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Engineering for Sustainable Development

- Learn in a non-traditional educational environment
- Apply your knowledge in Texel, a beautiful Dutch island.
- 5 ECTS Master Interdisciplinary Colloquium (WM0939TU)
- Compulsory for Technology in Sustainable Development Annotation
- Includes 1-week of fieldwork (expenses not covered: 100€)

KICK OFF - Engineering for sustainable development WM0939TU

ESD – kick off

- Welcome and get to know each other
- Texel sustainable?!
- Topics for research
- Learning by doing research
- Texel as a socio-technical systems
- Doing research, using gingerresearch.net

NB: invoices were send. Please make sure that your contribution is paid before 23 November 2015!

- While the music is playing, complete as many statements as you can with the name of a classmate who makes them be true.

- https://www.youtube.com/watch?v=KbXFL6i9aws
- https://www.youtube.com/watch?v=blUSVALW_Z4

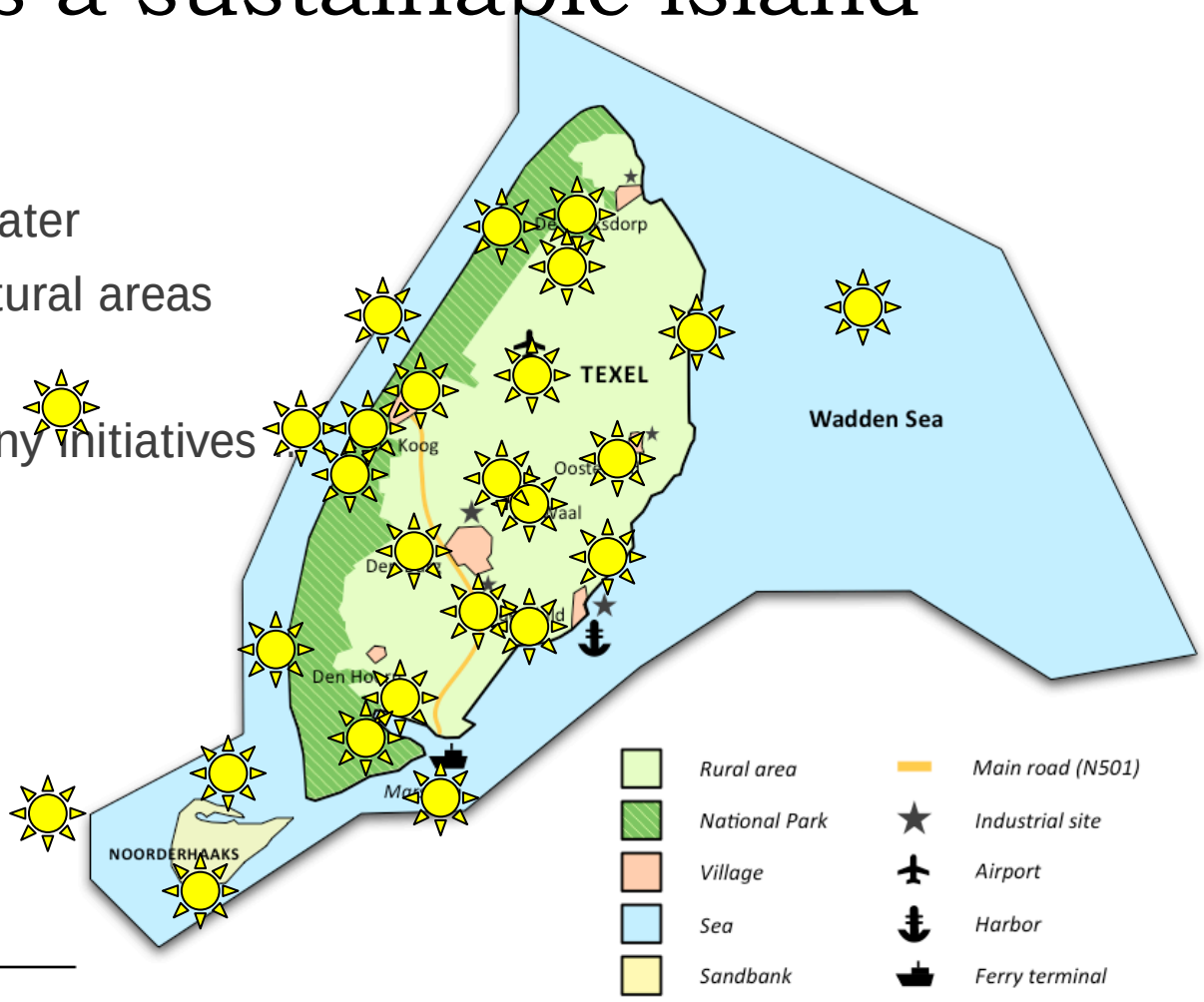
Or making it happen!

Learning by doing research: Texel as a sustainable island

Characteristics

- Consists largely of water
- Agricultural land, natural areas
- People and sheep
- Great ambitions, many initiatives

  but transition?



By doing such research, we will

- Experience complexity, tensions and dilemmas that come with sustainable practices and required interdisciplinary efforts;
- (Re)consider our role as an engineer in sustainability transition;
- Analyse (im)possibilities and design pathways of transitions to sustainable futures of sociotechnical systems.

Texel research results

WM0939TU Class 2014

Texel

- 13,600 inhabitants approx.
- 16 Ha of land area approx.
- Seven villages: Den Burg (main), De Cocksdorp, De Koog, De Waal, Oosterend, and Oudeschild
- Main economic activities: tourism (75%), fishing and agriculture
- Varied nature and landscape: Dunes as national park
- Homogeneous cultural identify: social cohesion
- Limited health & education options
- Goal: self-sufficient in sustainable energy and water facilities by 2020

Objectives

- Explore sustainability initiatives and research the sustainability transition of the Dutch island of Texel.
- Texel's sustainability to be studied on two levels:
  - The system
  - Subsystem (Specific challenges)

Subsystems

Texel as a host → Carrying capacity, socio-cultural impacts

Food & more → Landscape, Connection with mainland, Local production & consumption

Water cycle → Water supply from mainland, Extreme weather, Wastewater recycle

Mobility → Frequency of need, Capacity, Sustainable transport niches

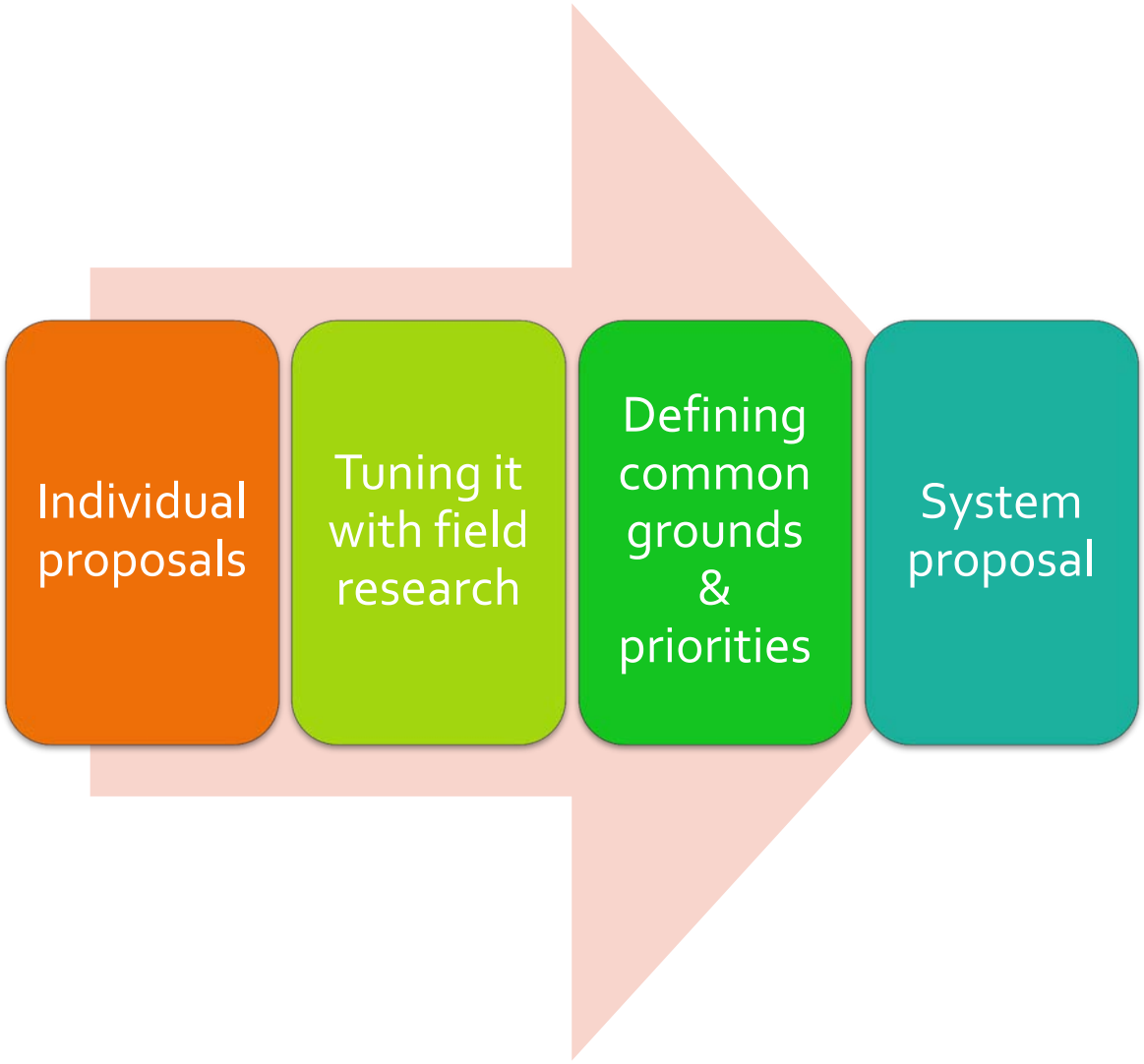

Health & Happiness → Life quality, Citizens' empowerment, Sustainability measurements

Public space → Tourism burden, Public safety, Air quality, Attractiveness

Materials & Waste → Open systems, Local production & consumption, Materials cyclability

Leisure & Knowledge → Citizens' knowledge and awareness of sustainability, Tourists involvement

Towards a system's proposal



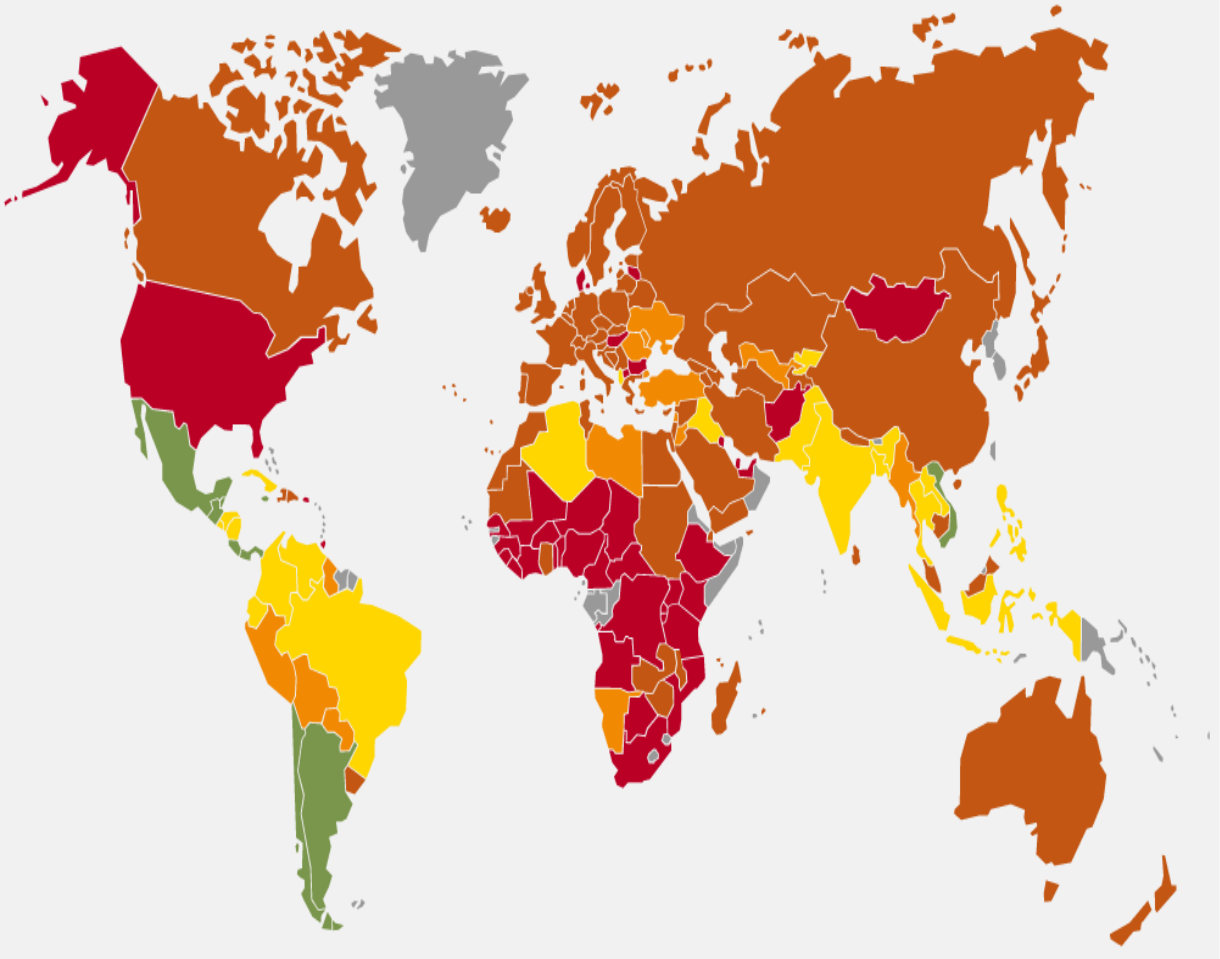
System State

- How to measure the current state and the proposed improvements?
- How to sell the idea (need) of sustainable Texel?

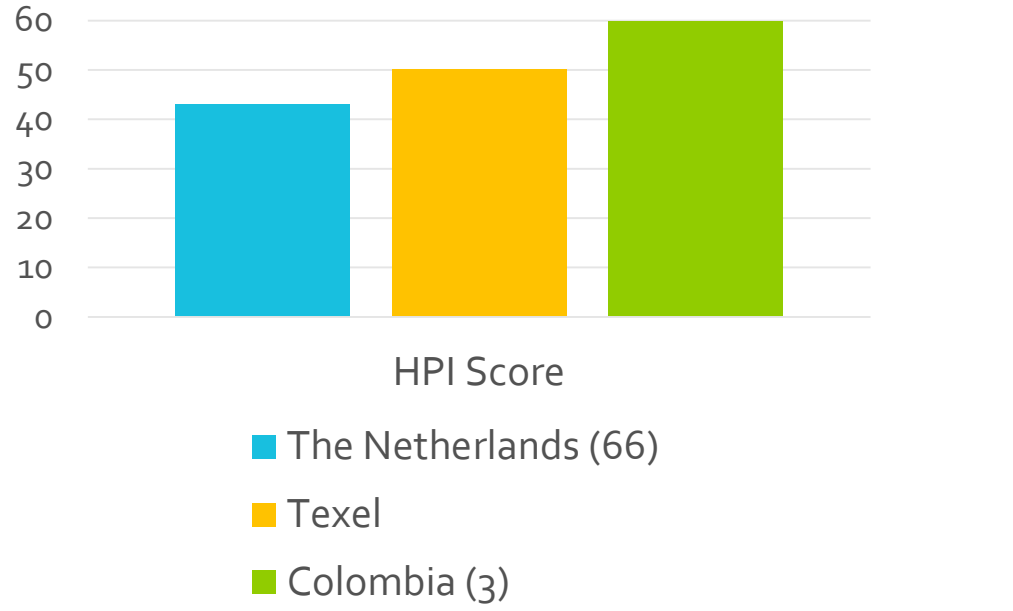
$$\text{HPI} = \frac{\text{Life expectancy} \times \text{Life satisfaction}}{\text{Ecological footprint}}$$

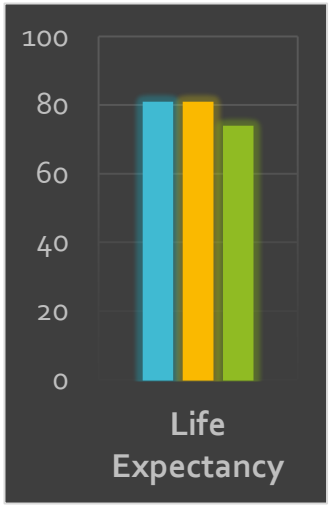
Happy Planet Index

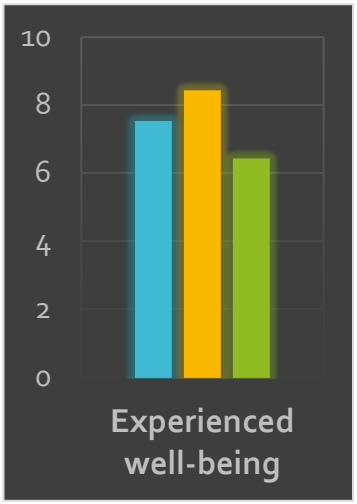
- Top 1: Costa Rica with 64 points out of 100

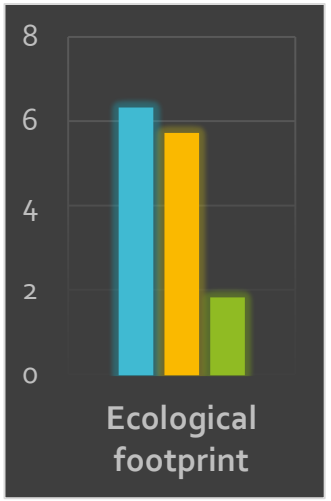


Happy Planet Index

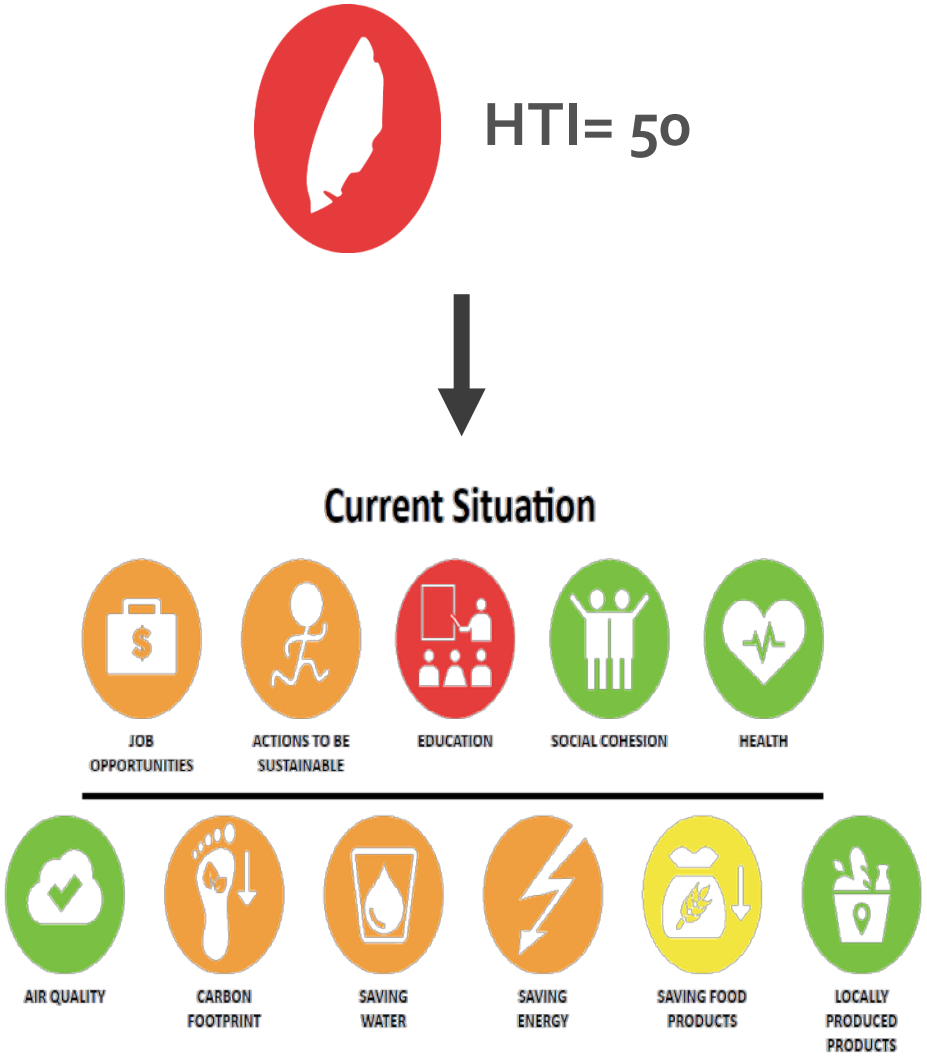








Happy Texel Index



System proposal

- Identification of a higher need for:
  - Cooperation
  - Inclusion
  - Recognition of current initiatives
  - Happiness while being sustainable

Proposal

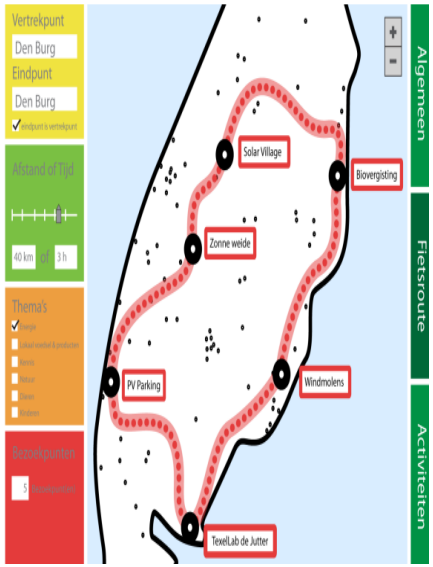
I. Overarching goal: The Jutter 2030 Network

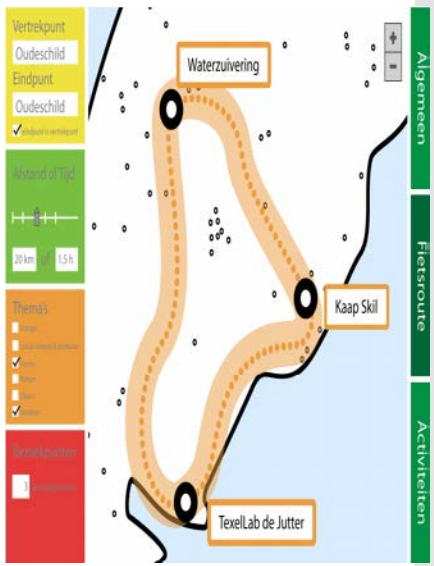
- Enhance connections to accelerate the transition to a self-supportive and a sustainable Texel.
- 3 initiatives

Initiative 1

1. Knowledge Routes

- Focused on existing initiatives.
- Potential as a knowledge catalyst.
- Texel common identity as a sustainable island





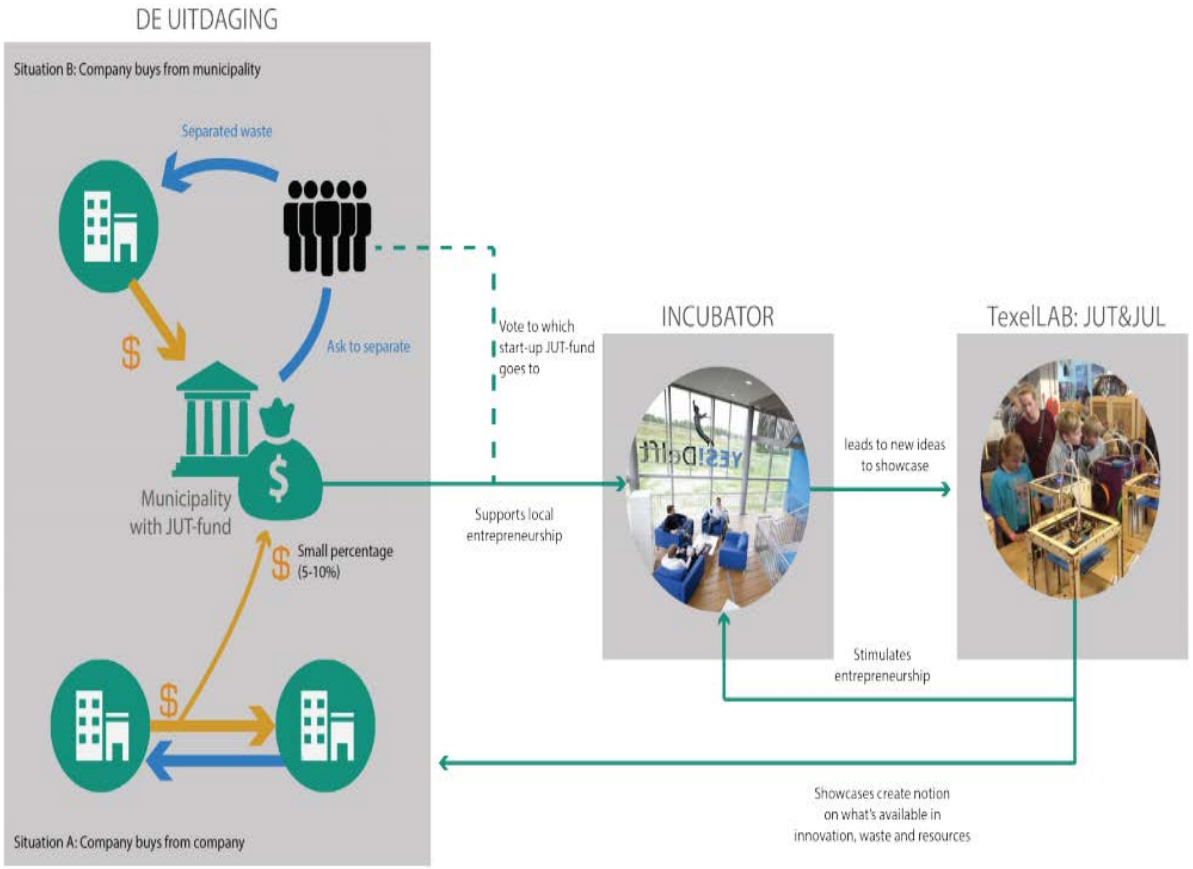
Initiative 2

2. The JUT-program (JUT: *van prut naar nut*)

- Stimulates entrepreneurship
- Projects to create transparency and increase value:
  - De Uitdaging: marketplace of waste among companies
  - TexelLab: Showcase local sustainable initiatives (Playful)
  - Incubator: Tools and space to accelerate growth

Initiative 2

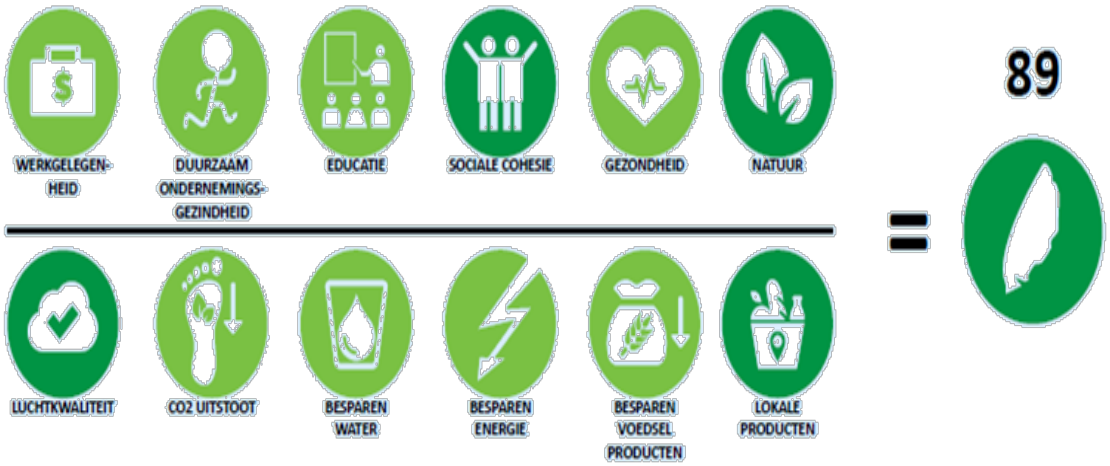
2. The JUT-program



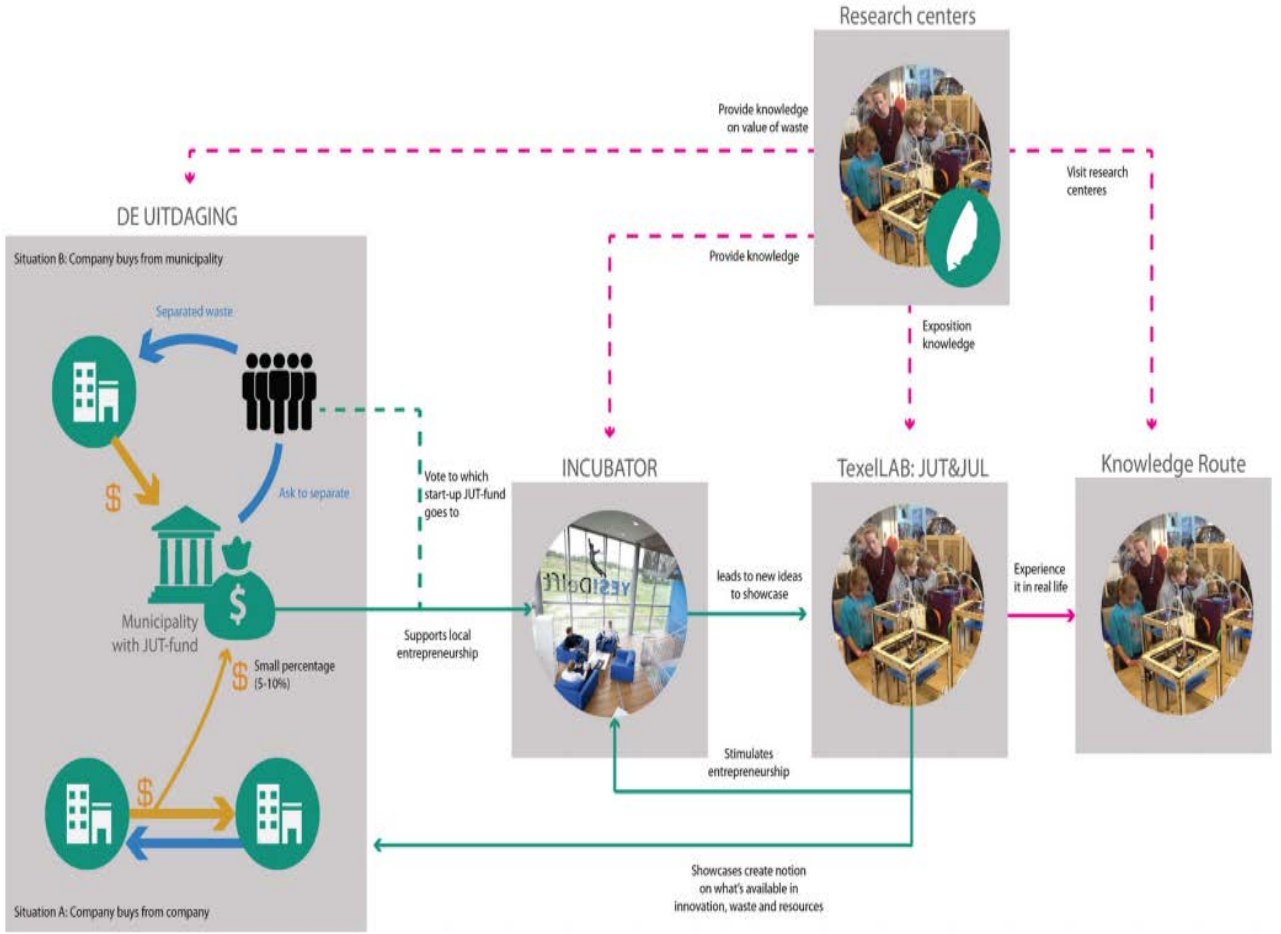
Initiative 3

3. Increase the HTI to 89

- Measurements
- Monitoring and evaluation
- Setting priorities
- Aligning actions



The Jutter Network



Personal reflection

- Challenge yourself to have a broad vision
- Individual research stimulates creativity
- Group research stimulates prioritization
- Think about how to share your knowledge
- Be open and establish several connections

Challenge: Design for 100% self-sufficiency in 2065

Which group investigates which sub-system?

1. Rank topics according group preferences
2. Randomly select a group to make a motivated choice

Learning by doing research

Research activities:

- Read literature
- Study the current ST system and daily life
- Explore new technologies, ideas ….
- Imagine the future ST system and daily life
- Design pathways how to govern change from the current to the future
- Reflect on conclusions and recommendations
- Consider what you can contribute

Activities and assignments

- Join 6 meetings and the bubble week at Texel
- Read and reflect on the literature
- Write 7 columns, one each week

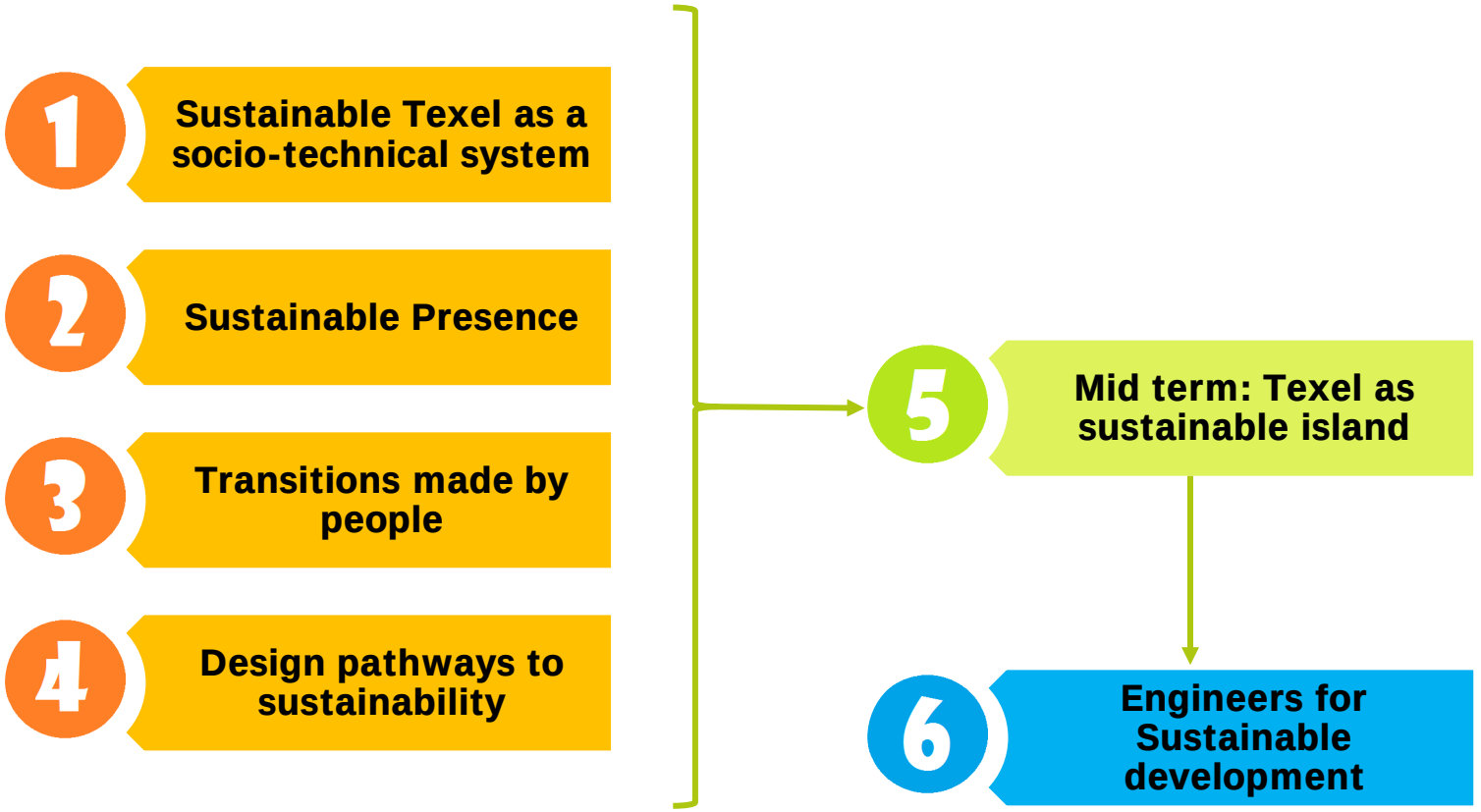
Group activities and assignments:

- Write and publish weekly chapters on group research
- Plan, perform and report on 2 interviews
- Organise your field research and site visit at Texel on Tuesday afternoon 12 January 2016, 13:00-17:30 hrs
- Discuss on literature and apply to the sub-system
- Complete the preparatory study report

Texel challenge

- Contact with locals, field research
- Integrate sub-system visions into overarching proposal for a transition pathway towards a sustainable Texel
- Improve sub-system pathways
- Present an attractive design to the Texelars

Weekly meetings



1 column and 1 chapter per week

Deadline*	Individual	Group
15 November 2015	Column week 1	Chapter 1
24 November 2015	Column week 2	Chapter 2
2 December 2015	Column week 3	Chapter 3
10 December 2015	Column week 4	Chapter 4 Report on interviews that serve as input for all chapters
14 December 2015	Column week 5	Chapter 5 Proposal for field research
6 January 2016	Column week 6	Improved final chapters
20 January 2016	Final column 7	

1 Sustainable Texel as a socio-technical system

Socio-technical systems

- Technological artefacts do not operate in isolation
- But its functioning is highly dependent on its interplay with and embedding in ensembles of other technical and non-technical elements
- (Borras & Edler, 2015)

Batteries

Insurance conditions

Electric engines

Software

Voluntary standards

Charging infrastructure

Regulation

Consumer demands

34

Socio-technical systems

Articulated ensembles of social and technical elements, which interact with each other in distinct ways, are distinguishable from their environment, have developed specific forms of collective knowledge production, knowledge utilization and innovation, and which are oriented towards specific purposes in society and economy.

Borrás (2015: 11)

Sustainability transition

a radical, structural change of society that is the result of a coevolution of economic, cultural, technological, ecological, and institutional developments.

Pesch (2015)

But … How to steer on transitions

- political institutions have limited capabilities to ‘steer’ due to the dynamics and complexity of ST systems
- ST systems are not influenced by state actors alone

- Governance can vary by nature of coordination, and nature of actors (Borras, 2015:13-15)

Governance of change

Borrás (2015: 25)

Figure 2.1 Three pillars to understand governance of change in STI systems

Chapter 1: Explore the sub-system and set research objectives

- **1.1.** The socio technical system and sustainability transitions: Introduce and discuss ideas and concepts from literature, in order to apply in the following sections.
- **1.2.** Describe in detail the current sub-system as a socio technological system
- **1.3.** Outline comparably the future socio-technological system (50 years, 2065) starting from the societal need or innovative technology.
- **1.4.** A detailed description of the sustainability challenge Texel is facing with regard to the sub system

Group work

- Discuss in your group what the sub-system is you are going to study and design,
  - What's the focus: a technological artefact like a car, a societal need for individual transport
- Sketch the current sub-system as a socio technological system
- Post your first article on gingerresearch today!

- At 17:10 pitch the first sketch of the sub system.

Engineering for sustainable development

Learning objectives

- Experience complexity, tensions and dilemmas that come with sustainable practices and required interdisciplinary efforts.
- Consider their role as an engineer with regard to sustainable development and reflect on personal educational objectives, professional values, ethics and beliefs.
- Analyse (im)possibilities and design pathways of transitions to sustainable futures of sociotechnical systems.

Final assessment criteria

- All assignments should be handed in, and actively contributed to by assigned students.
- All assignments and chapters are submitted in time, reflect serious work and professionalism by individuals and groups.
- Group chapters form a coherent book that reflect about sufficient hours of work. The chapters show informed reasoning.
- Personal profiles reflect connectedness to others, contributions to research, and fascinating columns.
- Grading ...

Grading

Assignments	Level	Criteria	%
Research contributions	System Texel	Adequate assignments; Quality of synthesis report; Coherence sub-systems; Inspiration; Use of scientific knowledge and insights.	40
'Pre' group report	Sub-system	Depth, quality and coherence of analysis and design; Ambition and creativity; Use of scientific knowledge and insights.	60
Columns	Reflective	Reflection; Reasoning; Style.	+/- 1 point

REGENERATE INORGANIC WASTE

Texel produces 700 kg waste per inhabitant every year. Due to the many tourists visiting the island, this amount is much higher than the average 518 kg per person the mainland is producing.

How could materials in the future be circulated on the island? If locally treated, would that provide energy as well? How can materials be reused for other needs like custom made souvenirs, sustainable housing, or clothing?

MANAGE ORGANIC MATTER

At Texel, organic waste from households and restaurants is collected bi-weekly. As much as 35% (2013) of the organic waste is left with the general (mainly inorganic) waste., but fertilizers are 'imported'.

How can organic matter in the future be recycled and/or upgraded on the island to maintain quality?

CLOSE THE WATER CHAIN

In theory there is sufficient freshwater at the island to abstract sufficient water for drinking; the main problem however is that both rain and consumption of fresh water are not equally distributed over the year. Moreover, a lot of fresh water is pumped out every year.

What innovations can optimize the water chain, and how can the water chain be

LIVE WITH SALINATION

Farmers, nature conservation and water managers currently perceive salination as a major threat that pushes the problem of the distribution of freshwater even further. Imagine that Texel no longer fights against salination, but would 'live with nature' and make use of salt and brackish water, and be more thrifty with the drain-off of freshwater.

How can land use match future soil, salt and water conditions?

LIVE FROM THE SEA

The seas surrounding Texel seem promising for new technologies seaweed farming. Seaweed is super food, not only for people but also for economy.

How may such a seaweed-based Texel look like and how can it contribute to self-sufficiency?

FEED TEXEL

Currently inhabitants and tourists consume food from the main land and abroad; and the world is fed by Texel. Texel produces many local products. These form however only a small amount of daily consumption at the island. And export is an important source of income for agriculture.

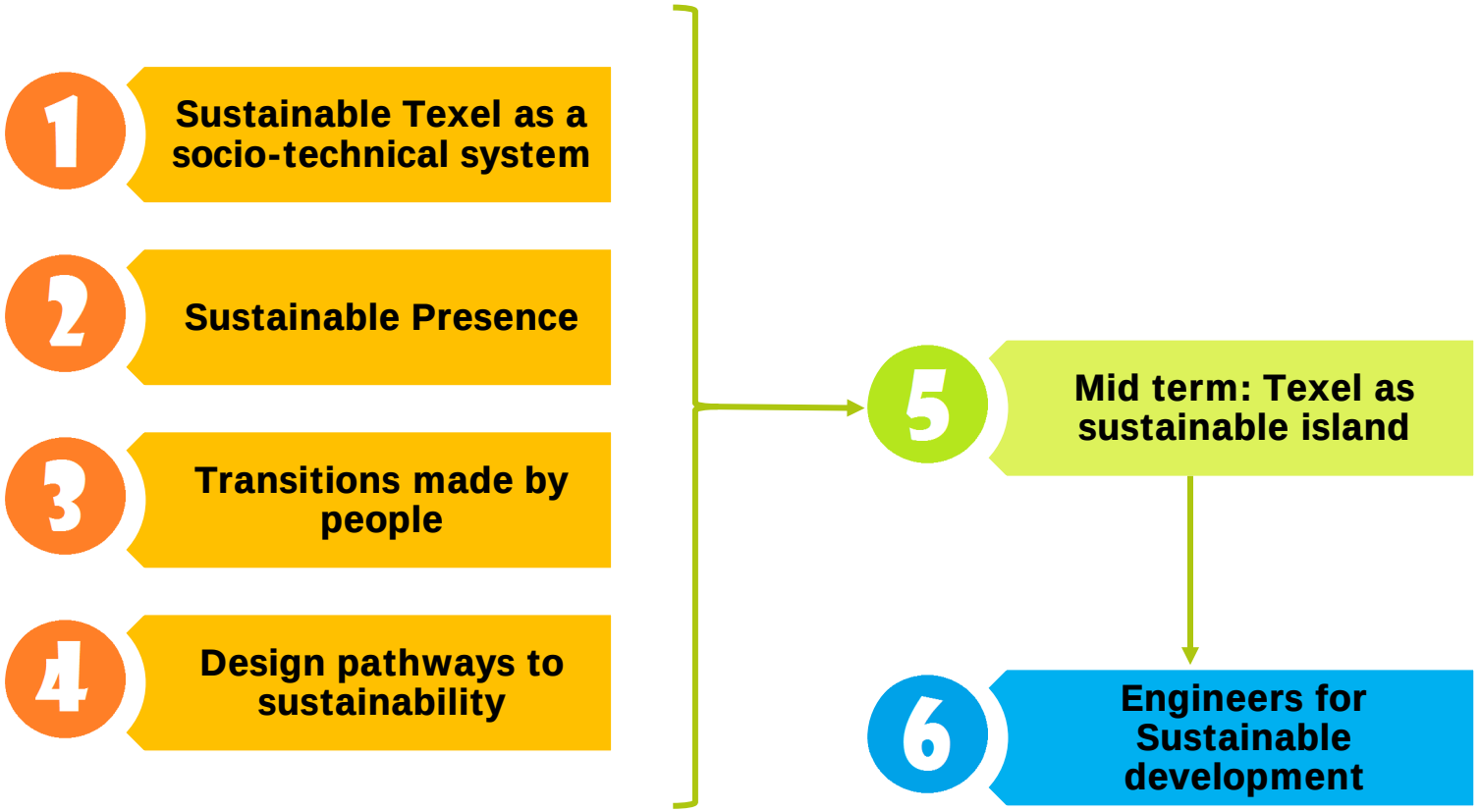
How can the food consumption been matched with island production?

TEACH YOUR OWN

Currently the islands population decreases. On a daily basis, many commute to the main land for work and study. Youngsters never learn to live on the island, since their main activities happen elsewhere. At the same time, there is a societal trend towards distance working and online learning enabled by ICT technologies.

How can the system for life-long learning at the island look like?

6 meetings


1
Sustainable Texel as a socio-technical system
2
Sustainable Presence
3
Transitions made by people
4
Design pathways to sustainability
5
Mid term: Texel as sustainable island
6
Engineers for Sustainable development

Socio technical system

Engineering for sustainable development

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