# Architecture Design Update

**Herbert Born & Jacob Lub**

27-08-2020

BURO DE HAAN

Smart Renovation Factory
by INDU-ZERO

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# Content

- *Team Buro de Haan*

- Situation – Missing information
- Task – Design factory layout
- Action – Define functions & collect ideas
- Result – An overview of ideas
- Reflection – Choosing concepts

- *Questions?*

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# Team Indu-Zero Buro de Haan

**LEAD TEAM**

*Arjan*
*Director*

*Herbert*
*Architect*

*Marthijn*
*Product Specialist*

*Jacob*
*Product Developer*

*Marcel*
*Marketing manager*

**SUPPORT TEAM**

*Jorelien*
*Visualizer*

*Folkert*
*Architect*

*Gert-Jan*
*City planner*

*Freek*
*City planner*

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# Situation missing information

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# GOAL

**Smart Renovation Factory**
by INDU-ZERO

**We are designing a factory that is manufacturing 15.000 sustainable renovation packages per year at 50% lower costs**

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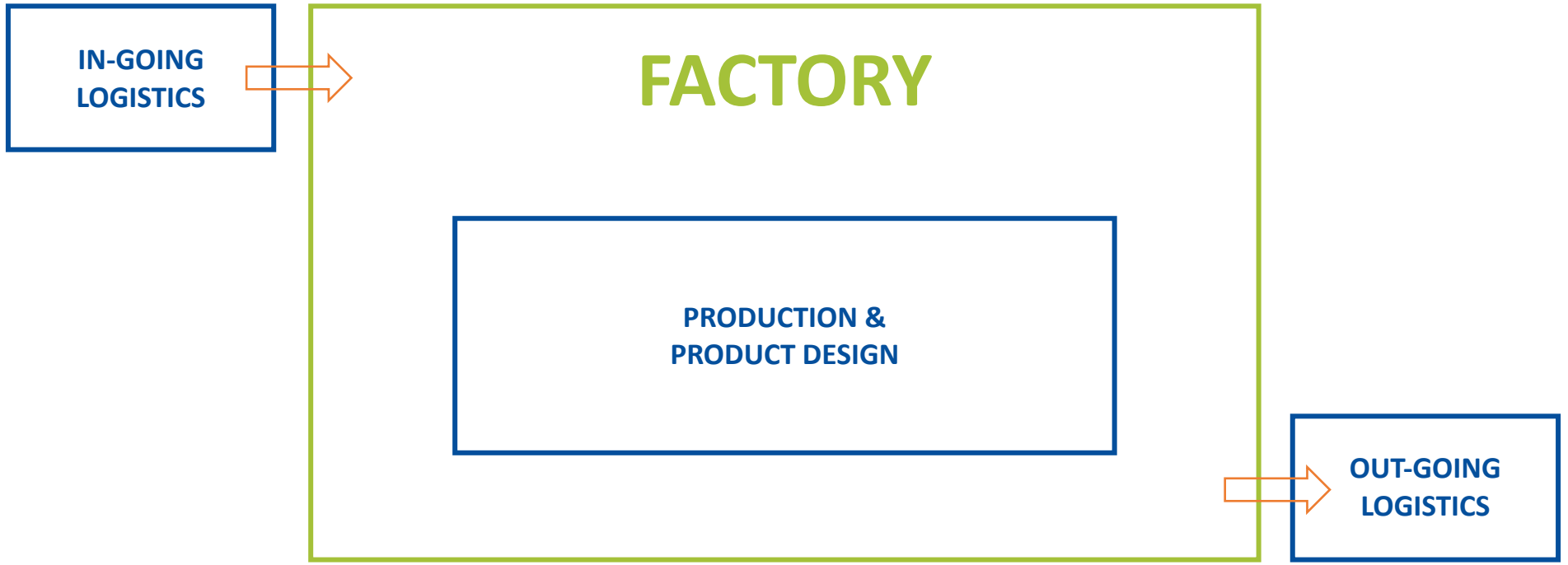


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# Task design factory layout

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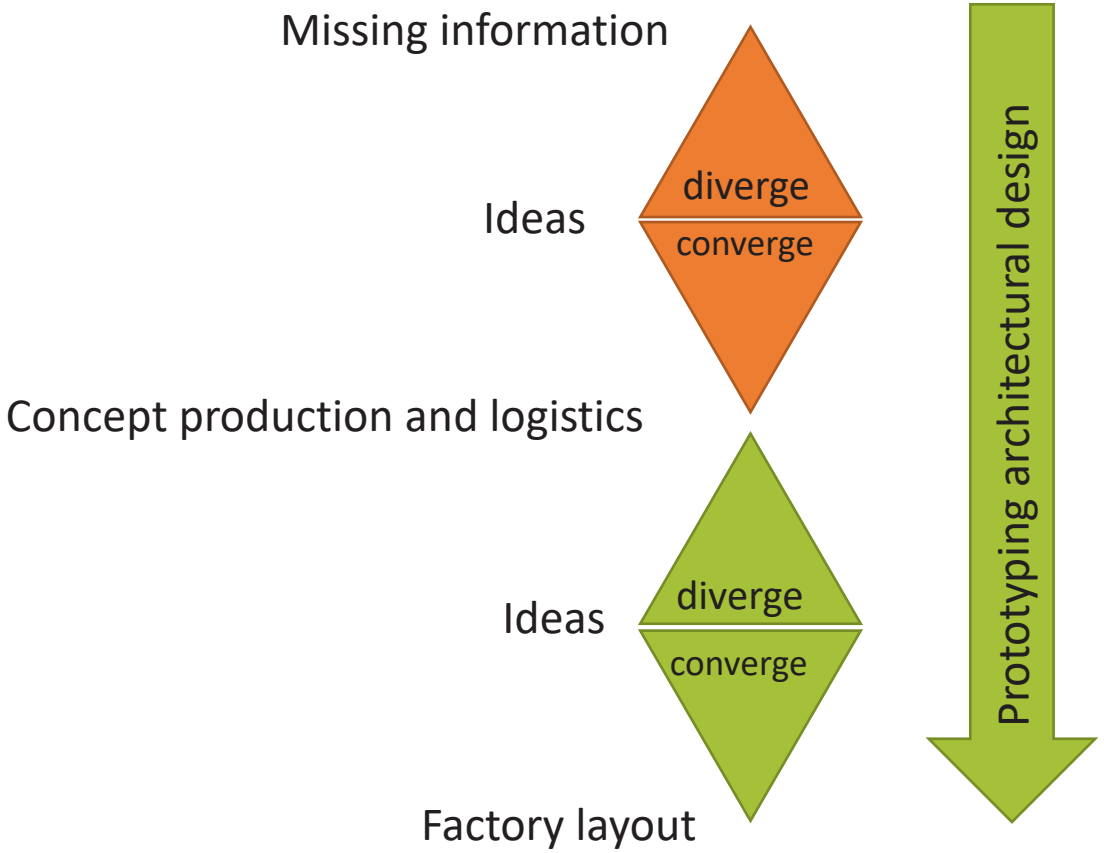
Architecture Design Update

# Architecture

**was used to structure process**

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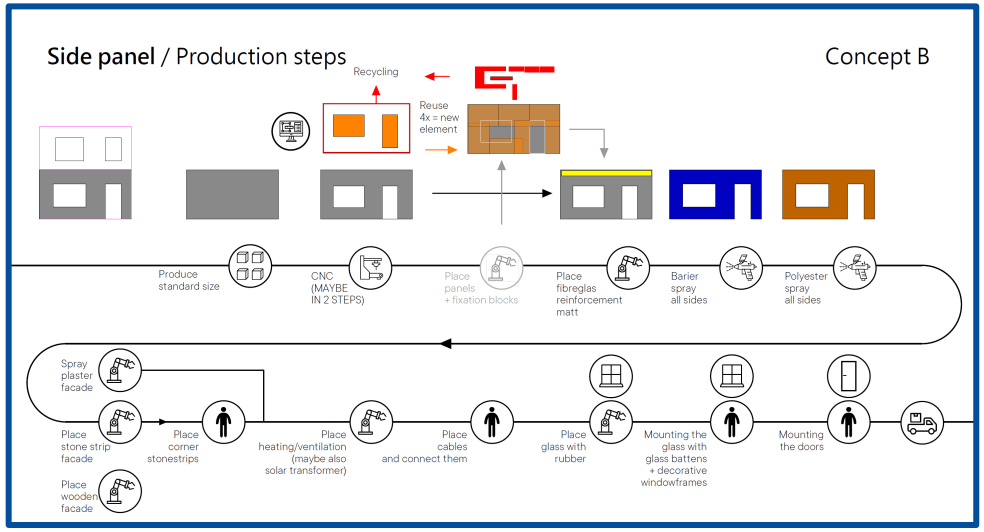


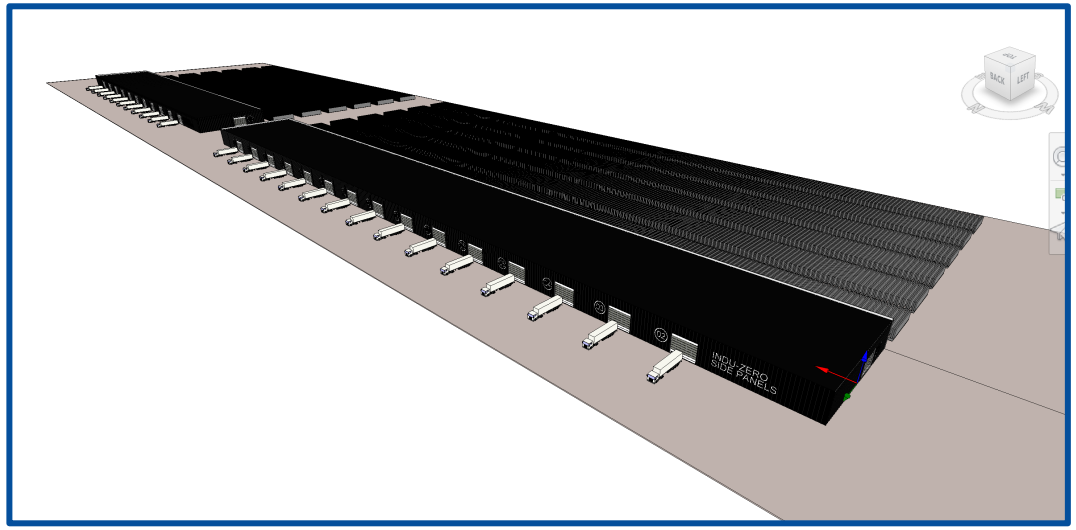


**Information**

**Result presented in external webinar 28-11-2019**

# Prototype: 1

## Hardly no information available

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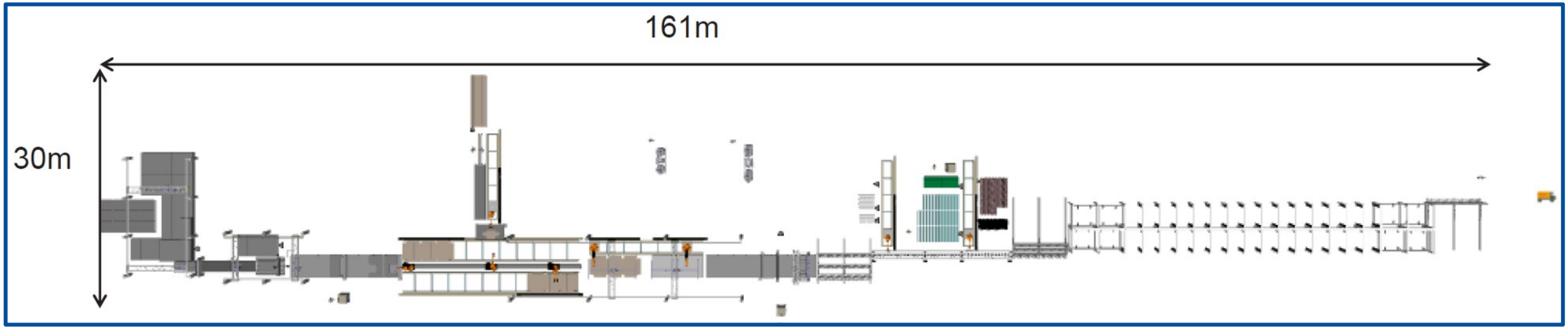


**Concept production line: 31,5 x 191 meter**

**Information**

# Prototype: 2

## Information became available

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**Result presented at 4th CG meeting Enschede 20-01-2020**

# Prototype: 2

## Information became available

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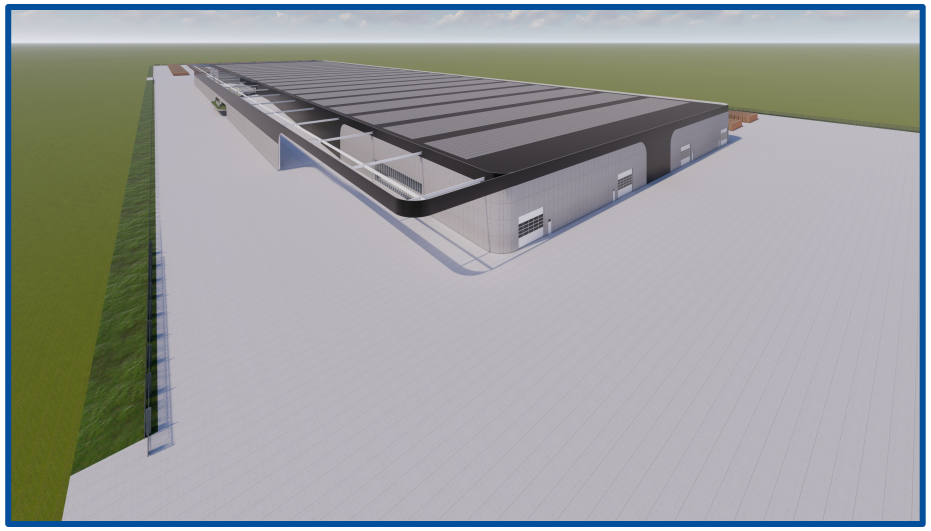
Information that came out of the
4th CG meeting, has been applied.

Information



Result presented in group meeting bleuprint development 14-02-2020

# Prototype: 3

## Lot of information available

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- 3rd update on the production line
- Production and warehouse heigt became visible
- Structural engineering has been applied

Information


Result presented external 21-04-2020

# Prototype: 4

## Blind spots in the project became visible

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Information

?

Result

# Prototype: 5

## Bringing the project to a higher level

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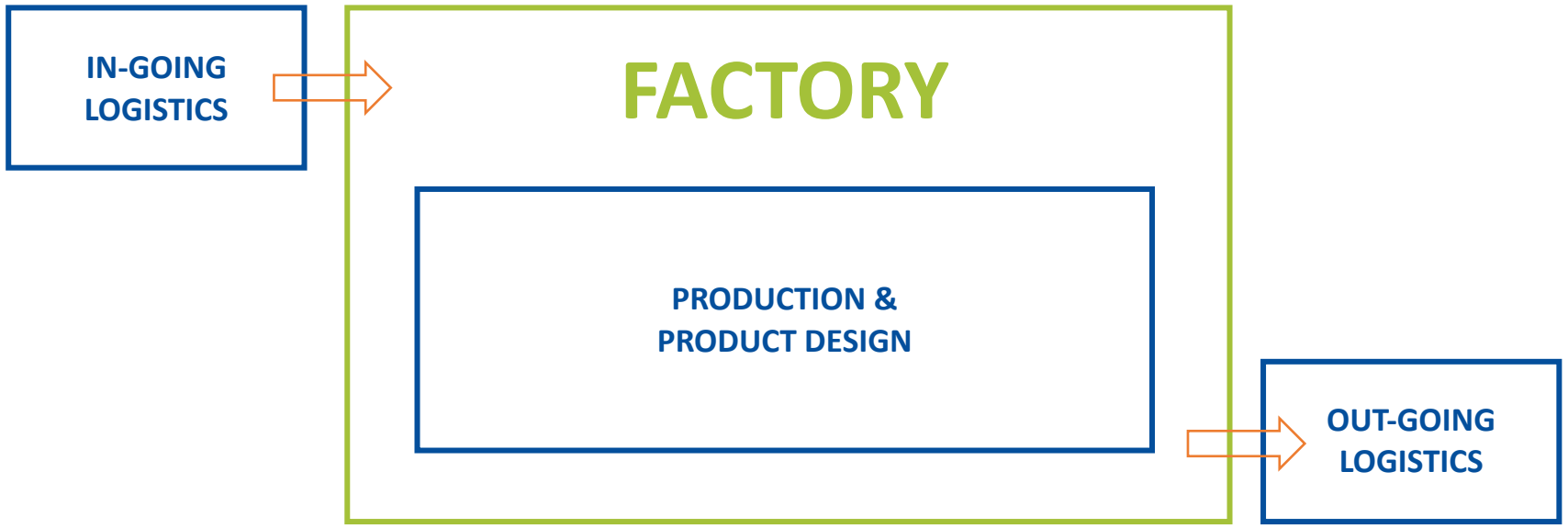
# A factory that represents the sustainable target for its product.

Comply with regulations

Be sustainable: Net Zero or Beyond

Support human mobility

Household employees

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# Action Define functions & collect Ideas

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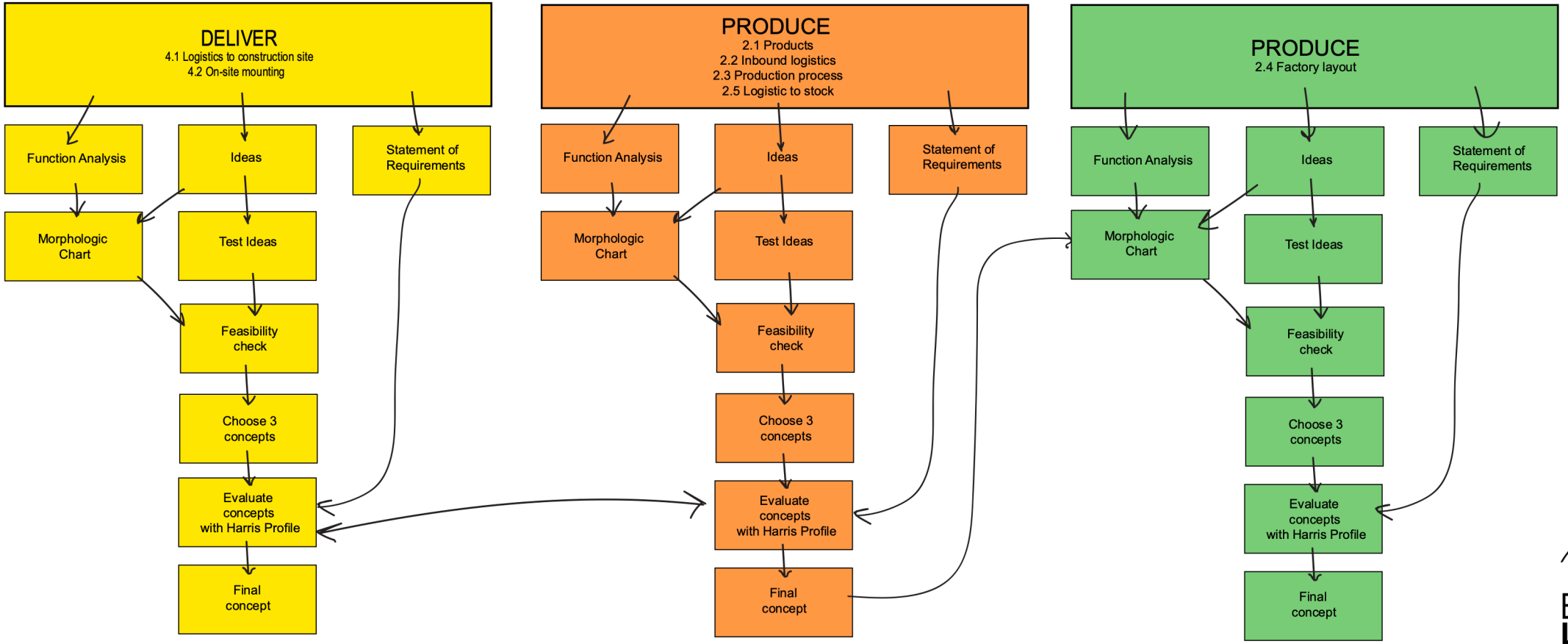
# Phase 1 - Concept Development




# PROCESS CHART

INDU - ZERO / BLUEPRINT DEVELOPM

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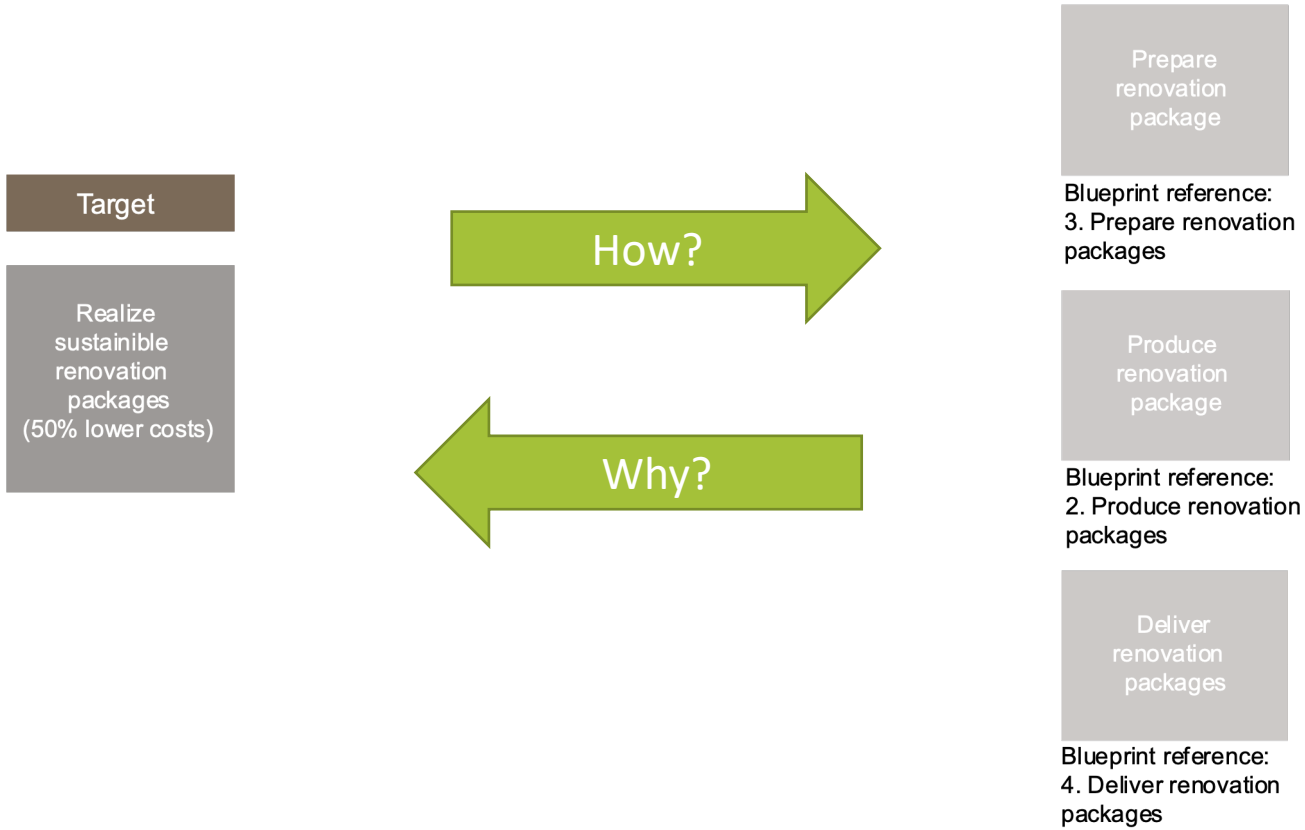
# Define functions

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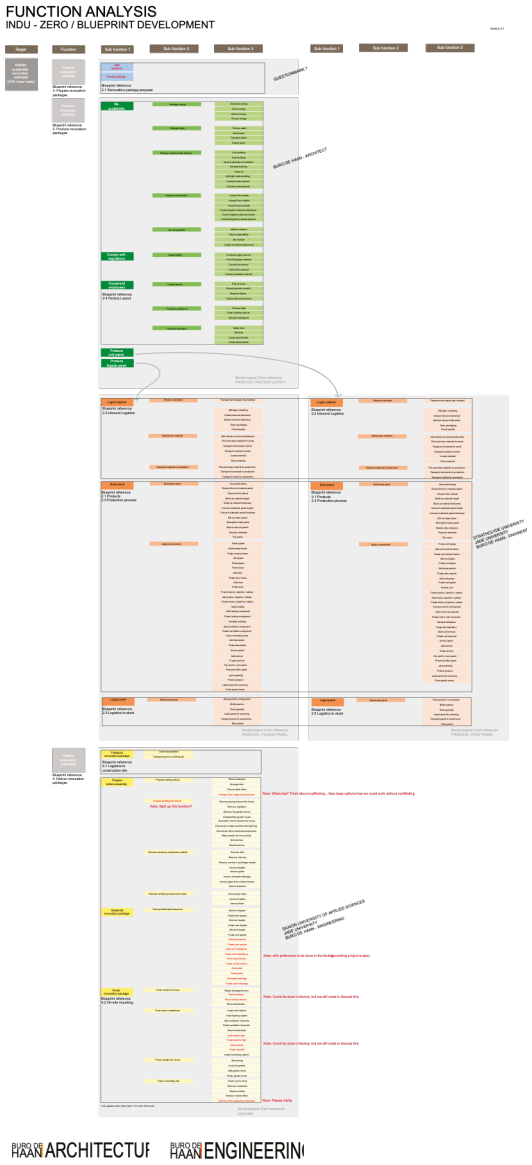
# Define functions

- How are we going to **prepare** renovation packages
  Customer request → Custom rennovation package design.
- How are we going to **produce** renovation packages
  Incoming goods → Produce panel → Logist to stock
- How are we going to **deliver** renovation packages
  Logist to building site → On-site assembly




BURO DE HAAN ARCHITECTUR BURO DE HAAN ENGINEERIN

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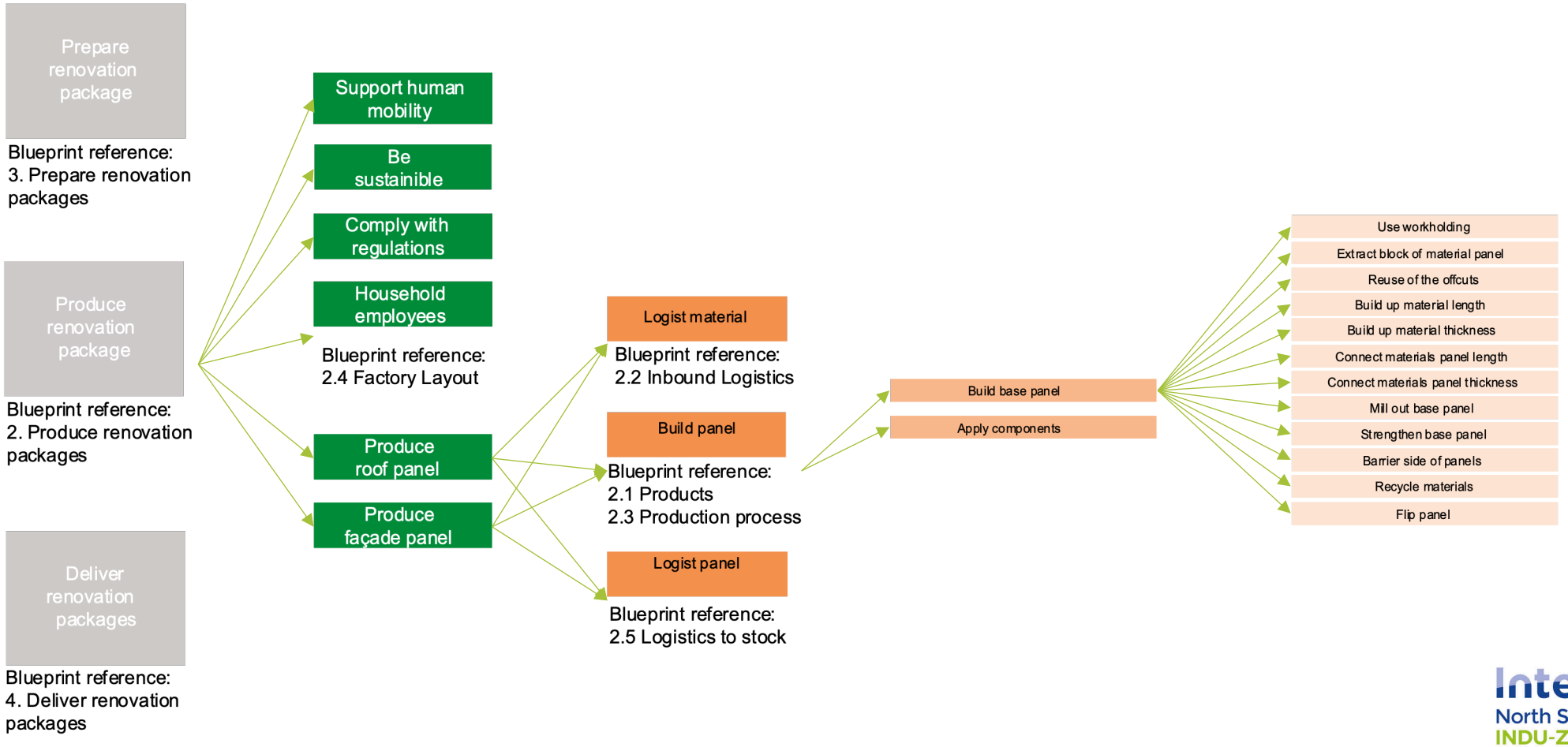
# Function Analysis

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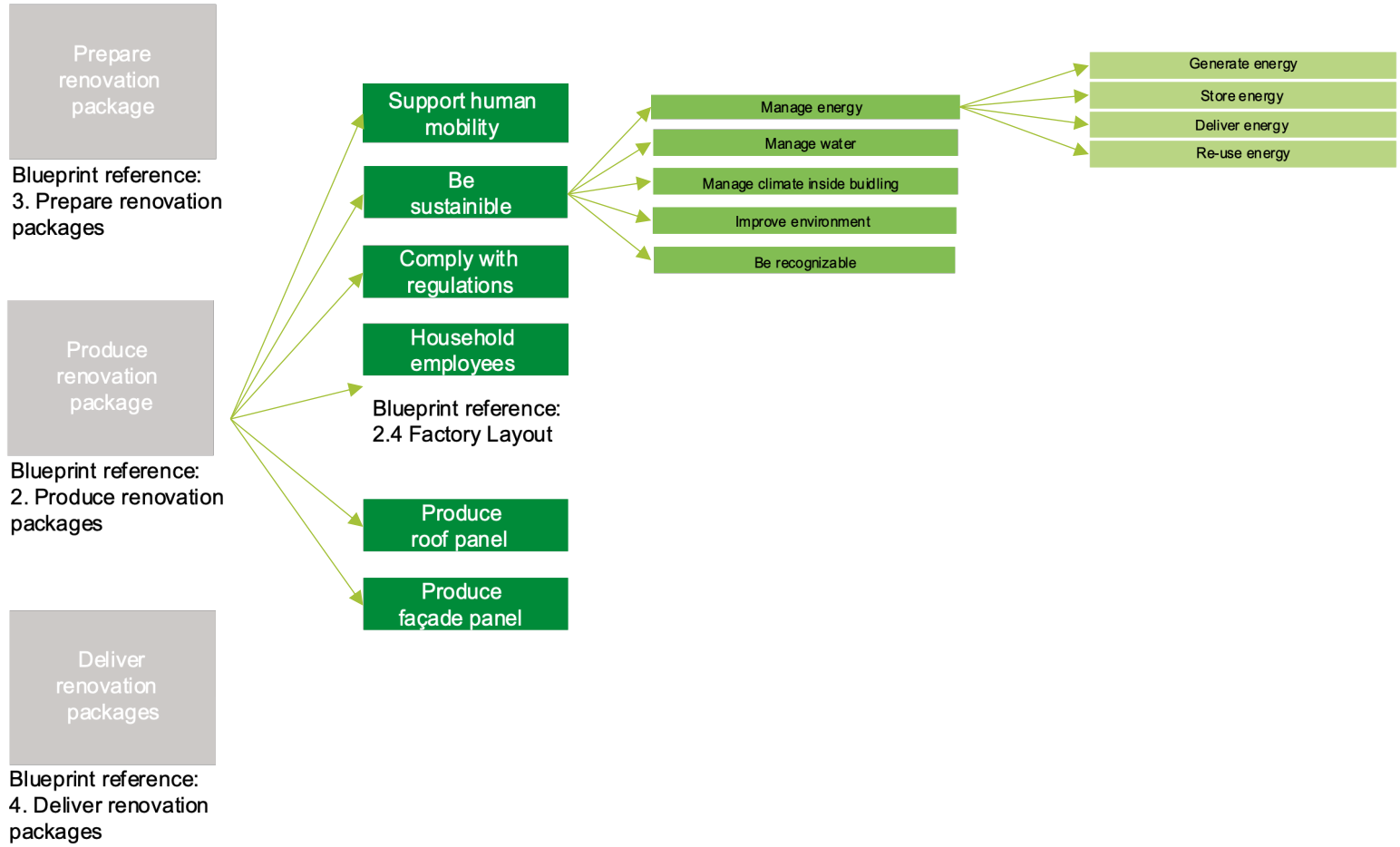
# Function Analysis

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# Result an overview of ideas

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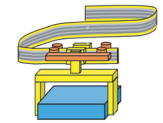
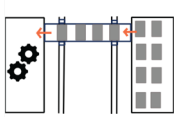
# Generating ideas for (sub)functions


Electric monorail system (EMS)


Parallel outdoor gantry

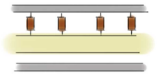
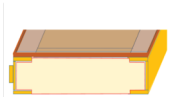
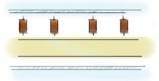
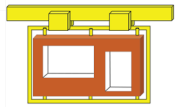


Plate Material Reinforced


GRP rails top and bottom


Fiber & resin reinforced


Vertical workholding & transfer frame


Bar code scanner

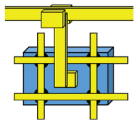

Forklift


Crane track horizontal & vertical


3D Print


Laser cutting


No window frame


smart docking fixture

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# Morphological Charts

Prepare renovation package

Blueprint reference:
3. Prepare renovation packages

Flow Chart

Produce renovation package

Blueprint reference:
2. Produce renovation packages

**Morphological Chart / Produce / Factory Layout**

**Morphological Chart / Produce / Façade panel**

Morphological Chart / Produce / Roof panel

Inbound logistics
Product
Production process
Logistics to stock

Deliver renovation packages

Blueprint reference:
4. Deliver renovation packages

Morphological Chart / Deliver

Logistics to construction site
On-site mounting

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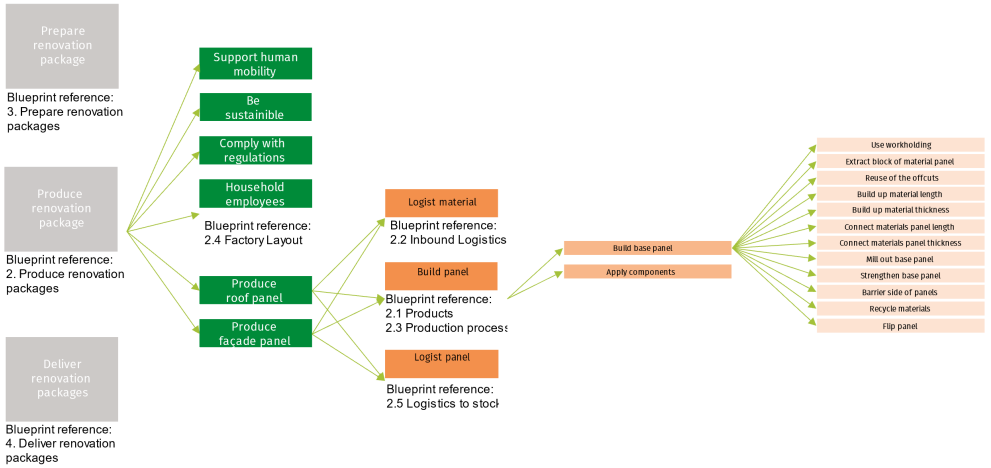
# MORPHOLOGICAL CHART

## INDU - ZERO / PRODUCE / FAÇADE PANEL

| NR | Function | Ideas A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PRF-1 | Use workholding | Use mount in factory | built in Handling / Locating | Horizontal adjusting platten | Vertical workholding & transfer frame | | | | | | |
| PRF-2 | Extract block of material panel | Hot Wire Cutter | Blade Cutter | Pre made from Supplier | Laser cutting | Water cutting | Sand cutting | | | | |
| PRF-3 | Reuse the offcuts | Convert offcuts into standard panels | Reuse offcuts among standard panels | Pre made from Supplier | | | | | | | |
| PRF-4 | Build up material length | 12m Large joint overlaps needed | EPS interlocking joints | Re-use skinned offcuts for infills | Glue | Additional joints between panels | | | | | |
| PRF-5 | Build up material thickness | Plate Material | Plate Material Reinforced | Fiber & resin | Fiber & resin reinforced | 3D Print | 2K Moulding | GRP solid panels | GRP rails top and bottom | | |
| PRF-6 | Connect materials panel length | Vacuum suction + glue | Glue | GRP mat wet UV glue | 3D Print | EPS interlocking joints | GRP rails top and bottom | 2K Moulding | | | |
| PRF-7 | Connect materials panel thickness | Vacuum suction + glue | Glue | Robot poly chop spray | 3D Print | Soak fiber | Click connection | 2K Moulding | Press stack | | |
| PRF-8 | Mill out base panel | Laser cutting | Water cutting | Sand cutting | 3D Print | Cnc milling cutter | multiple axis milling | Punching | Moulding | Hot wire groove cutter | |
| PRF-9 | Add fixating reinforcement | Wooden blocks | OSB3 wood | Stacked EPS | Mould in, not bolt on. | Structural metal | | | | | |
| PRF-10 | Lifters on panel | Mould in, not bolt on. | GRP rails top and bottom | Brackets | Glue | Screw | demountable clamp | No Lifters | | | |
| PRF-11 | Add lifter | Robotic Arm | By hand | Robotic arm and by hand | Human operated manipulator | Use mount in factory | demountable clamp | No Lifters | | | |
| PRF-12 | Fixate lifters | Mould in, not bolt on. | Glue | demountable clamp | No Lifters | Screw | Nuts and bolds | | | | |

### Function Analysis

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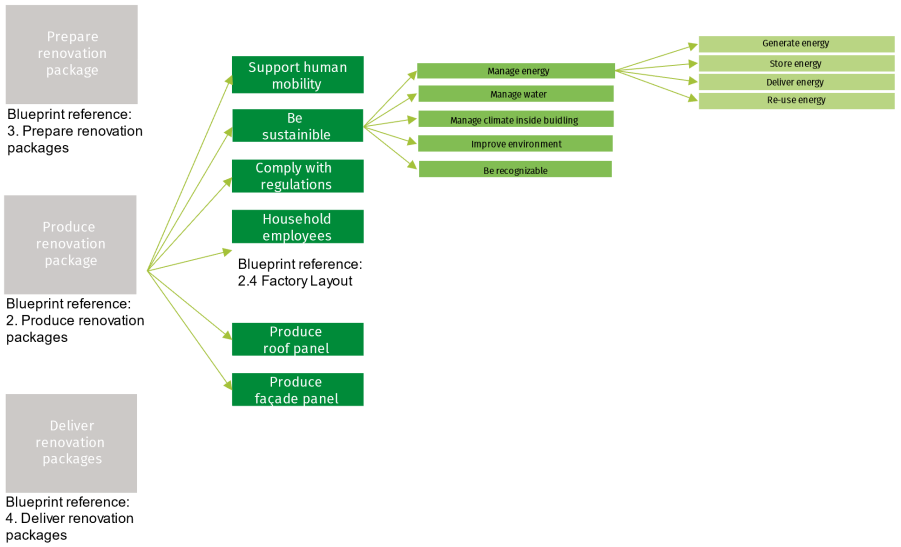
Version 3.0

# MORPHOLOGICAL CHART

## INDU - ZERO / PRODUCE / FACTORY LAYOUT

| NR | Function | Ideas A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Generate energy | Solar energy | Windmill | Windturbine | Hydropower plant | Heat pump | Biogass | H2o | Mass in roof | Nuclear energy | Kinetic energy | | |
| 2 | Store energy | Battery | Water bath Open system | Buffer Closed system | Green waste | Electric vehicle | Salt battery | H2o storage | Geothermie | | | | |
| 3 | Deliver energy | Factory as hub | Charging station | H2o station | | | | | | | | | |
| 4 | Re-use energy | Residual heat from machines | Use own water | Residual heat from climate facade | | | | | | | | | |

### Function Analysis

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# Reflecting choosing concepts

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# Feasibility check

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| | | Ideas | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
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| PRF-7 | Connect materials panel thickness | Vacuum suction + glue | Glue | Robot poly chop spray | 3D Print | Soak fiber | Click connection | 2K Moulding | Press stack | | |
| PRF-8 | Mill out base panel | Laser cutting | Water cutting | Sand cutting | 3D Print | Cnc milling cutter | multiple axis milling | Punching | Moulding | Hot wire groove cutter | |
| PRF-9 | Strengthen base panel | OSB3 wood | GRP sheet & spray glue | GRP rails top and bottom | Robot poly chop spray | Magnesium Oxide panels | Metal skin PU foam | GRP solid panels | Robot spray reinforced cement | GRP mat wet UV glue | |
| PRF-10 | Barrier side of panels | Robot poly chop spray | GRP rails top and bottom | Vacuum suction + glue | Panel with comers | Add fiber and chop spray | | | | | |
| PRF-11 | Recycle Materials | Screw Compactor | Solvent treatment | Melting | Ship it out | | | | | | |
| PRF-12 | Flip panel | Butterfly table | Crane track horizontal & vertical | Crane | Robotic Arm | No flipping vertical transportation | | | | | |

Note: Only gives an impression how the process works.

Feasible

Maybe feasible

Not feasible

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# Choose concepts

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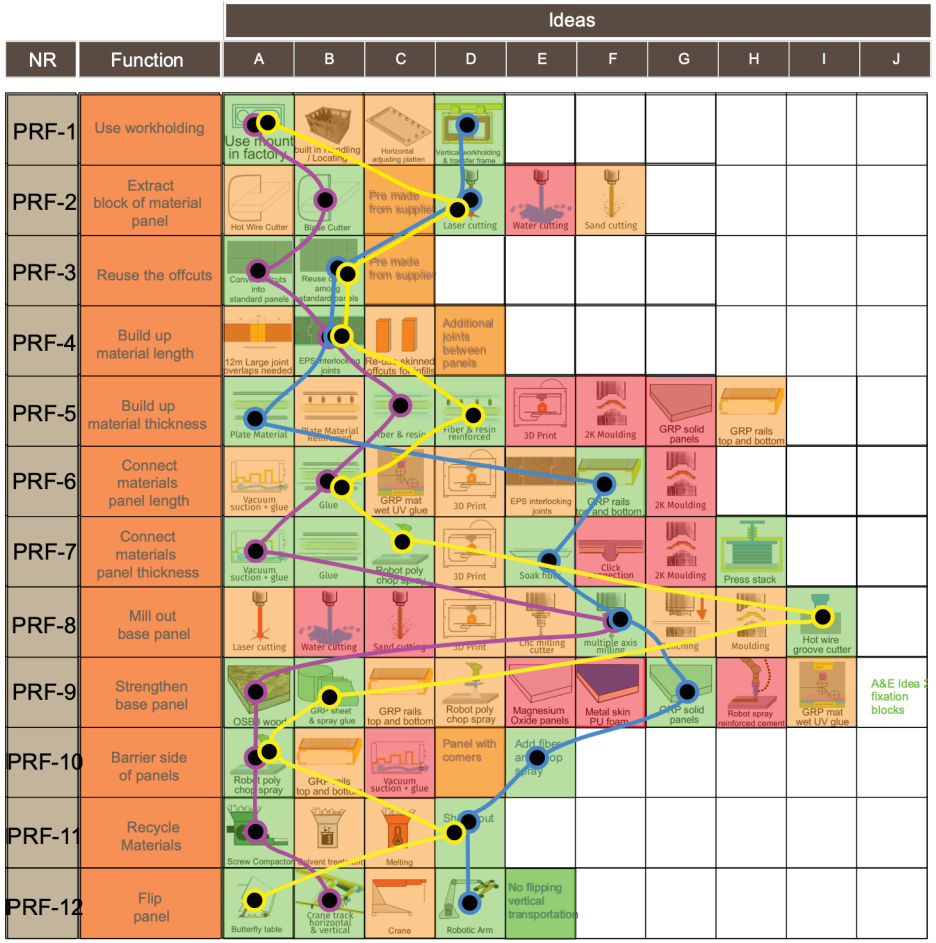


Note: Only gives an impression how the process works.

Concept 1

Concept 2

Concept 3

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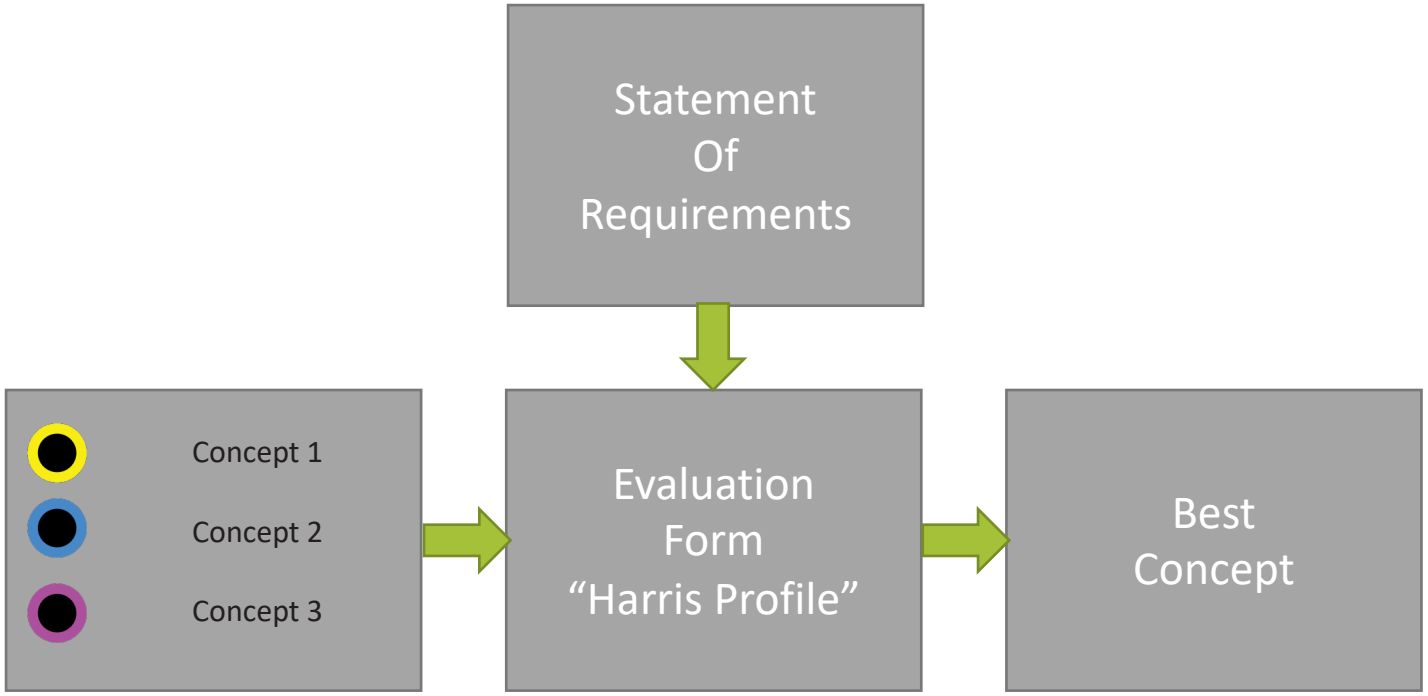
# Evaluate concepts



| | concept 1 | | | | concept 2 | | | | concept 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | -2 | -1 | +1 | +2 | -2 | -1 | +1 | +2 | -2 | -1 | +1 | +2 |
| controlable on velocity and direction | | | | | | | | | | | | |
| safe | | | | | | | | | | | | |
| gain enough speed | | | | | | | | | | | | |
| basis construction simple | | | | | | | | | | | | |
| well accesible parts | | | | | | | | | | | | |
| well replacable parts | | | | | | | | | | | | |
| distinct | | | | | | | | | | | | |
| stable | | | | | | | | | | | | |
| compact | | | | | | | | | | | | |
| springs | | | | | | | | | | | | |
| price | | | | | | | | | | | | |

http://wikid.io.tudelft.nl/WikID/index.php/Harris_profile

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# Thank you

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