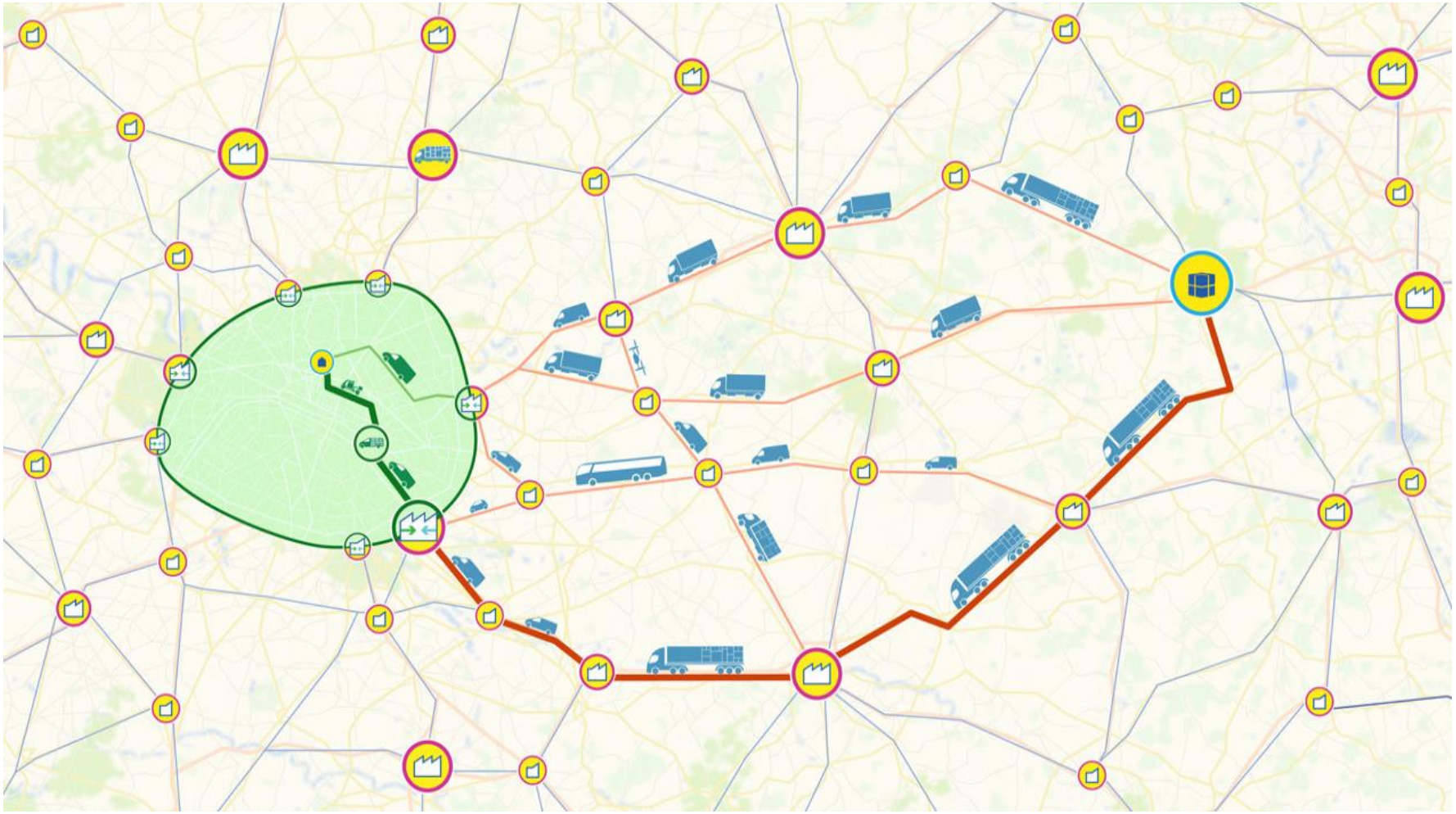

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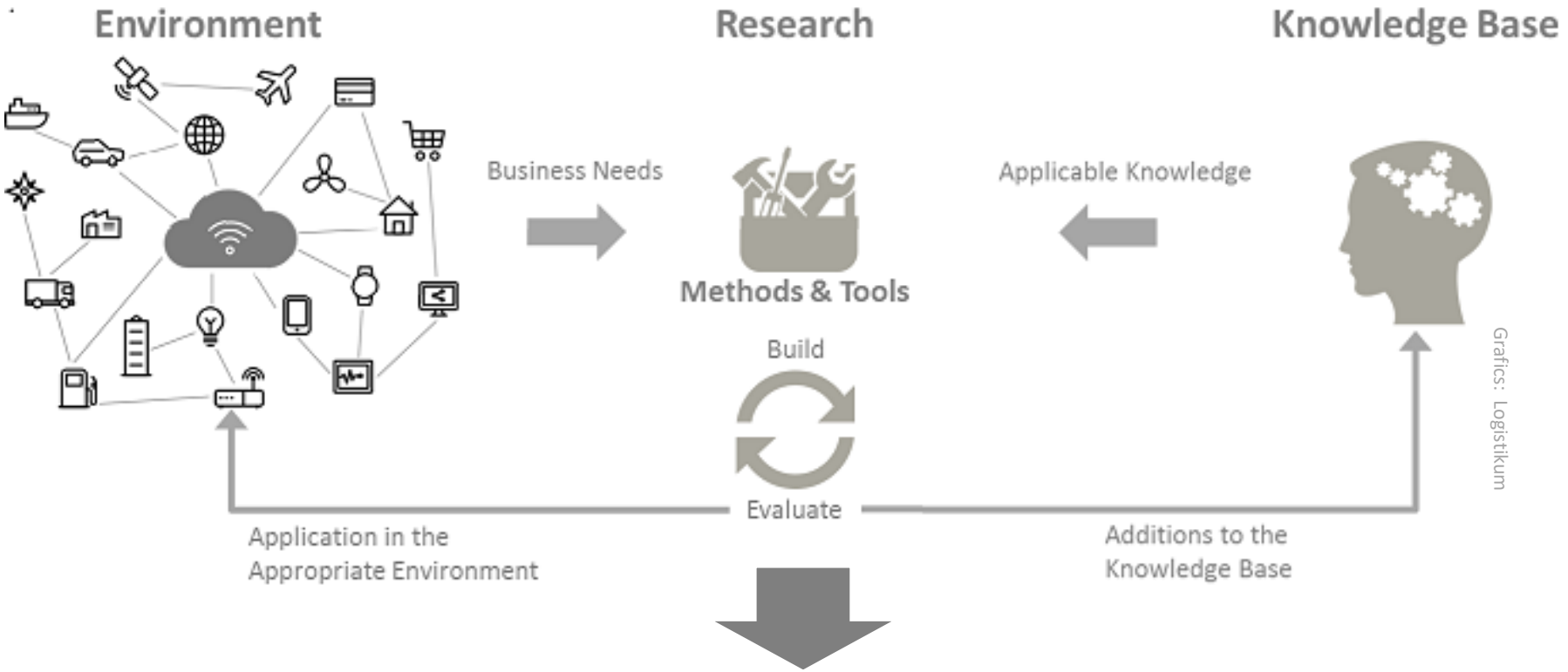
Introduction: PI Systems



Aim:
Putting the Physical Internet Vision into Action

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IPIC 2017

Physical Internet and its impact on the emission calculation standardization of transport chains – are we there yet?

Dr.-Ing. Verena Charlotte Ehrler
DLR Institute of Transport Research
IPIC 2017, Graz

DLR

PI and its impact on emission calculation standardisation

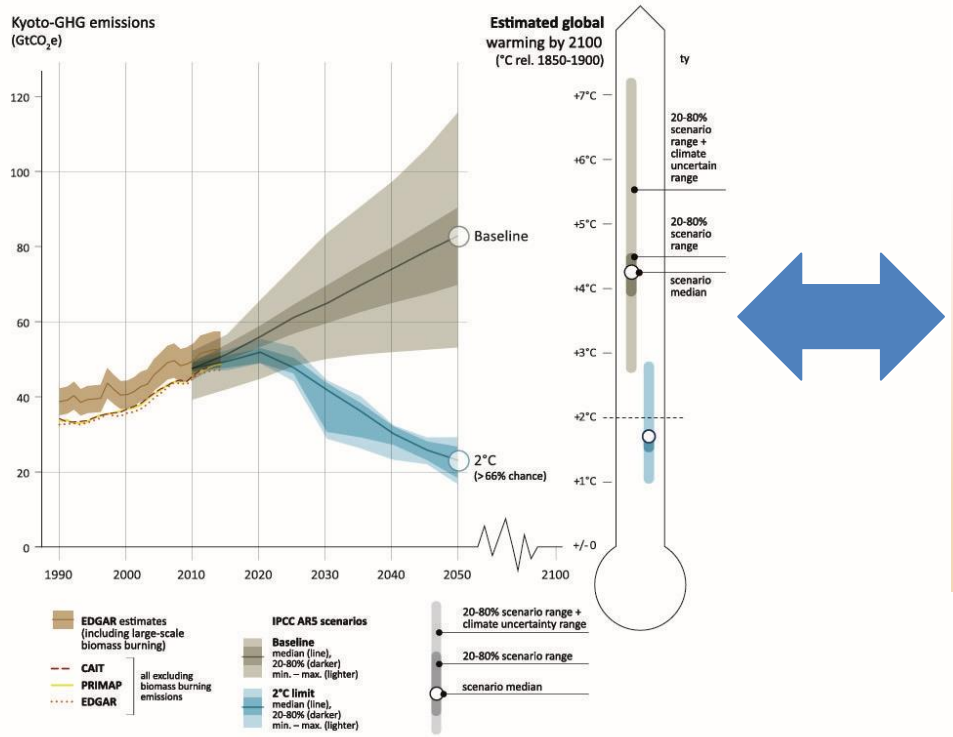
- Further optimising logistics
- Physical Internet – a change of game
- Emission calculation standardisation
- PI and its impact
- Are we there yet

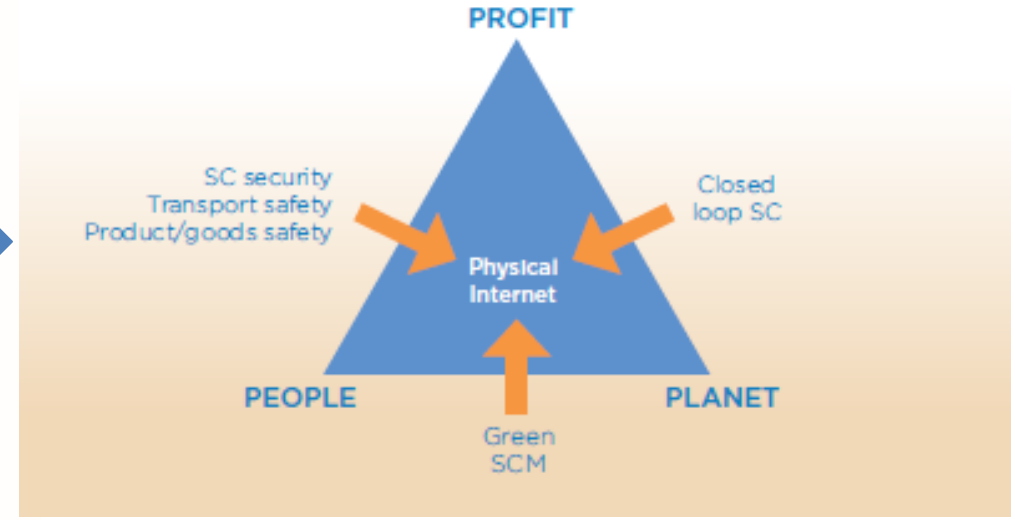
Source: Rainer Sturm / pixelio.de

Further optimising logistics
- why we need to understand the impact of PI on emissions

UNEP

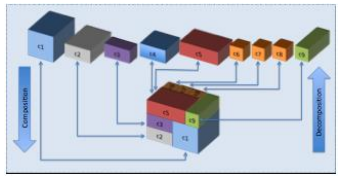
Historical greenhouse (GHG) emissions and projections until 2050





Source: IPIC and alice

Physical Internet – a change of game



Modular containers

Universal interconnectivity

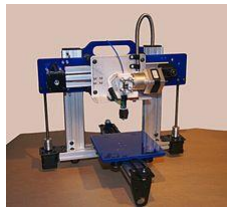
From material to PI-container handling and storage

Smart networked containers

Physical Internet

Capability certicicaions

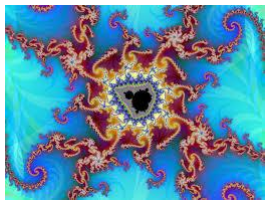
Multi-segment intermodal transport



Materialize objects as locally as possible

Design products fitting containers

Open Global Supply Web



Multi-tier conceptual framework

Source: alice, Petra Dirscherl / pixelio.de, wikicommons.org, BlickReflex.de / pixelio.de, Boris Wettig / pixelio.de, S. Hofschlaeger / pixelio.de

Businesses that measure their emissions

have the opportunity to make informed decissions

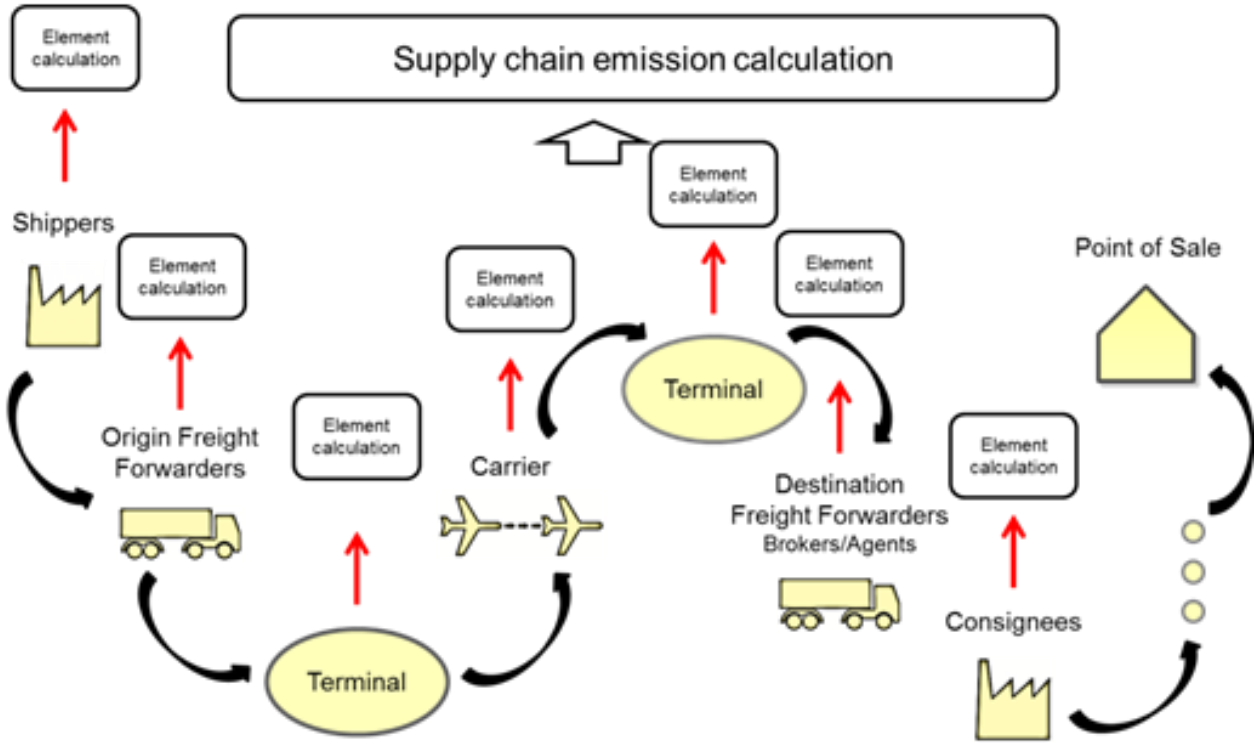
that lead to improved efficiency and reduced emissions

(source: LEARN 2017)

Emission calculation standardisation

Emission Transportation Standard	Scope
ISO 14064	methodology for the calculation and declaration of energy consumption and GHG emissions of transport services, freight and passengers
ISO /TS 14067	methodology for the calculation of carbon footprint of products
GREENHOUSE GAS PROTOCOL Scope 3	methodology for the assessment the impact of emissions of companies entire value chains; no explicit focus on transportation
EN 16258	methodology for the calculation and declaration of energy consumption and greenhouse gas emissions of transport services
GLEC GLOBAL LOGISTICS EMISSIONS COUNCIL LED BY SMART FREIGHT CENTRE Framework	framework combining existing standards and methodologies to calculate logistics emissions

The challenges of emission calculation standardisation



SIMPLICITY
Easy to apply and understand

TRANSPARENCY
Clear format for calculation and clearly stated assumptions

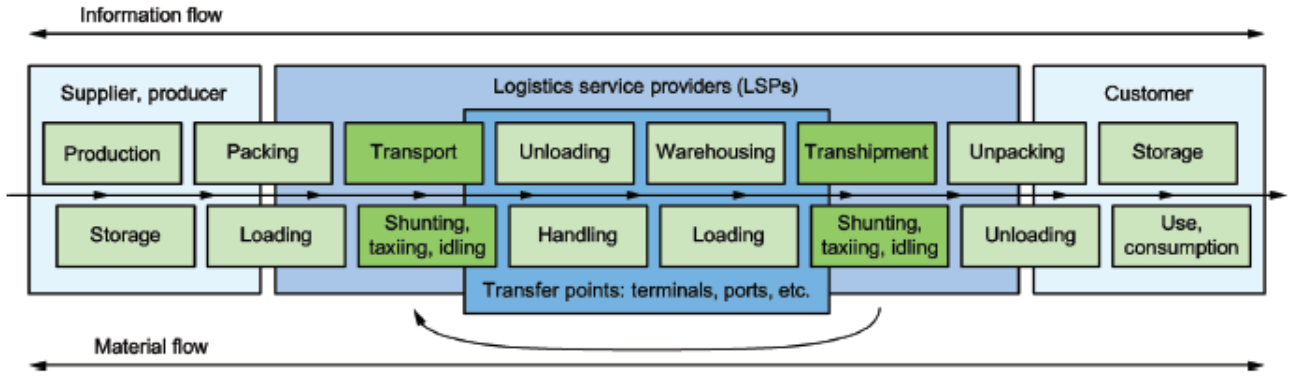
ACCURACY
Reasonable estimation of all emissions, allocated fairly

FLEXIBILITY
Useable by all business models and modes of transport

Source: own and GLEC Framework

Current gaps

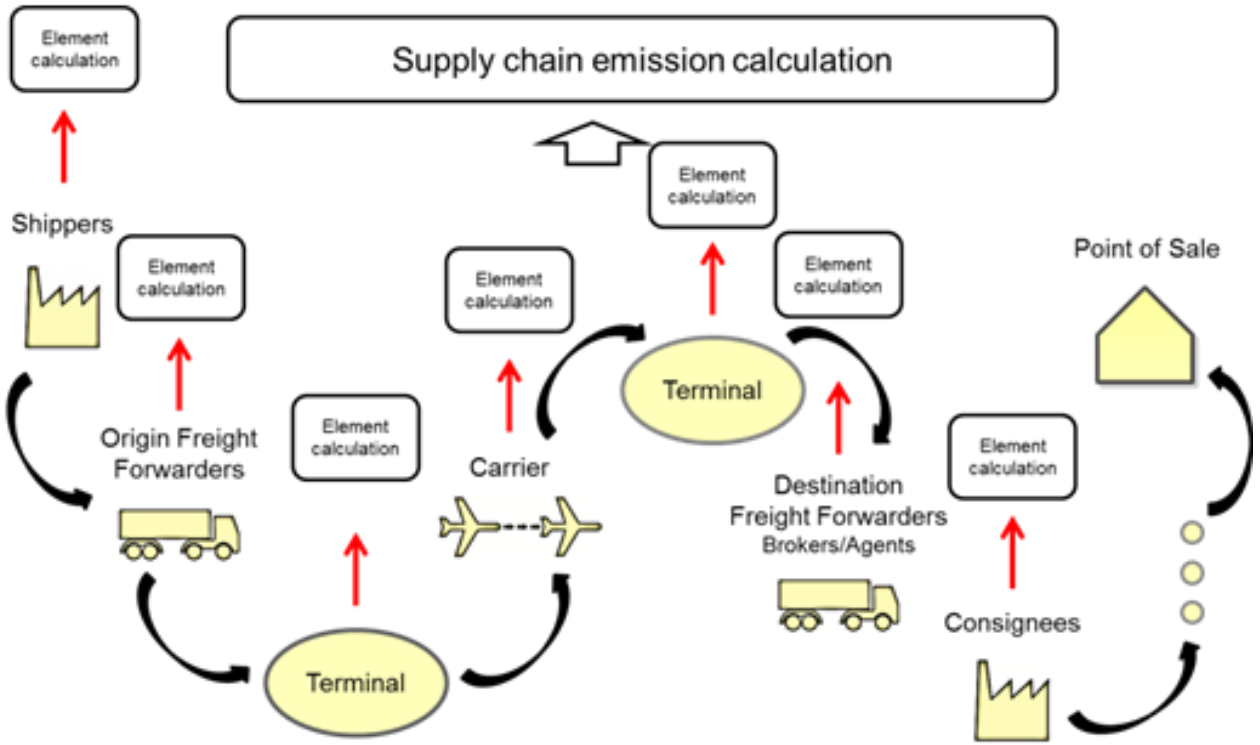
- inclusion of black carbon
- refining modal default factors
- improved accounting of scope 3 emissions
- accuracy of emissions estimates
- challenges in data collection by SMEs
- transshipment center methodology
- default dataset of transshipment center
- Further research into weight of contents
- allocation between passengers and freight in shared transport
- accounting for leakage of gaseous fuels and refrigerants



Source: IWA 16:2015 (draft)

PI and its impact

Level of operations of transport chain element



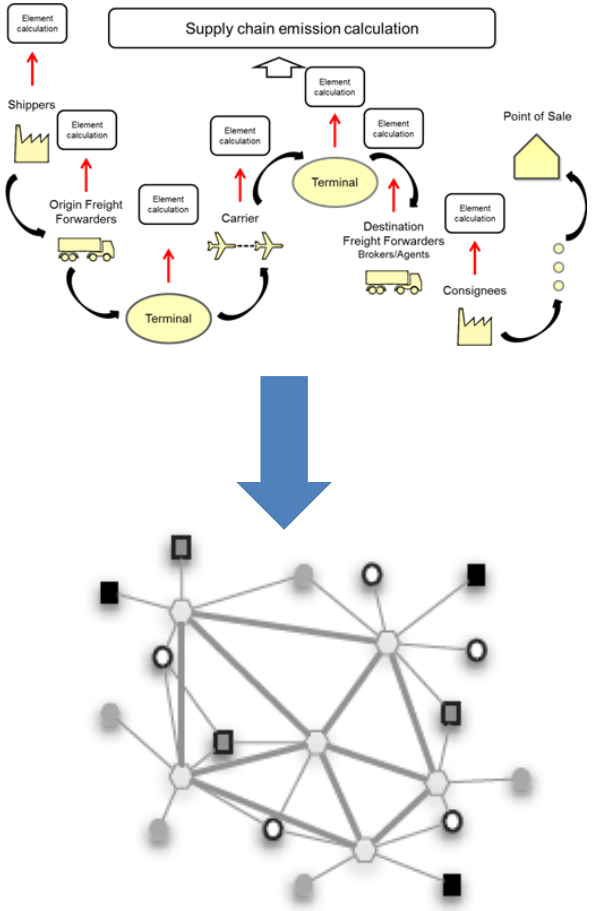
Source: own

PI and its impact

Level of network including company level

- shift of decision maker
- routing decisions taken at each node
- ad-hoc choices
- requirement for ex-ante calculation at each node

- track-and-trace of emissions easier



Source: own and Montreuil, Ballot, Fonate

PI and its impact

Level of cargo

- shippers define
  - final destination
  - requested time of arrival, monetary budget and
  - emission budget

- ex-ante estimations at every node
  - for node-to-node leg and
  - impact of decision on overall routeing

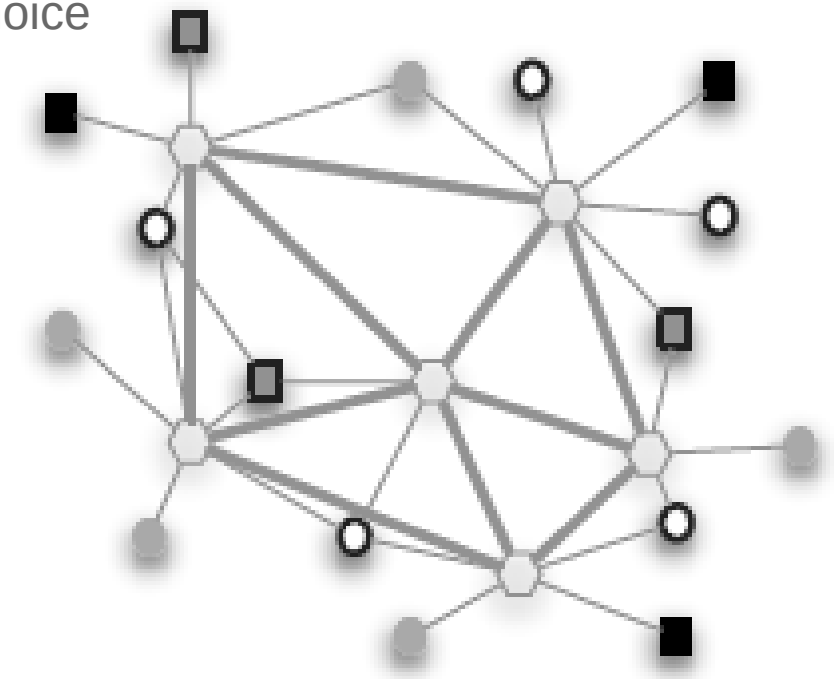
Source: Rainer Sturm / pixelio.de

Challenges toward emission calculation of PI

- ex-ante calculation of emission in ad-hoc network
  as basis for identification of overall lowest emission transport choice

- optimisation of transport networks require
  - steering of usage of network and
  - providers' decision processes

- linking information of a shipment
  - to information on the transport device is was carried with
  - on every leg of its journey



Source: Montreuil, Ballot, Fonate

Are we there yet
- what needs to be done to estimate the PI‘s impact

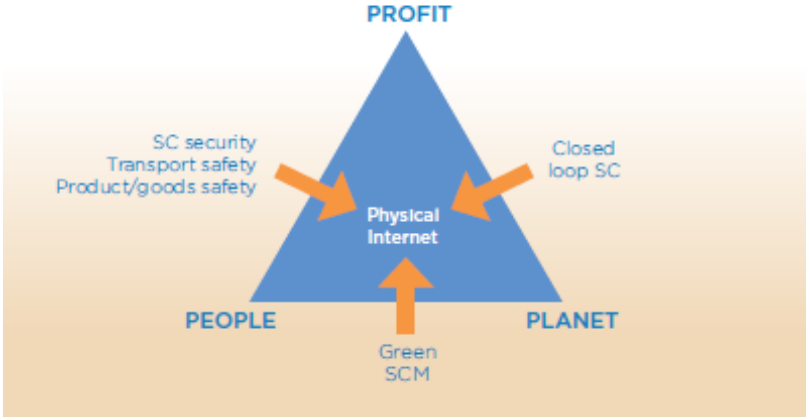
Development needs regarding emission standardisation efforts

- inclusion of empty containers and their routing within PI
- identification of categories of goods suitable for the PI, including volume and routing

Development needs regarding PI development

need to establishing impact of PI on sustainability including

- environmental
- economic
- social aspects



Development needs beyond PI and emission standardisation efforts

need to discuss and consider paradigm shift in economics and business

Source: alice

Physical Internet and its impact on the emission calculation standardization of transport chains - we are not there yet

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Source: Rainer Sturm / pixelio.de

Dynamic Capacity Management to Support the Development of Physical Internet's Framework Conditions

Projects „ProKapa“ & „IPPO“

Graz, July 19 2017

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Content

- Adressed challenges
- Current project „IPPO“:
  - Objectives and expected results
  - Methodology
- Current project „ProKapa“:
  - Objectives and expected results
  - Methodology
- Discussion

Addressed challenges for freight transportation service providers and carriers:

- Economy:
  - **Atomic market structure** (exchangeability of contractors, intense competition) enforces ruinous competition.
  - Logistics service providers (owned fleets) have a **high share of fix costs** and are in danger to slide into the reds easily in case of fluctuations in capacity utilization.
- Ecology:
  - Traffic is highly **dependent on oil** products as primary energy source (> 80 %)
- **Greenhouse-gas (GHG)** emissions are growing disproportionally faster compared to gross domestic product (Germany from 1998 – 2007):
  - Gross Domestic Product: + 21 %
  - Traffic: + 51 %
- The **European Union** presented ambitious objectives to GHG-emissions, which are directly related to modal split and capacity utilization:
  - Road transportation: 50 – 70 % of available capacities are utilized.
  - Transportation mode: Road transportation grows relatively faster than rail and inland waterway from 1995 to 2013

Rising economic and ecological pressure on freight transportation sector.
Capacity management actions directly influence these dimensions.

Current projects on anticipatory transportation planning

- **IPPO: Continuous pre-planning of required transportation capacity for the design of sustainable freight transportation networks**
  - Partners: RISC Software GmbH, HÖDLMAYR INTERNATIONAL
  - Duration: 2015 – 2017
  - Focus: Long-term, Fleet-sizing, Modal Choice
- **ProKapa: Dynamic capacity management to support the development of Physical Internet's framework conditions**
  - Partners: RISC Software GmbH, MOLLER TOP QUALITY TRANSPORT, UNIT Transport CARGO Intelligence
  - Duration: 2017 – 2019 (Kick-off: October 2017)
  - Focus: Short-term, integrated personnel and resource planning, pricing strategies

… supported by: bmvit, FFG

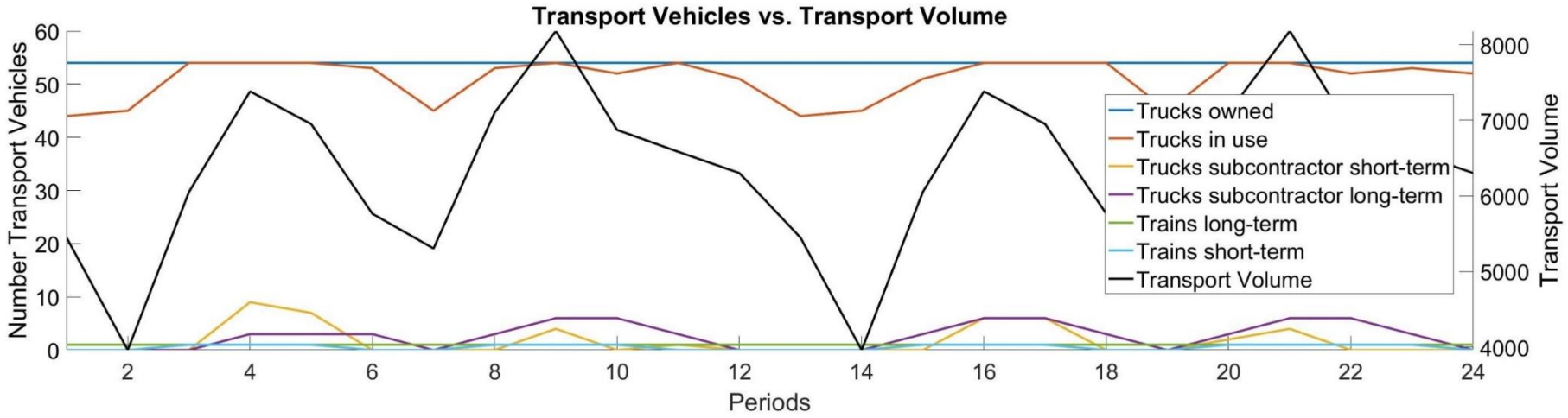
IPPO: Objectives and expected results

- IPPO aims at the **reduction of empty/loaded mileage and an increase in number of intermodal transports**:
  - **Forecast:** Project future transport volumes
  - **Planning:** Gap-Analysis of needed and available resources in the network
  - **Optimization:** Identify alternative concepts to cope with mid- to long-term demand fluctuations
- As a result, applied methods are summarized in a "Proof-of-Concept"-Demonstrator:
  - Combine developed algorithms and methods
  - Give **guidance for capacity adjustments**
  - Demonstrate economic and ecological added value
  - Generic application of methods in automotive use-case

Objective is to contribute to positive development in resource utilization and mode choice and therefore add value to economic and ecological sustainable development.

Approach: Forecasting, Fleet-Modelling, Decision support

- Approach: Three-Step-Approach
  - **Demand forecasting** with different data sources
  - Model and Evaluate different **fleet-variants** for each future time period.
  - Model decision support for **future fleet adjustments.**
- **Result:** Favourable development of fleet size and mix according to transportation demand:



IPPO: Planned Results

- **Evaluation of rolling pre-planning** compared to static models.
- Evaluation of **interrelation of CO2 compensation cost and emission-reduction-potential**.
- Evaluation of **fleet utilization** in respect do different **forecast-qualities.**

Prokapa: Objectives and expected results

- ProKapa aims at enabling logistics service providers to **react flexibly and adaptably to dynamic market** changes:
  - Accelerate **planning duration**
  - Enhance planning **frequency** (close to "real-time")
  - Increase **resource utilization** and reduce empty mileage
  - **Smoothen** transportation demand:
    - Proactive capacity management
    - Implementation of cooperation-strategies
    - Development of dynamic pricing strategies
- As a result, necessary **flexibility** is created in order to face future challenges in a highly dynamic market environment by **continuous recommendations of actions** in…
  - …capacity adjustments,
  - …resource allocation and
  - …dynamic pricing.

Expected results are suitable methods and tools for the preliminary planning for transports from a logistic service providers perspective.

Comments, Questions and Answers

- …

We are looking forward to assist you in innovative projects …

Fraunhofer AUSTRIA

„Innovations for the today of the future“

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