Tackling Materials and Manufacturing Innovation Challenges with Digitalised Translation – from conceptualisation to ontology

Michael Noeske, Fraunhofer IFAM, DE
Jesper Friis, SINTEF, NO
Emanuele Ghedini, UNIBO, IT

Our perspectives

Tackling Materials and Manufacturing Innovation Challenges with Digitalised Translation – from conceptualisation to ontology

Michael:
How can we accomplish innovation in manufacturing?

Emanuele:
How can we understand materials and each other?

Jesper:
How can we communicate and share materials data?

Translation in manufacturing

Make innovation a white box and FAIR – for us

- In manufacturing, following DIN EN ISO 9000:2015-11
  - innovation relates to a new or changed object realizing or redistributing value
  - activities resulting in innovation are generally managed.
- Translators support innovation managers by
  - performing translation, a dialogue-based semiotic process
  - translating a need into a solution.

Innovation challenges

Embrace translation in a holistic way[1]

- The high-level **innovation challenge** is global,
  and so is the high-level value to be realized.
- Ecosystems are formed to
  - gain speed
  - join efforts
  - comprise further generations.
- An individual innovation case and new product is part of a global scenario.

[1] P. Klein et al., Translation in Materials Modelling – Process and Progress, DOI: 10.5281/zenodo.4729918

Information challenges

Embrace translation in a holistic way

- The quality of products (materials, services) is governed by the quality of information exchange.
  - The communicative key expertise "**translation**" facilitates mutual understanding.
  - Holistic dialogues are meant to comprise more than two stakeholders.

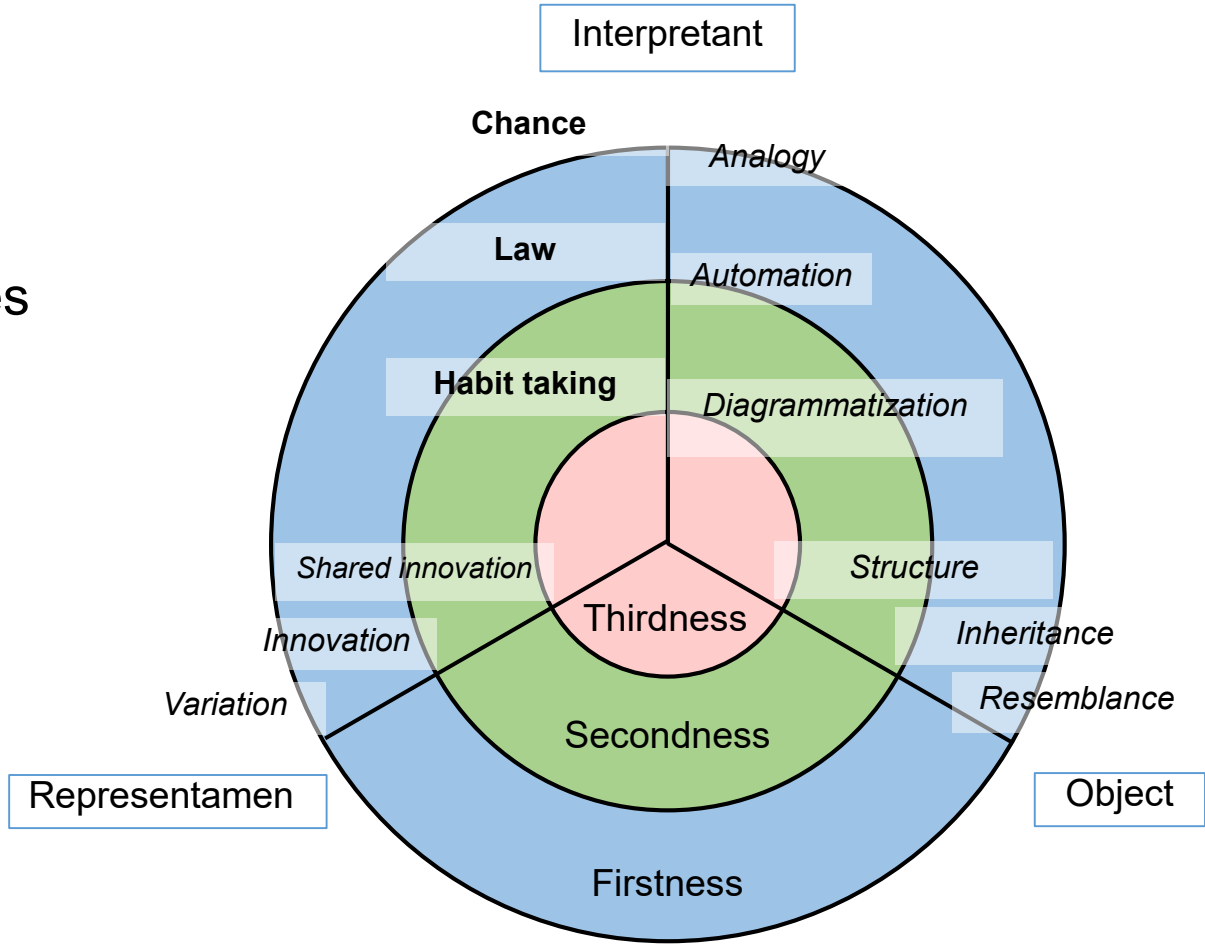
- Ontologies are fundamental for level-comprehensive, holistic and cooperative **translation**.
  - In H2020 OntoTrans, ontologizing (based on EMMO) is pathbreaking for boosting translation.

Translation challenges

Follow a human-centric way

- Translation in (natural) language:
  - dynamically applying A→ D → I triades
    - for achieving “shared innovation”
    - sketch adapted[2a]

Diagrammatic reasoning at three consecutive levels
- “reveal the chance/challenge”
  - **A**bductive reasoning (firstness), intersemiotic
  - “taking your best shot”[2b]
- find the law to be applied”
  - “**D**eductive reasoning (secondness), interlingual
  - “conclusion guaranteed”[2b]
- habitually/customarily perform magic!
  - **I**nductive reasoning (thirdness), intralingual
  - “move from the specific to the general”[2b]



[2b] https://www.butte.edu/departments/cas/tipsheets/thinking/reasoning.html ;[2a] J. Pelkey, Peircean Semiotic for Language and Linguistics, DOI: 10.5040/9781350076143.ch-14

Translation as a White Box

Communicate the way and conclude step by step

- Dialogue partners may opt for convention-based semiosis (translation),
  - e.g. DIN EN **ISO** 17100:2016 “Requirements for translation services”
  - e.g. DIN 6701-3:2015-12 “Adhesive bonding of railway vehicles and parts - Part 3: **Guideline** for construction design …”, a **(check)list** of requirements
  - e.g. EMMC Translators **Guide**[3]

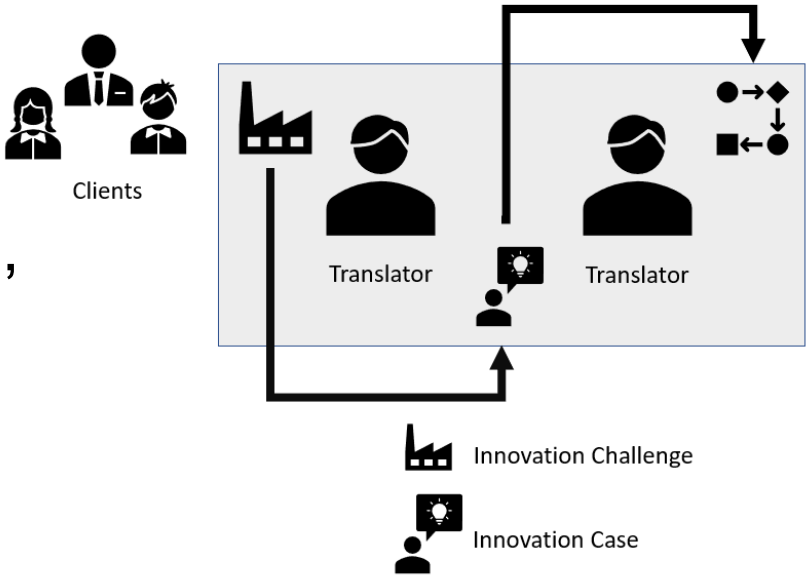
- Stepwise conclusion among dialogue partners
  - after each A, D, or I step
  - after each A→ D → I triade (“dynamic interpretant”)
  - after each of the six steps of translation in Materials Modelling

[3] D. Hristova-Bogaerds et al., EMMC Translators Guide, DOI: 10.5281/zenodo.3552260

FAIR Translation and Innovation

OntoTranslator uses ontologisation

- Translators perform translation,
  - a dialogue-based semiotic process.
- In OntoTrans they also perform ontologization,
  - a further semiotic process.
  - This requires the expertise of an OntoTransLator.

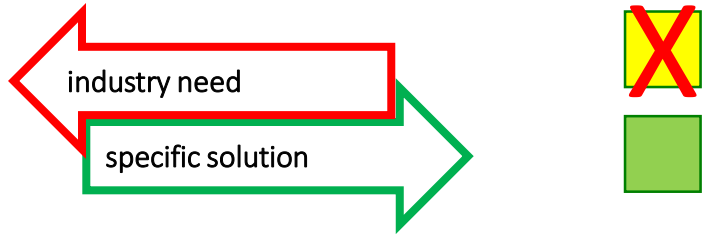


Sketch from: P. Klein et al., Translation in Materials Modelling – Process and Progress, DOI: 10.5281/zenodo.4729918

FAIR Translation and Innovation

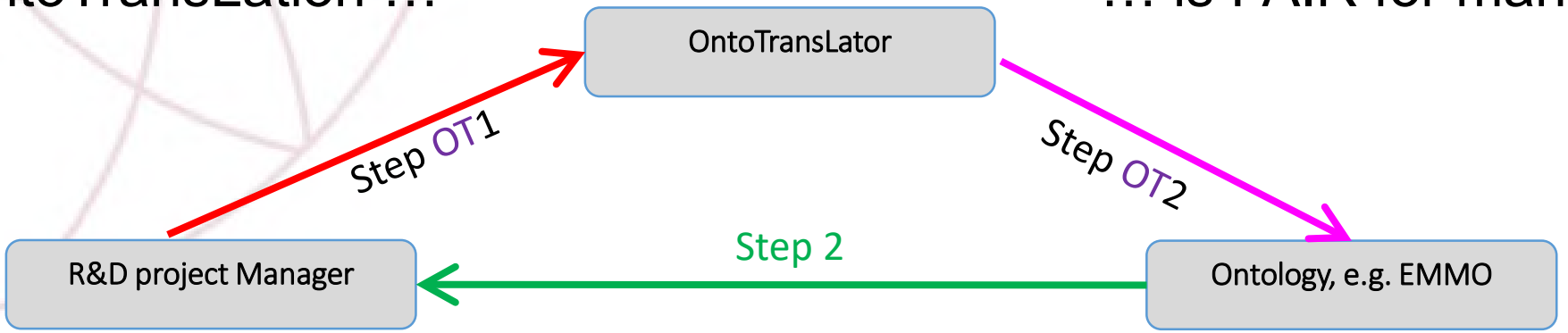
OntoTranslator uses semantic technologies (e.g. ontologies)

- Innovation in manufacturing



- OntoTransLation …

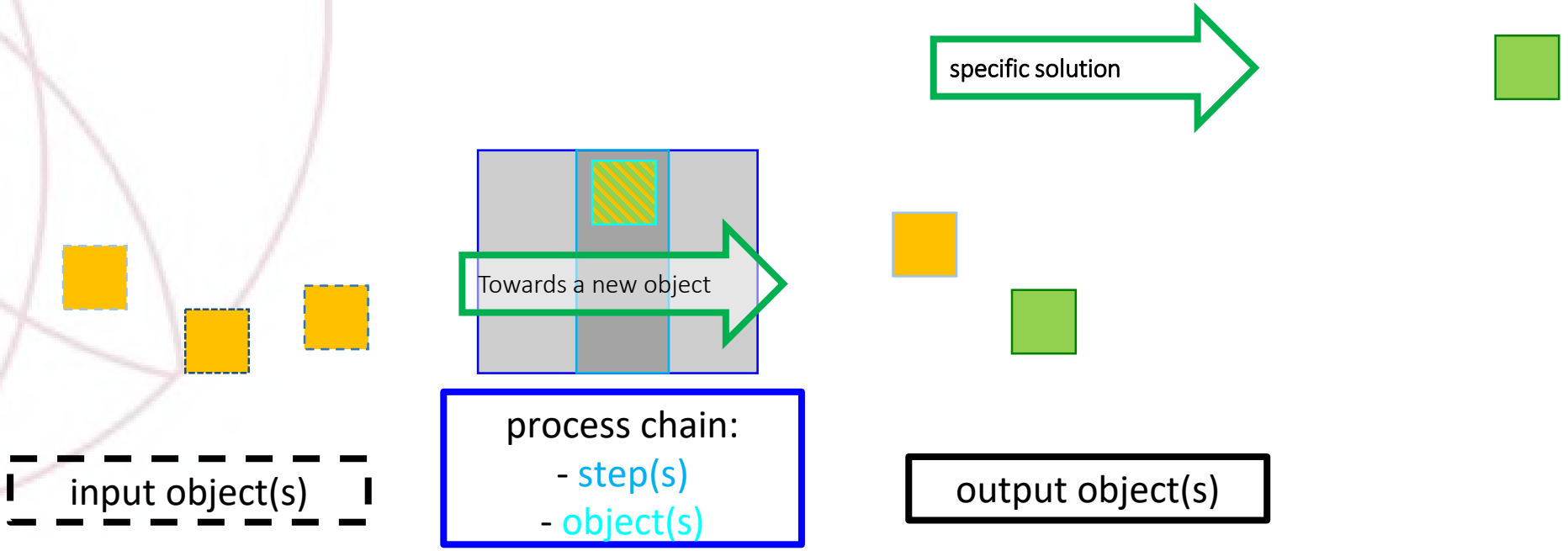
… is FAIR for managers



FAIR Translation and Innovation

OntoTranslator and manager „share“ concepts

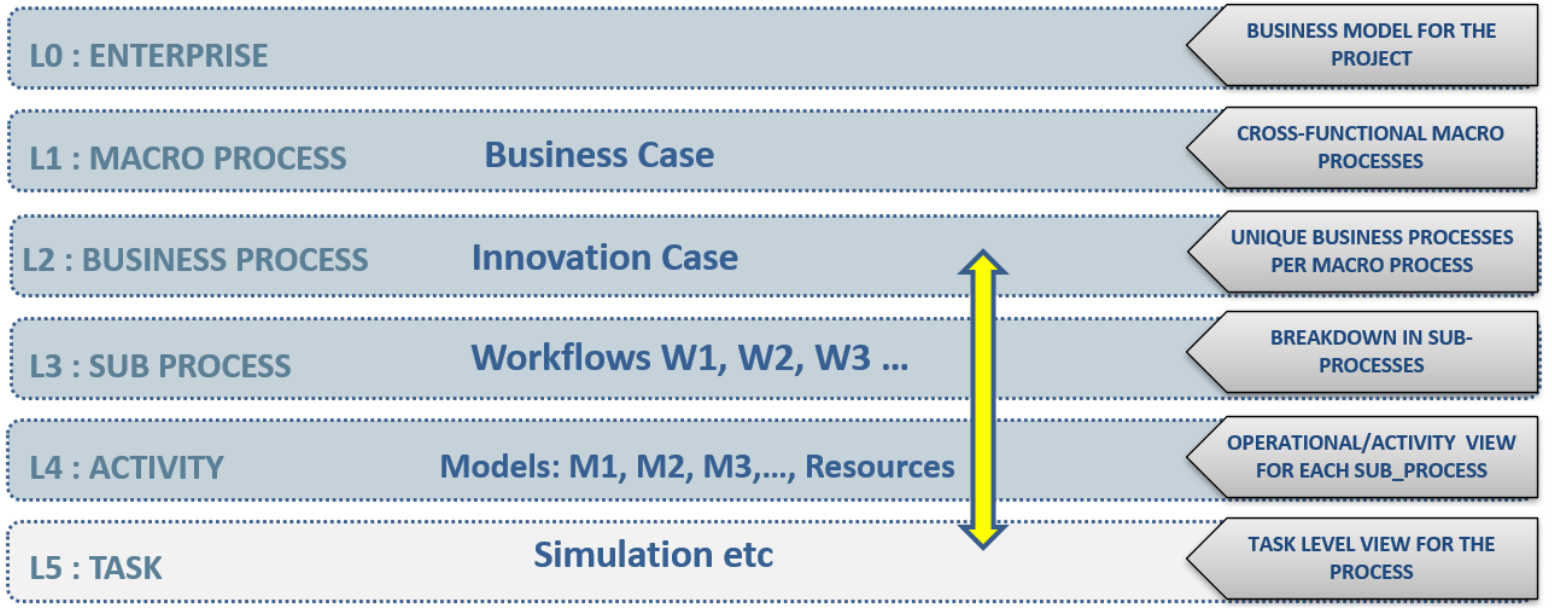
- Dialogue partners may opt for convention-based ontologisation,
  - e.g. in step OT1, Manager|Translator sketch their conceptualisation



Innovation Cases in Organisations

OntoTranslator and manager agree on project framework

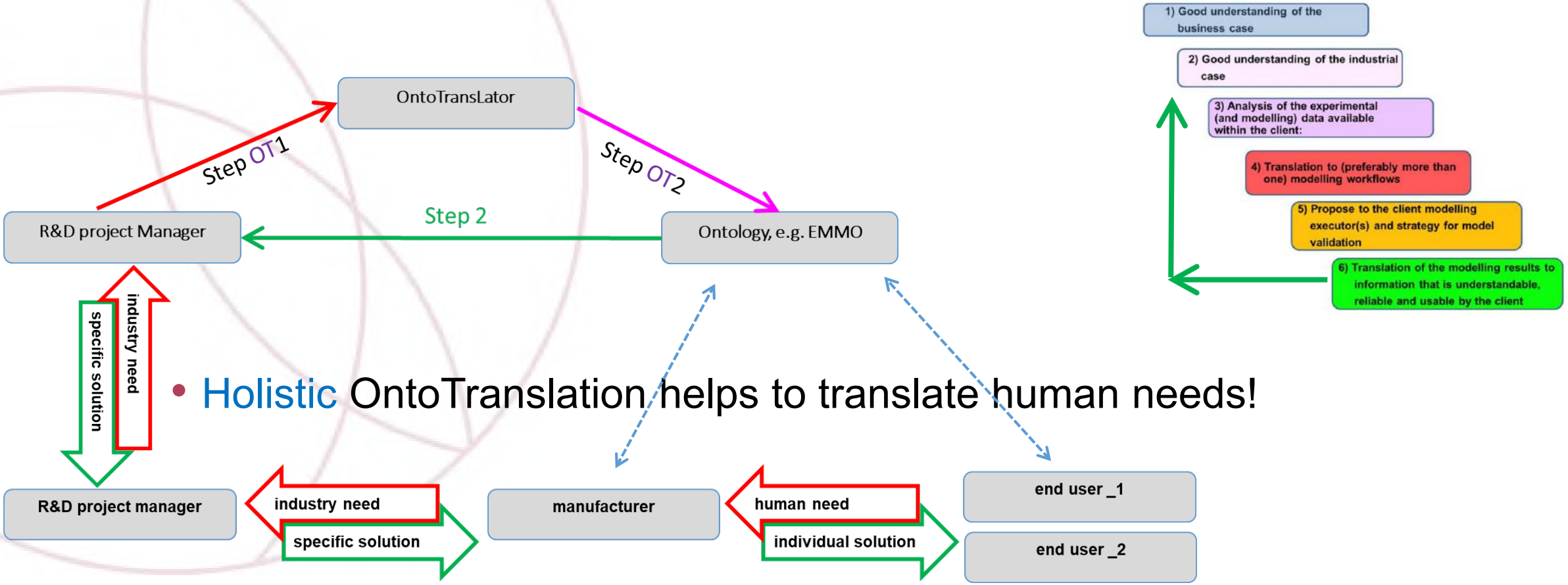
- in dialogue manager|translator
  - innovation-relevant options for changes are elaborated



Sketch from: P. Klein et al., Translation in Materials Modelling – Process and Progress, DOI: 10.5281/zenodo.4729918

FAIR Translation and Innovation

OntoTranslator and manager cooperatively find a first solution



- Holistic OntoTranslation helps to translate human needs!

Innovation Case in Ontology

OntoTranslator formalises Manager|Translator's conceptualisation

- following dialogue manager|translator,
  the OntoTranslator (team)
  - integrates objects and processes of the innovation case
    - with a FAIR framework provided by an ontology
  - realises the perspective used by the Manager
    - greatly profiting from guidance by a multi-perspective ontology, e.g. EMMO
  - links conceptualisation with (e.g. perspective-specific) ontology branch
    - concepts are related to appropriate ontological classes
    - interactions are related to ontological relations
    - individuals are related to ontological entities/things

Our perspectives

Tackling Materials and Manufacturing Innovation Challenges with Digitalised Translation – from conceptualisation to ontology

Michael:
How can we accomplish innovation in manufacturing?

Emanuele:
How can we understand materials and each other?

Jesper:
How can we communicate and share materials data?

Our perspectives

Tackling Materials and Manufacturing Innovation Challenges with Digitalised Translation – from conceptualisation to ontology

Michael:
How can we accomplish innovation in manufacturing?

Emanuele:
How can we understand materials and each other?

Jesper:
How can we communicate and share materials data?

Thank you!

The OntoTrans project has received funding from the European Union‘s Horizon 2020 research and innovation programme under Grant Agreement No 862136.