GeniusTex Smart Textiles Ontology - enabling smart textiles product and process development with semantic technologies

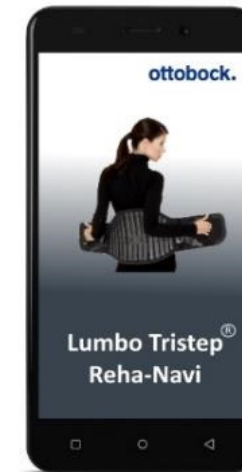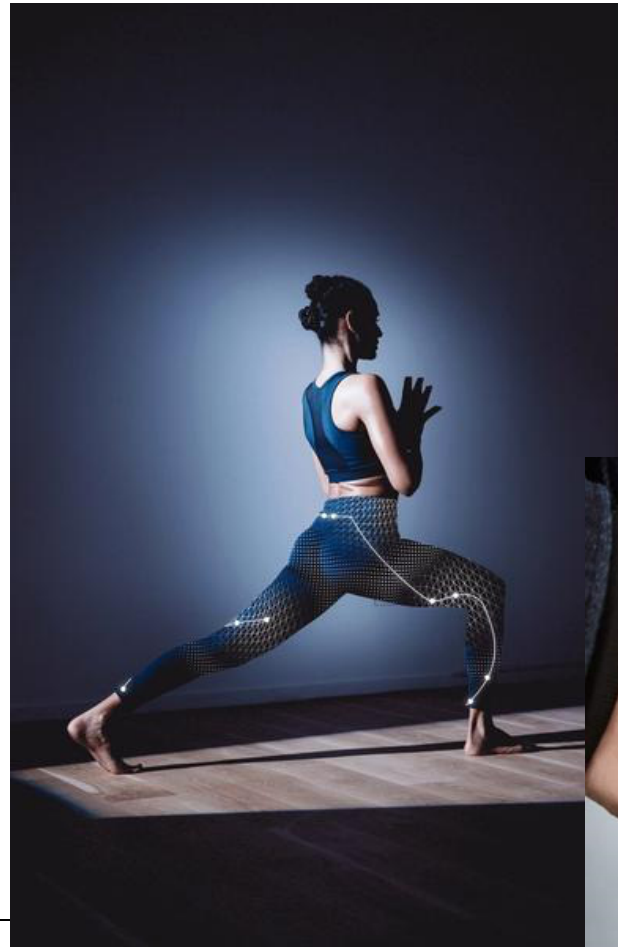Inga Gehrke – Institute for Textile Technology (ITA), RWTH Aachen University
Magnus Knuth – eccenca GmbH

Smart Textiles

- Clothes with hidden electronic components

- Complementary to Wearables (smart watches, etc.)

- Uses:
  - Monitoring
    - Vital parameter
    - Location
    - Drowsiness
  - Telecommunication
  - Regulate body temperature
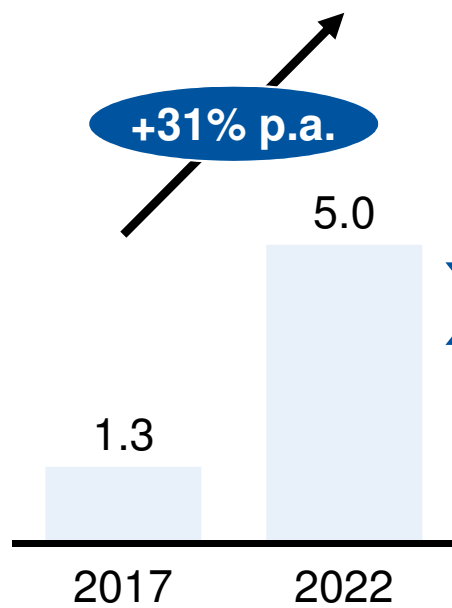 - Innovative fashion
  - …

The high complexity of the current smart textile value chain scares off SMEs

While a high market potential is expected for smart textiles, big players may dominate it before SMEs master the complex value chain

Chances

Sales p.a
in Bn EUR

+31% p.a.

5.0

1.3

2017   2022

> **Positive market outlook for smart textiles**

Risks

Large players aggressively move into e-textiles by acquisitions, e.g., Google:
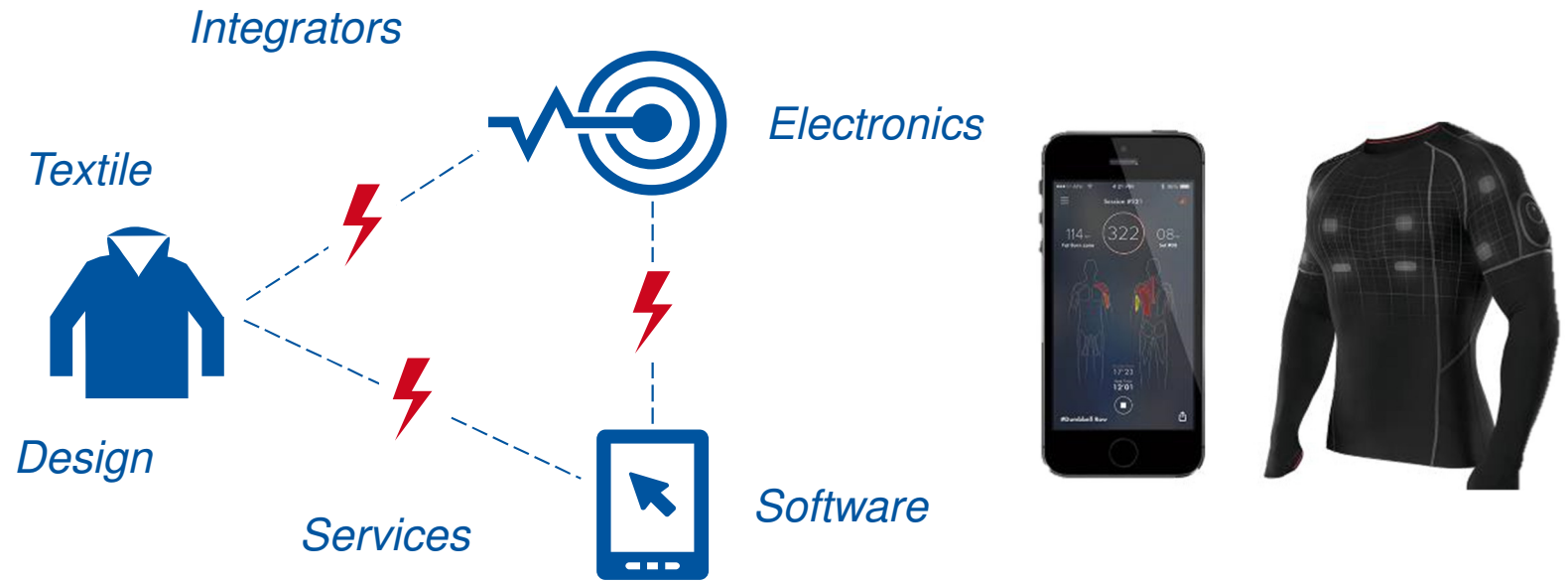
"Jacquard is the first full scale digital platform created for smart clothing"

> **Will innovation and smart services around smart textiles be dominated by incumbents of platform and services-driven business models?**

JABIL CLOTHING+

NYPRO A JABIL COMPANY

Google

amazon

JACQUARD by Google

OWLET BABY MONITORS

THALMICLABS™

MYANT + STOLL IN COLLABORATION

Source: GTAI 2018; Google 2019; IDTechEx 2018; Press releases

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GeniusTex enables various players to collaborate by translating technologies and providing market access

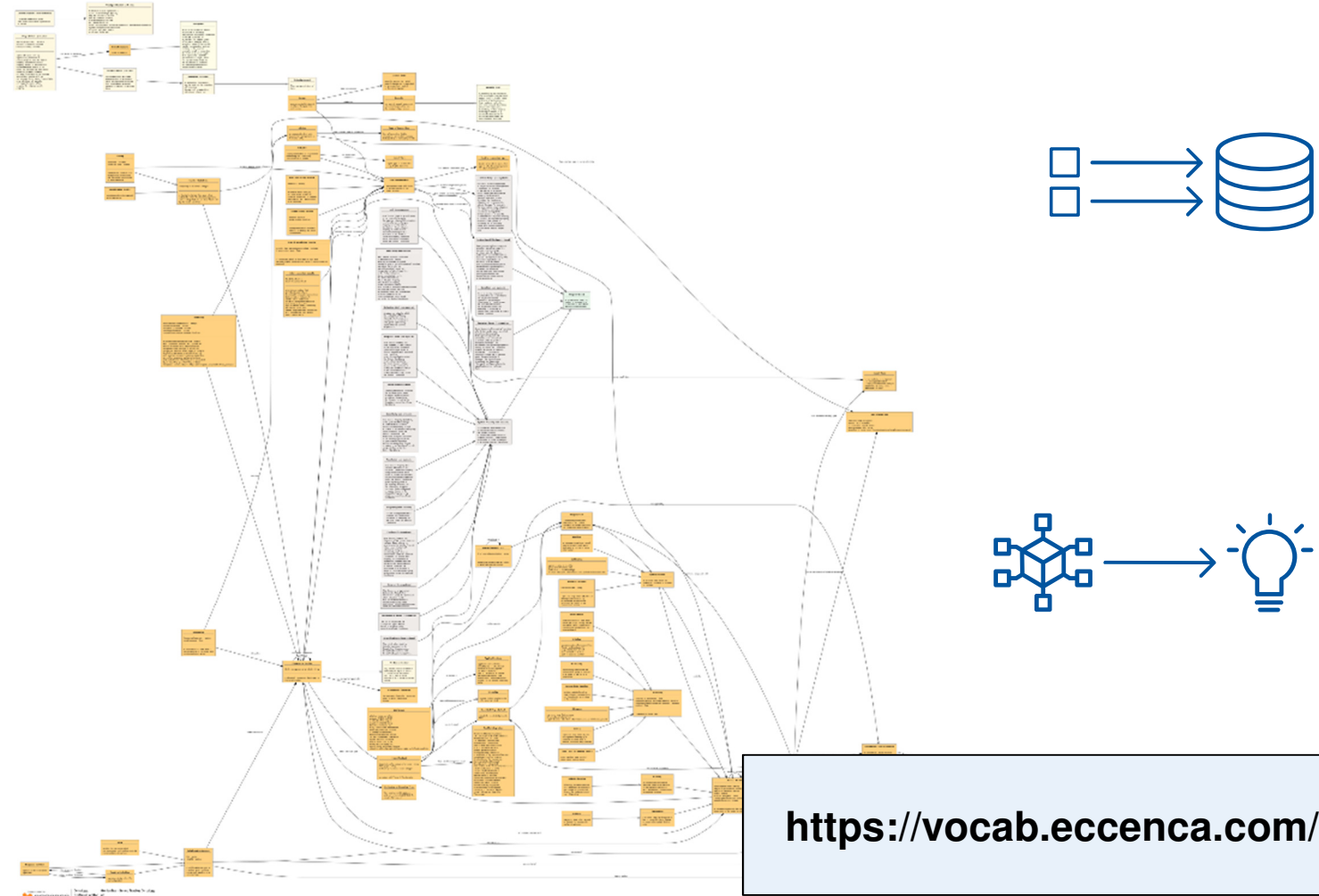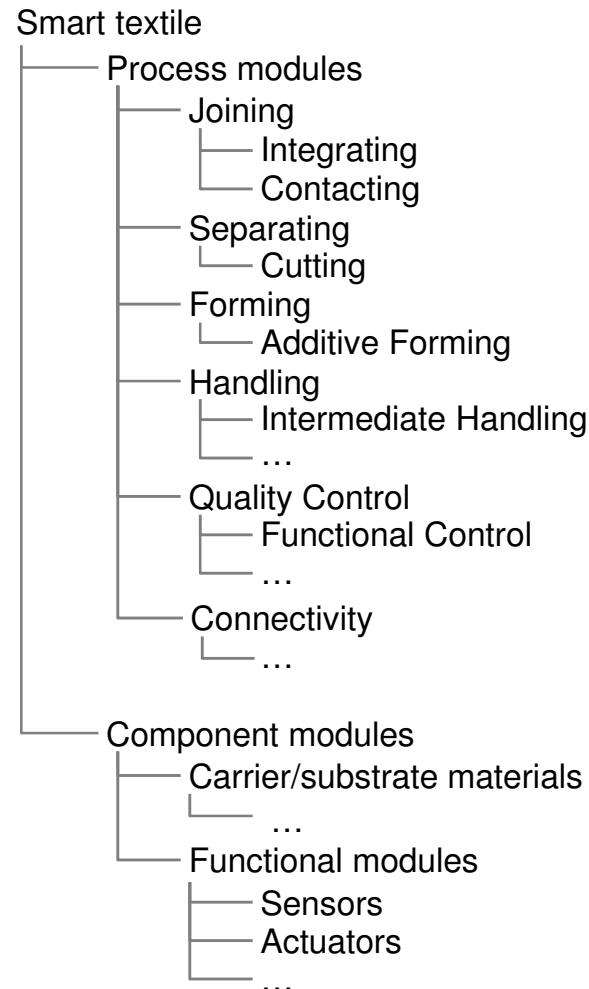## "The smart textiles value chain lacks integrated collaboration structures"

Integrators

Textile

Electronics

Design

Services

Software

> **Need for modularity including "common language" to enable collaboration**

Source: Göpfert1998; Schwarz2010; Socha2013

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ITA

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GeniusTex

Smart Textiles are modularized with an ontology that describes interdependencies between material, components, and processes

**The semantic description of classes, properties, and relations…**

…is implemented as an OWL ontology so that new (implicit) knowledge can be obtained

Smart textile
- Process modules
  - Joining
    - Integrating
    - Contacting
  - Separating
    - Cutting
  - Forming
    - Additive Forming
  - Handling
    - Intermediate Handling
    - …
  - Quality Control
    - Functional Control
    - …
  - Connectivity
    - …
- Component modules
  - Carrier/substrate materials
    - …
  - Functional modules
    - Sensors
    - Actuators
    - …

https://vocab.eccenca.com/geniustex/

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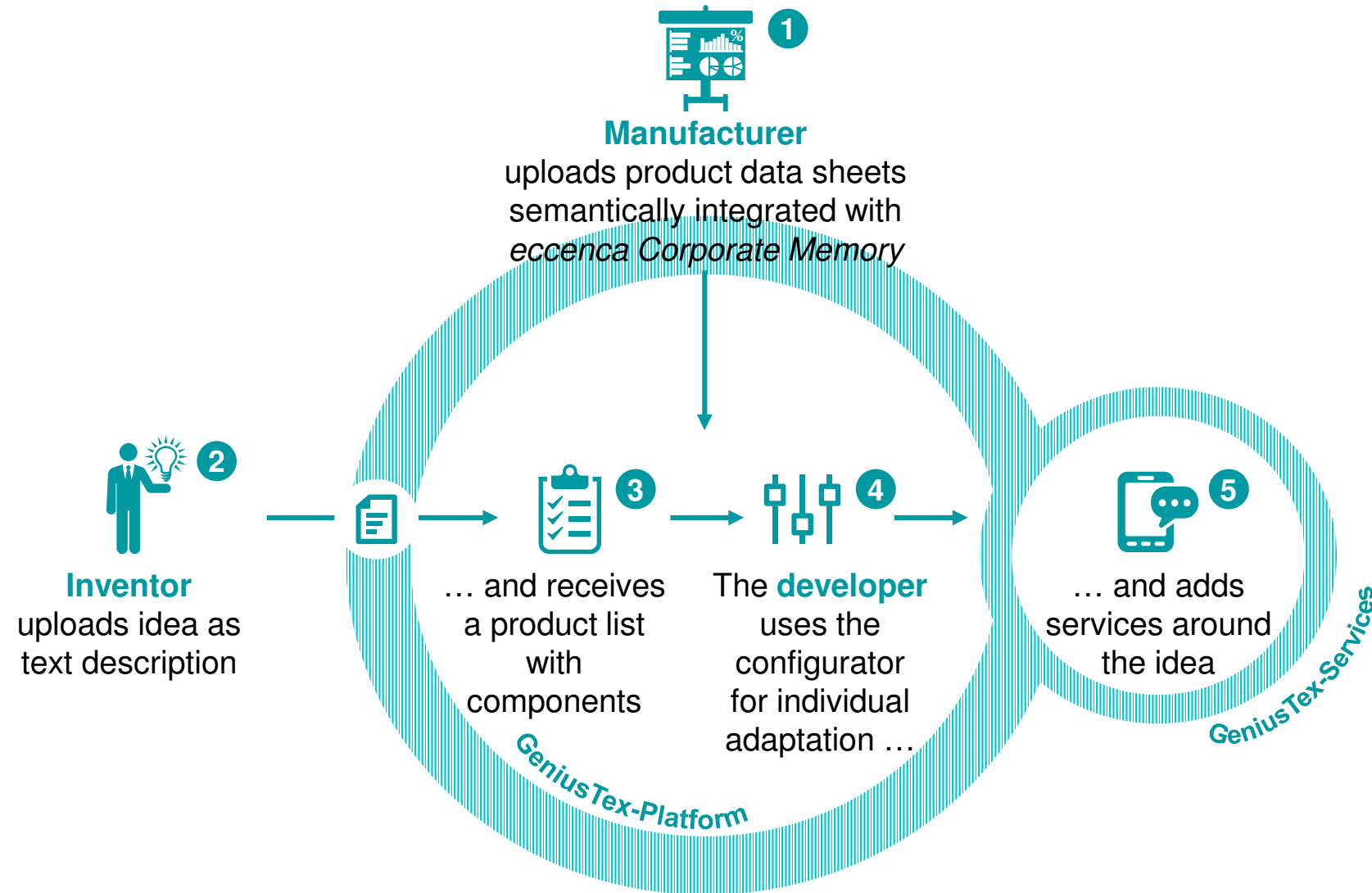
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GeniusTex

Development of the Smart Textiles Ontology

- Knowledge acquisition template for domain experts
  - Here: Excel master template for collecting ontology elements
- eccenca CI Ontology Pipeline:
  - Building the ontology
  - Evaluation and Reporting
  - Visualization and Documentation
  - Release

feedback

Evaluation

Knowledge
Acquisition
Template

eccenca
Ontology
Pipeline

OWL

Documentation

Release
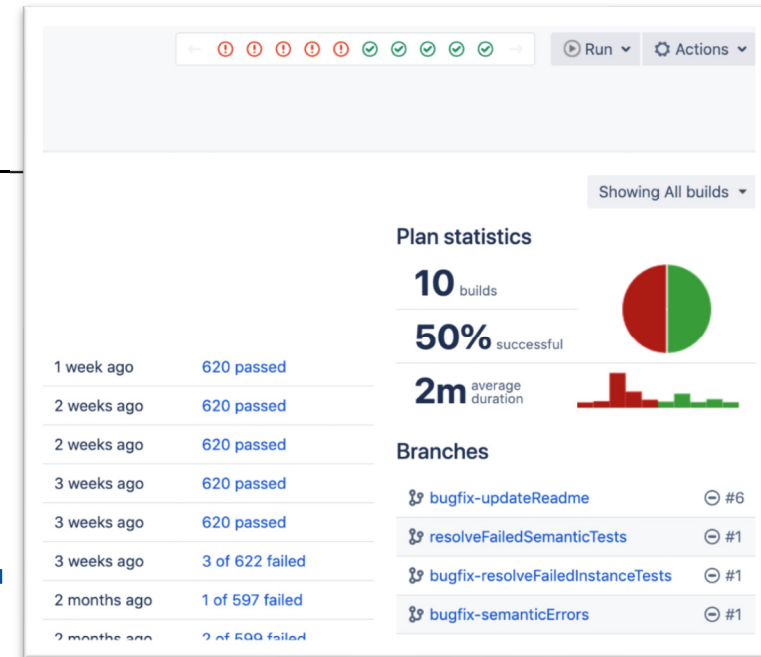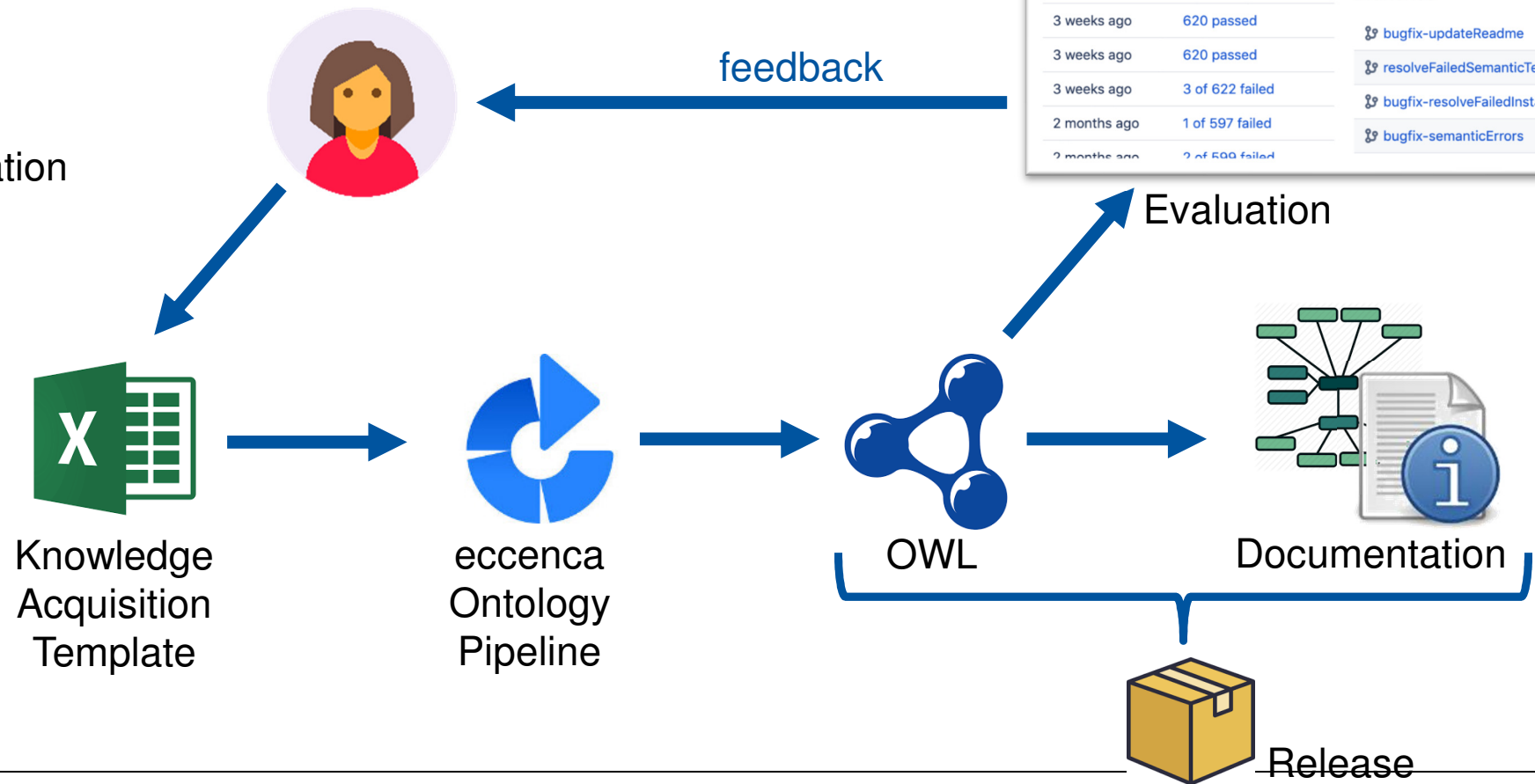
GeniusTex connects manufacturers, inventors, developers, and end users based on the Smart Textiles Ontology

Manufacturer
uploads product data sheets
semantically integrated with
eccenca Corporate Memory

Inventor
uploads idea as
text description

… and receives
a product list
with
components

The **developer**
uses the
configurator
for individual
adaptation …

… and adds
services around
the idea

GeniusTex-Platform

GeniusTex-Services

Adding and adjusting ontology as smart textiles domain advances?

Integrating from diverse data structures?

Integrating knowledge from different types of experts?

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GeniusTex

Connecting the value chain to bring Smart Textiles from niche to scalable production

Summary

- GeniusTex platform supports
  - Collaboration
  - With a "Common language" (ontology)
- Further incorporation (adding, altering) of expert knowledge and data needed – throughout platform lifecycle

Outlook

- Improve platform functionalities and UI/UX design
- Internationalize GeniusTex
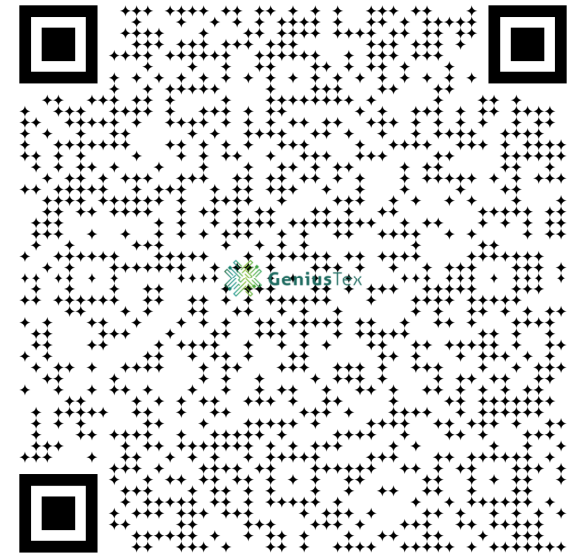- Realize and scale more examples with your ideas and collaboration

Get GeniusTex information

The consortium

- **Find us on https://geniustex.net**

ASYS GROUP

Fraunhofer FIT

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TIME Research Area Technology, Innovation, Marketing, Entrepreneurship

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Smart Service Welt

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GeniusTex

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- GTAI2018   Döhne, O. Endlich wieder Oberwasser: Technische und smarte Textilien. Germany Trade & Invest Berlin
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- IDTechEx 2018   Hayward, J. E-textiles 2018-2028. Technologies, Markets and Players: Cambridge, 2018.
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- Socha2013   David Socha; Tyler C Folsom; Joe Justice. Applying Agile Software Principles and Practices for Fast Automotive Development. Proceedings of the FISITA 2012 World Automotive Congress; pp 1033–1045.
- Press releases accessed 02/2019   https://www.idtechex.com/research/articles/jabil-acquires-clothing-plus-00007936.ja.asp?donotredirect=true&setlang=ja
https://www.printedelectronicsworld.com/articles/14286/myant-and-stoll-unveil-the-digital-textile-factor
https://www.reuters.com/brandfeatures/venture-capital/article?id=27468
https://www.inc.com/magazine/201705/zoe-henry/will-amazon-buy-you.html
BMWblog2019: https://medium.com/@openbom/openbom-real-time-collaboration-for-supply-chain-885f95b4df45

Sources

CC-BY

- Image *LEDs built into dress*: saschapohflepp @flickr

CREDIT

- *Levi's® Commuter X Jacquard By Google*: Levi Strauss & Co.
- *Tech-enabled Yoga*: wearablex.com

Backup

Knowledge about components and processes is integrated as semantic data (1/5)

Manufacturer
uploads product data sheets
- semantically integrated with
eccenca Corporate Memory

Within the configurator, users can define requirements for their smart textile (2/5)

Inventor
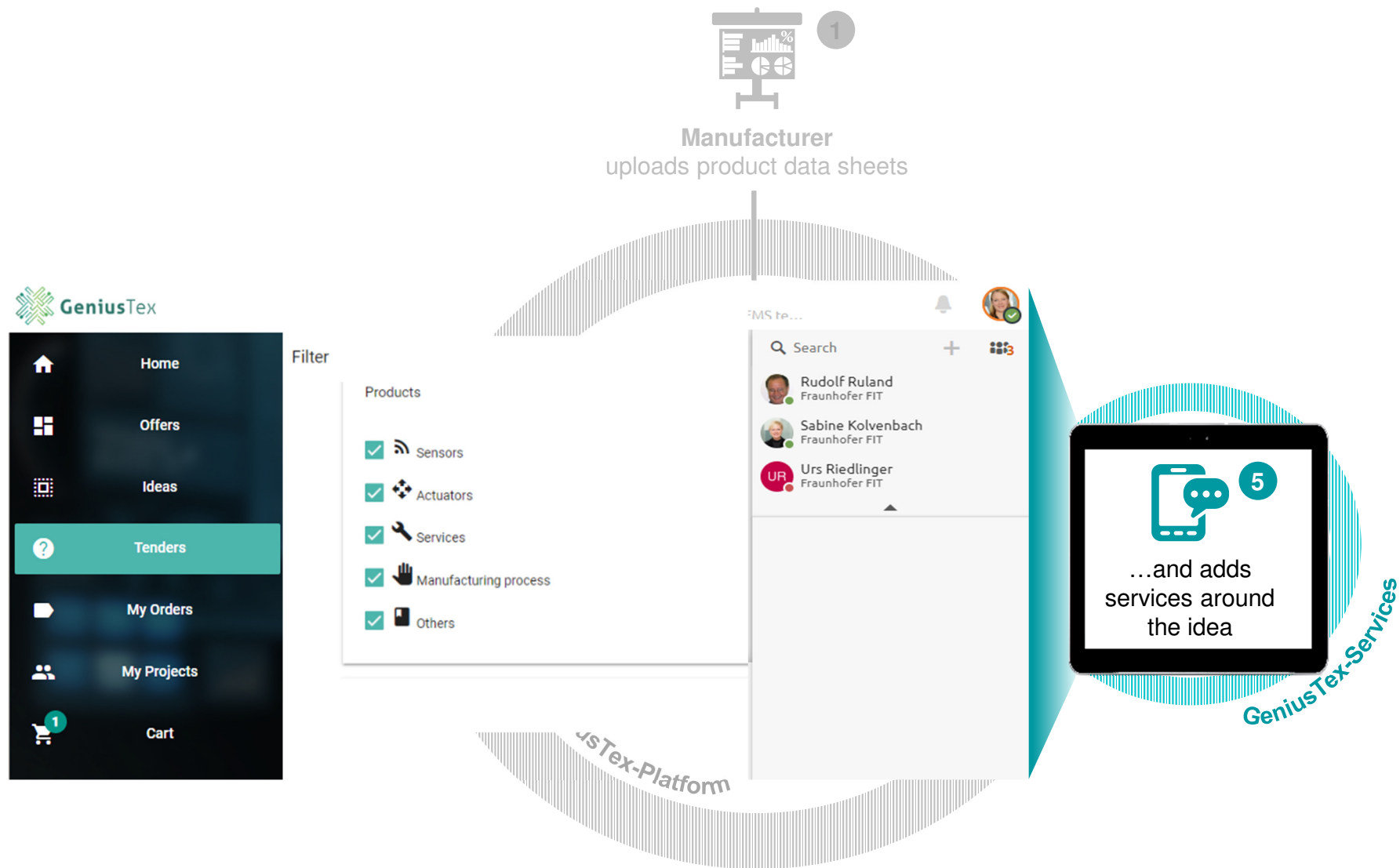uploads idea as text description

Users can select suitable components and look specifically for suppliers and manufacturers (3/5)
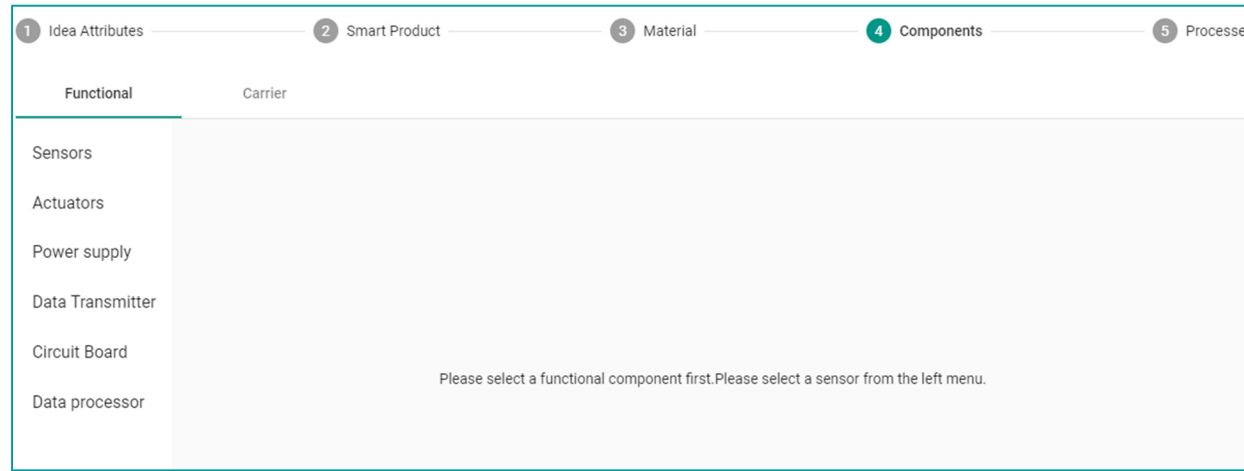
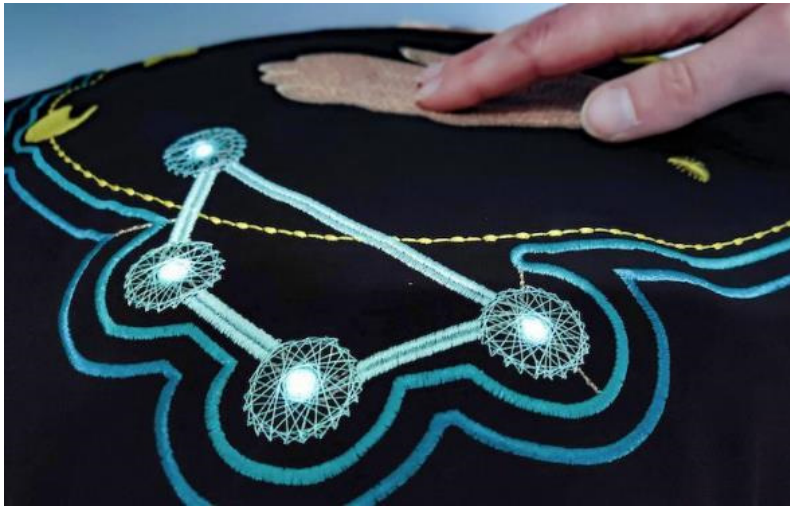# In collaboration with other users the idea can be turned in a functional product (4/5)
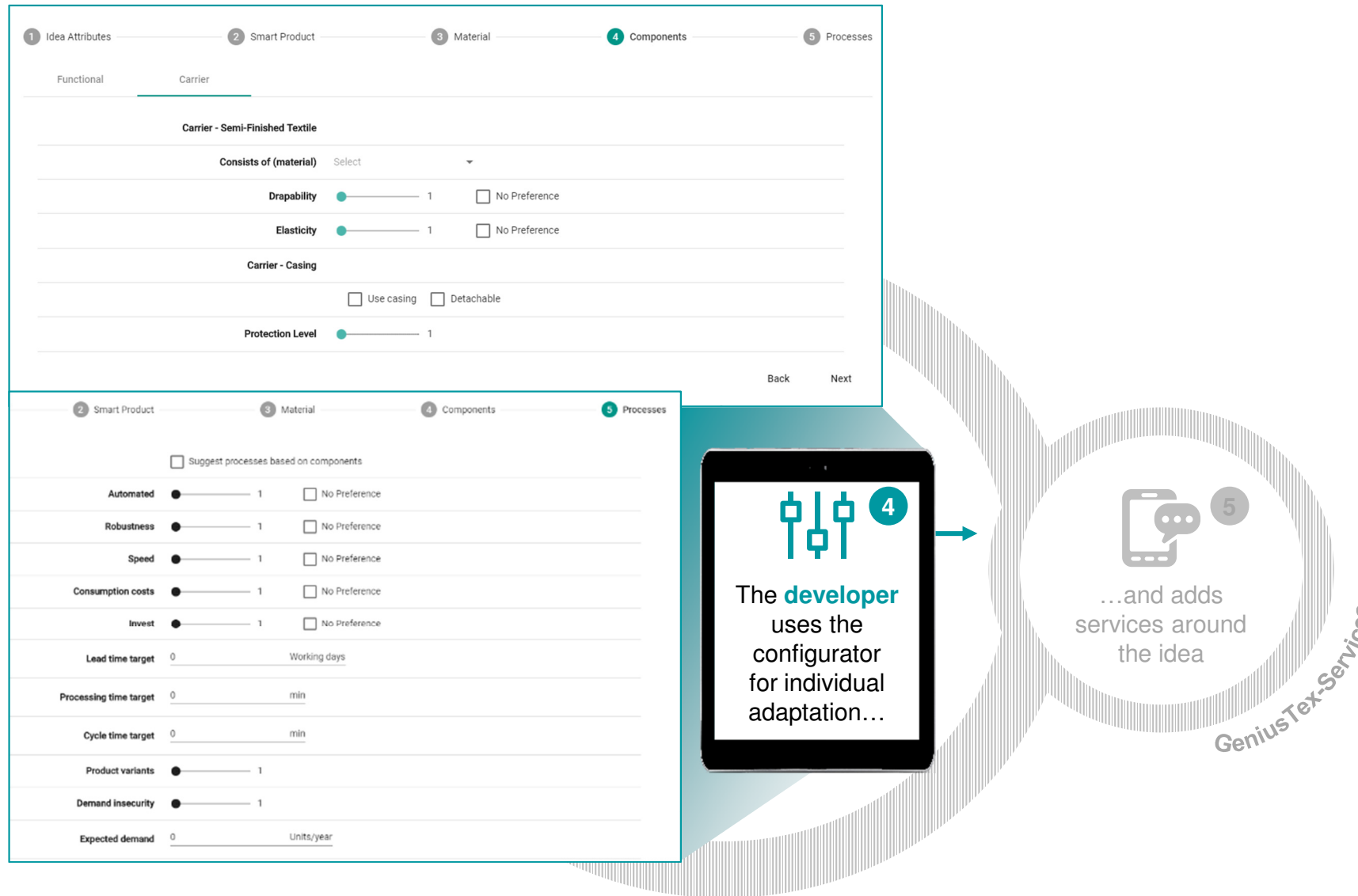
GeniusTex supports developing smart textiles and services (5/5)

The configurator was validated along the product and process development for the smart pillow component and process definition
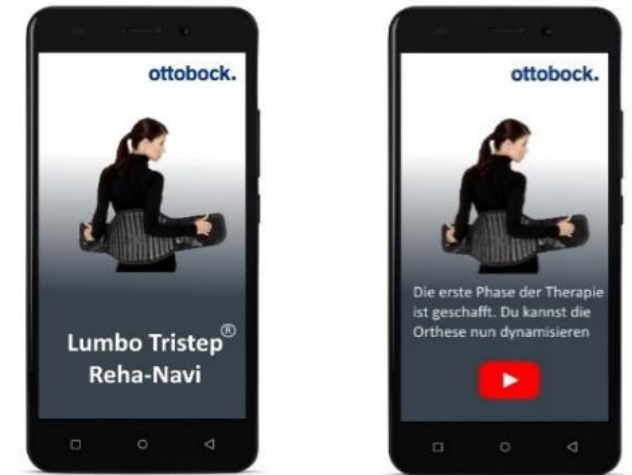
Smart Pillow

- Prototype of a communication / remote control device
- Touch sensitive surface, LEDs
- Production at TexProcess exhibition booth

Smart Polling Wristband

- Simple communication device
- Distinguishes hand position up/down, e.g. for voting

Smart Orthosis

- Medical device spinal orthosis
- Records the individual wearing period
- Recommendations on usage in combination with a smartphone app