

# Leren van ervaringen in geotechniek Vertaald naar uitdagingen!

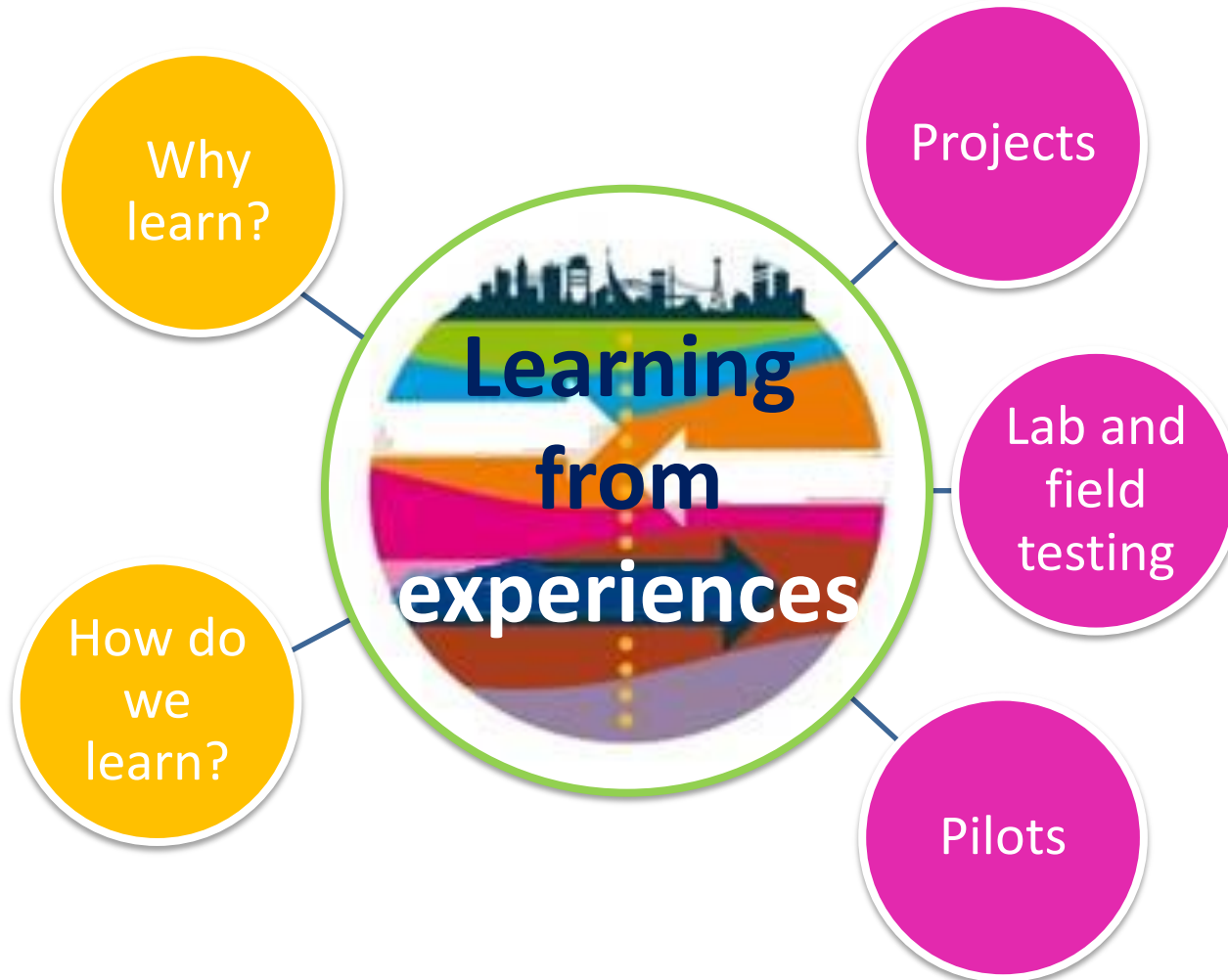
**Dr. Ir. Mandy Korff**

slides in English for non Dutch speakers

**Deltares**  **TU Delft**



# Presentation overview



# Trends and observations:



- ❑ Failure costs still have a large impact on time, money, image, and (quality of) life!
- ❑ Lack of skilled people in construction
- ❑ Construction industry contributes little to sustainability and green challenges

**Challenge:**

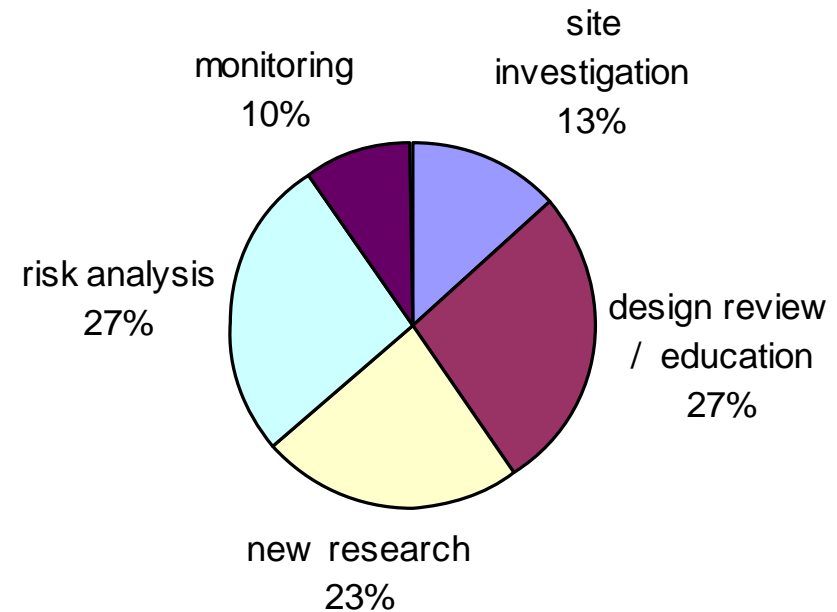
**How can we learn (and improve!) faster?**

# (How) could failures have been avoided? Based on 50 excavations:



- In 87% of claims the knowledge to prevent problems existed, but for various reasons was not used.

- Most relevant measures (in hindsight):



# Causal analysis from literature



The top 3 reasons costs of failure USP Marketing Consultancy (2007):

1. Lack of communication and information transfer
2. Inadequate attention for feasibility during design phase
3. The delivery of quality to end user not being the highest priority.

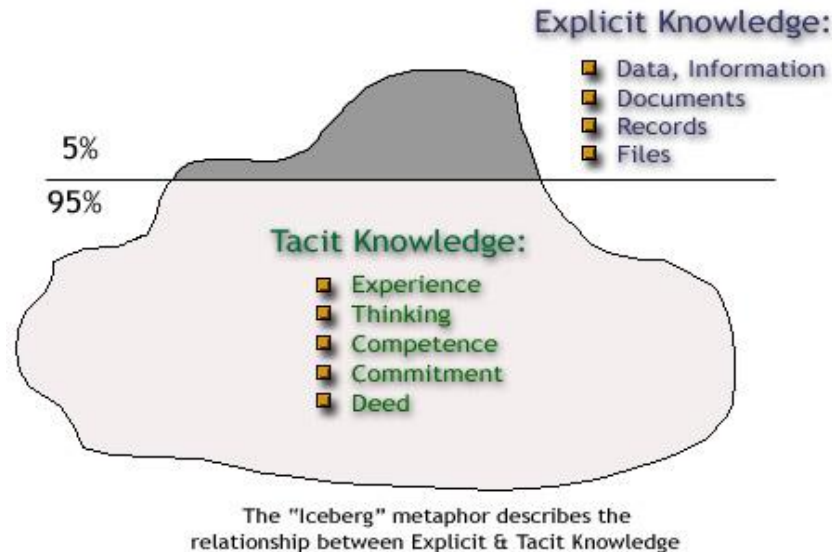
Potential improvements:

- Identification of common and recurring mistakes and errors that could be considered at the beginning of future, similar projects and better consideration of the training needs and meeting training targets of employees. (Hall and Tomkins, 2000)
- Spending 1% more on prevention efforts reduced the failure costs of construction from 10% to 2% (Roberts ,1991)



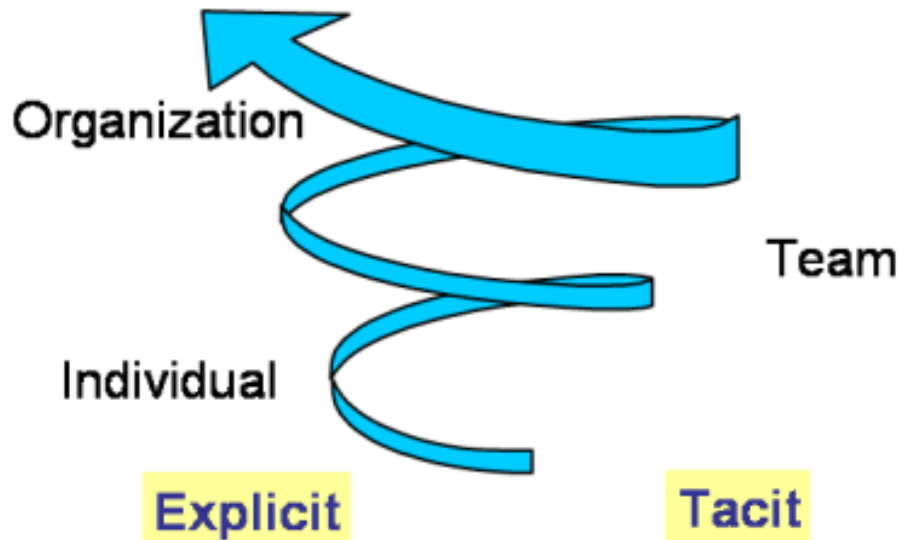
# How do we learn?

Learning = the process whereby **knowledge** is created through transformation of **experience**.



- 85% of project personnel gain their knowledge, both explicit and tacit, through experiential learning (Crawford and Gaynor, 1999)
- Not only individuals need to learn, but also organizations.

# Learning organizations

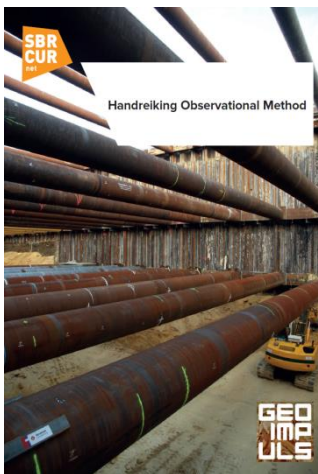


- Successful project-based organizations:
- capture their learning from successes and failures on past projects
  - expose project professionals to organizational learning
  - encourage project teams and professionals to reflect on their own experiential learning

(Pinto 1999)

Limited evidence of systematic learning  
between projects

# Learning methods from cases







# Monitoring lessons



Complete picture of initial conditions



RISK DISTRIBUTION

CLIENT



CONTRACTOR



Distribute risks wisely

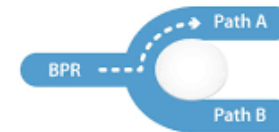


Work together with all stakeholders

Deal with damages generously



Chose redundancy



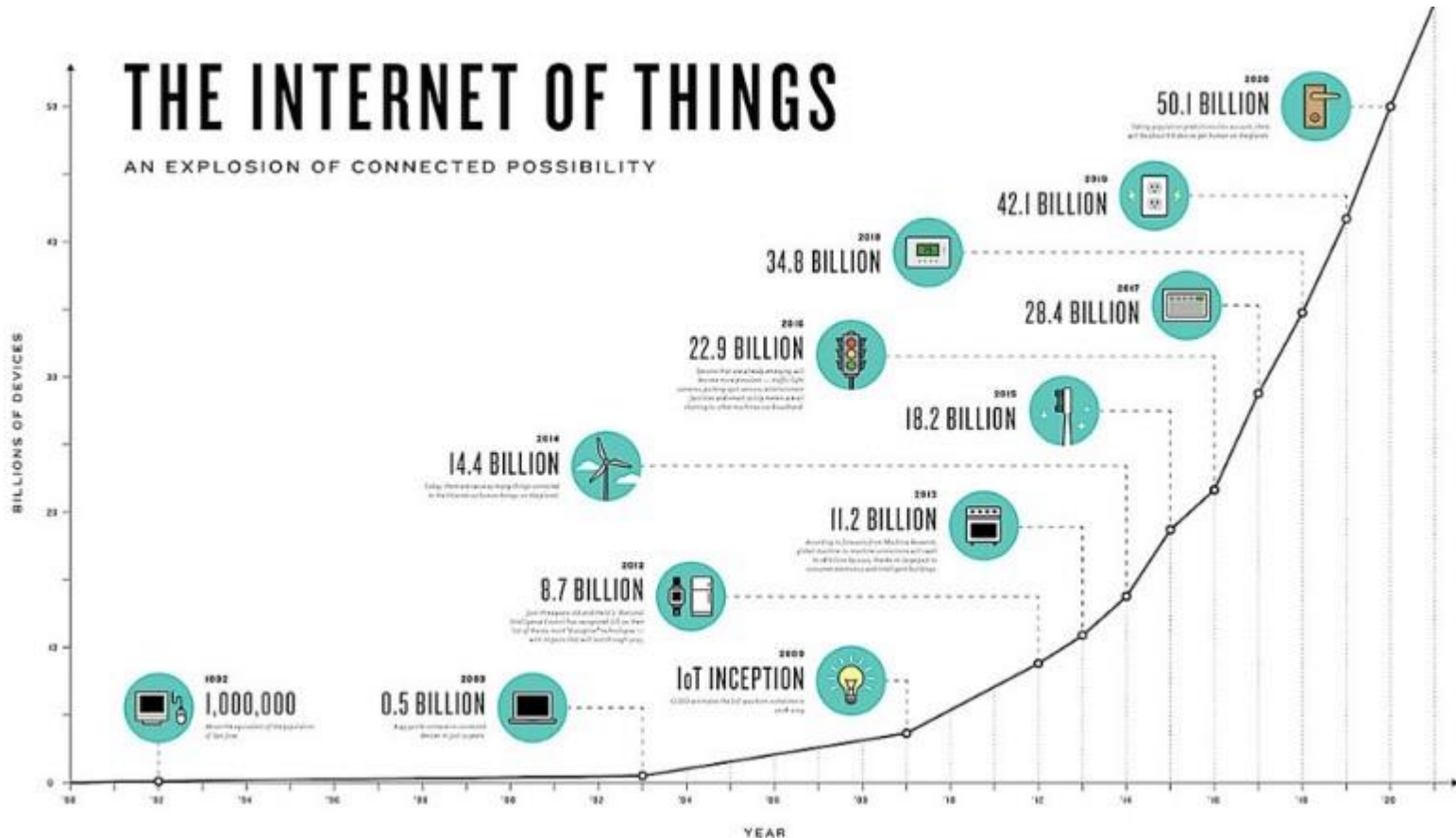
Get information out of your data



Be sensitive to the surroundings



# Are we learning **fast** enough?



Source: Gartner (November 2015)



# Are we learning **fast** enough?

The [Google Brain team](#) combined two techniques:

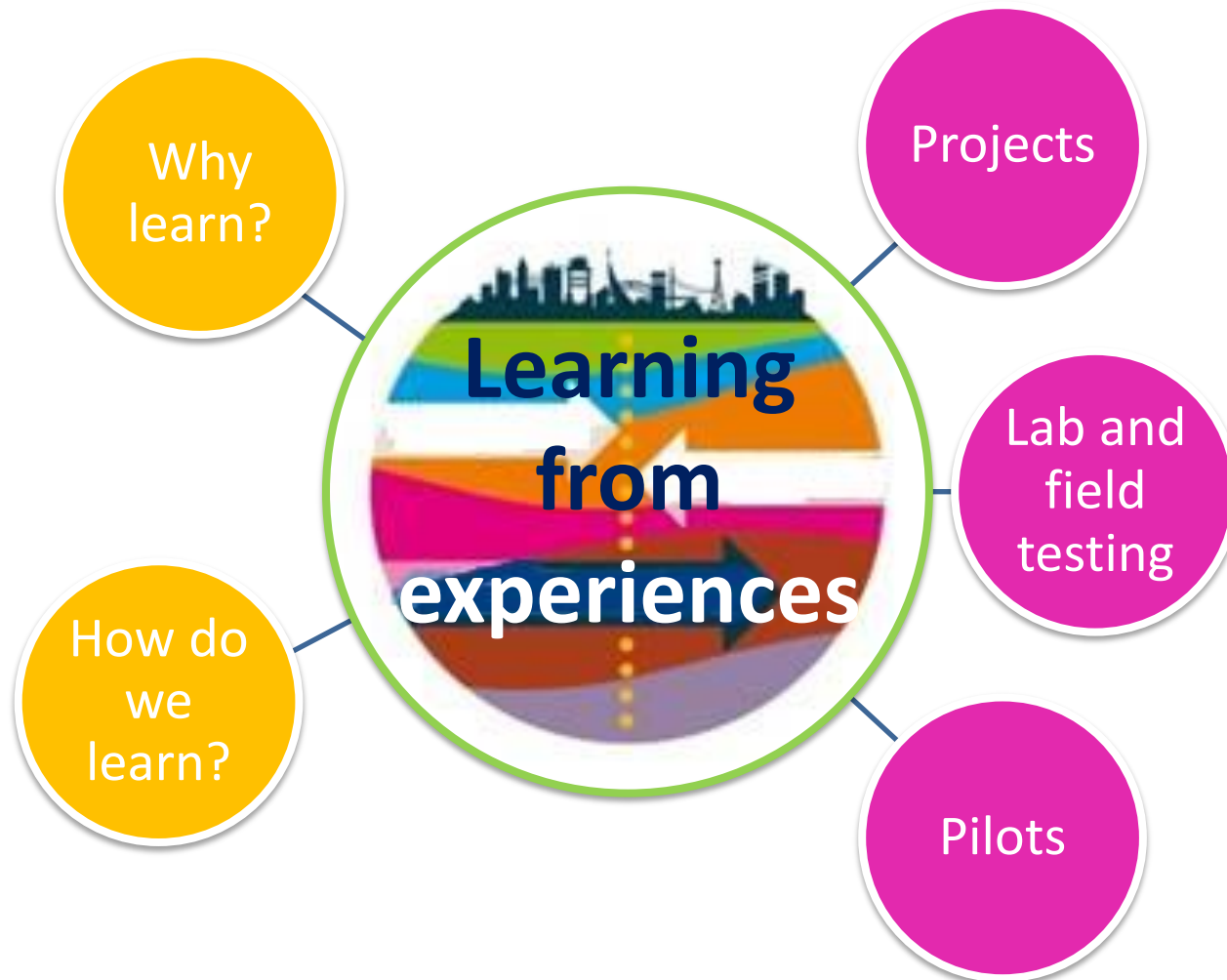
- cloud robotics, robots sharing data and skills with each other
- deep neural networks to let robots learn for themselves.

RESEARCH QUESTION I  
IS THE GROUP OF ROBOTS ABLE TO  
LEARN TO AVOID OBSTACLES?



**SWARMING ROBOTS THAT EVOLVE,  
LEARN, AND TEACH EACH OTHER**

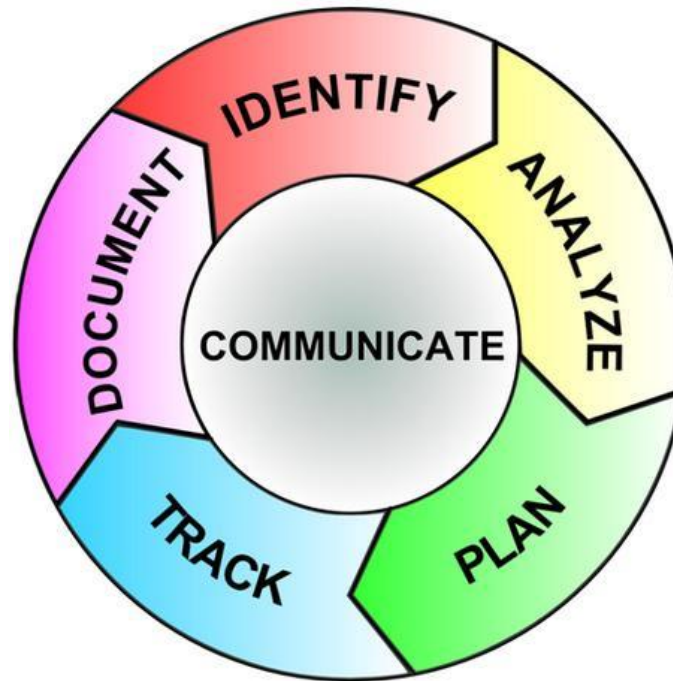
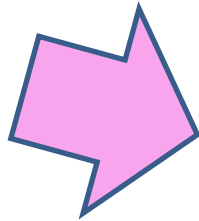
# Presentation overview



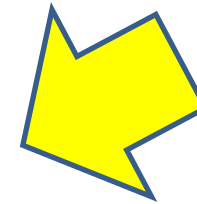
# Learning from projects: risk management



LeerScan

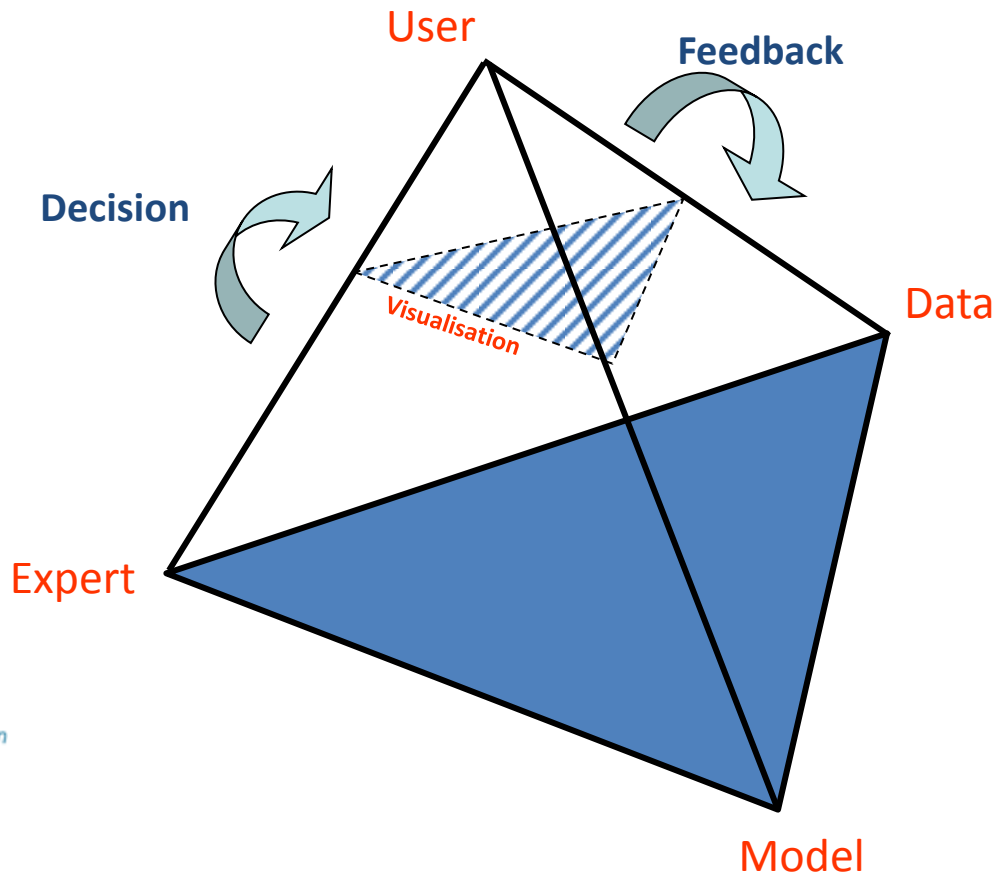


(Geo)RisicoScan



**Challenge:** Start reflecting actively

# Learning from projects: GeoBrain (1.0)



# Currently over 3000 projects



Exit Search Predict Statistics Information

**Search for**

- Drive sheet piles
- Extract sheet piles
- Drive prefab piles
- Drive vibro piles
- Horizontal directional drilling
- Vibrations

**Search by map | Browse through experiences | Search by CPT**

Drive sheet piles

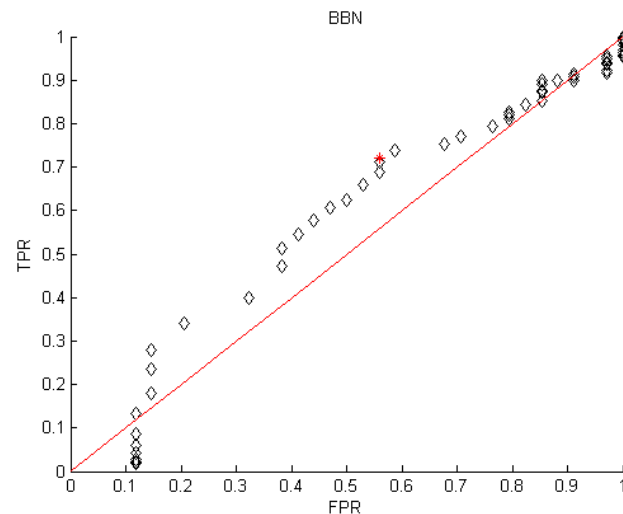
Search the experience database for 'Drive sheet piles' by using 'Search by map'

Zoom in to view individual experiences. Zoom out to view the total per area.

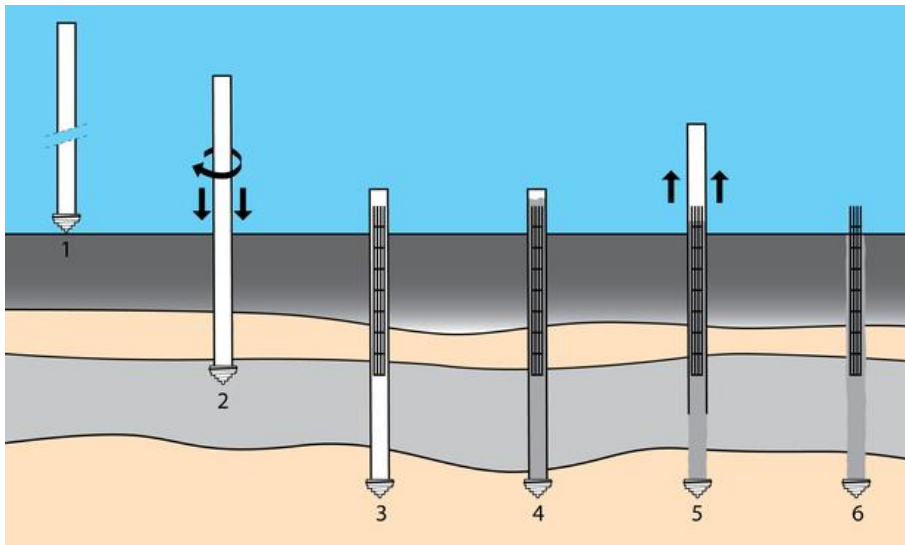
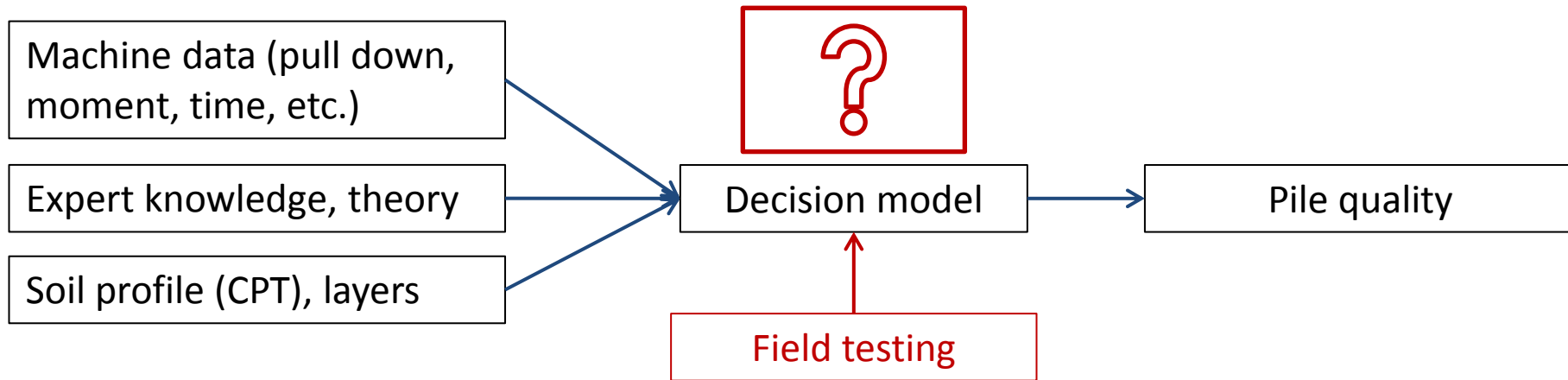
Standard questionnaires  
 Through the internet  
 (www.geobrain.nl)  
 By contractors

## Performance indicators

	Total (%)
1. Damage	
2. Number of sheet piling	
3. Not achieving depth	1.40
4. Damage to sheet piles	0.40
5. Burned interlocks	0.20
6. Breaking out elements	0.20
7. Driven out of interlocks	0.12
8. Lowering of adjacent piles	0.24
9. Problems with hammer/vibrator	0.03
10. Sloping of sheet piles	0.16



# GeoBrain 2.0: Learning from process parameters pile quality



## Consortium

GeoConsult B.V., BAM Speciale Technieken, Fundex Companies, Van 't Hek B.V., Volker Staal en Funderingen, Bauer Funderingstechniek B.V., het voormalige samenwerkingsverband Geo-Impuls en Deltares

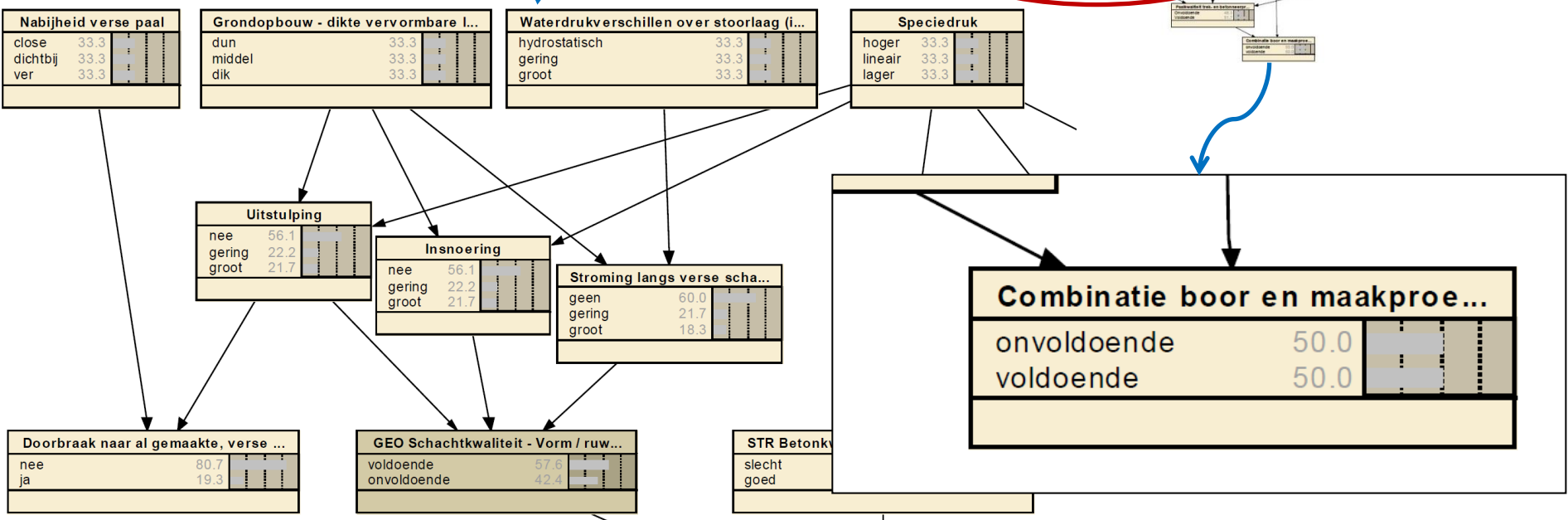
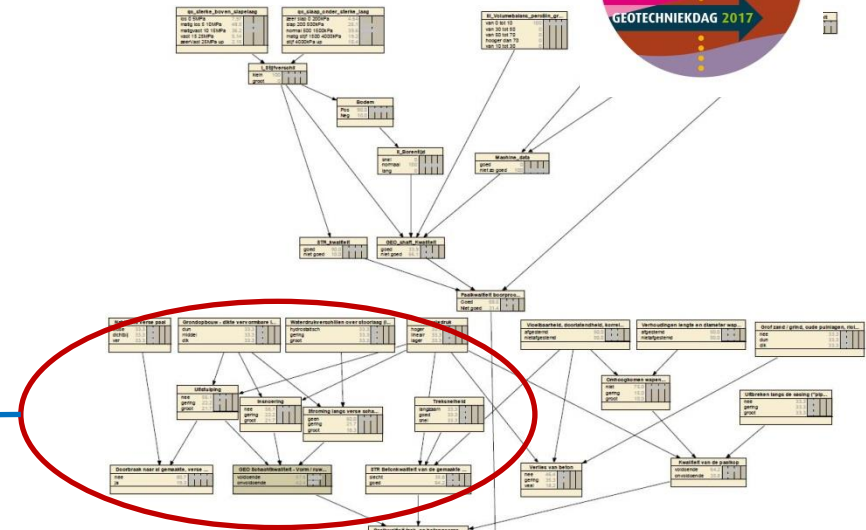


# Bayesian Belief Network (BBN)

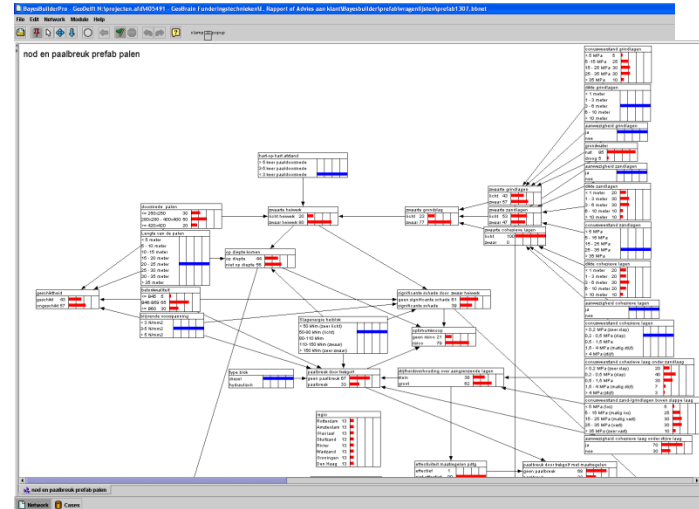
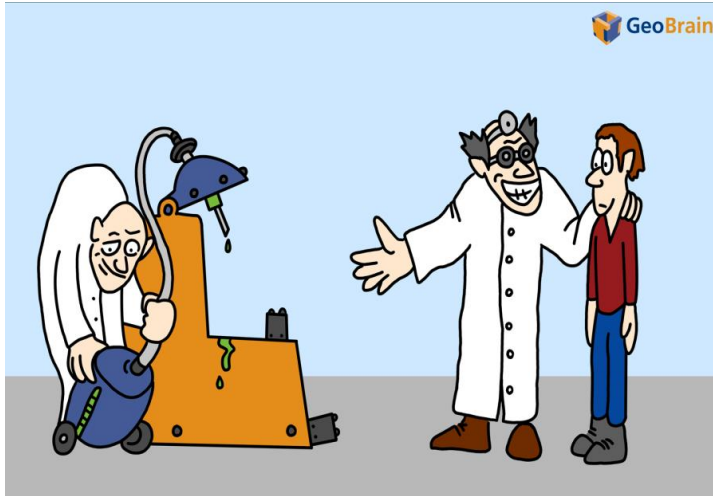


## Challenges:

- Field testing (pile load tests)
- Modelling: include grout injection, pattern recognition
- Guideline



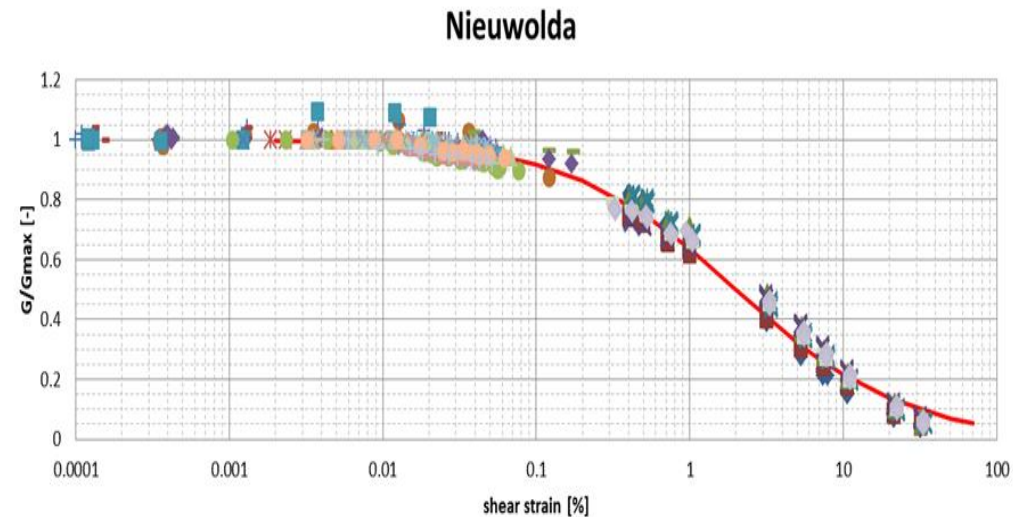
# Challenges GeoBrain2.0



It is possible to learn from practical projects if the overall gain is large enough for all parties involved.

But: it requires large amounts of data to be statistically sound

# Learning from lab and field testing - peat



Degradation curve  $G/G_{0}$  vs shear strain

**Challenge:** dynamic testing of very soft soils (peat)

Classification tests ( $\rho$ ,  $\rho_{dr}$ ,  $\rho_s$ ,  $w$ ,  $LOI$ )

Resonant column tests + bender element tests

Cyclic and static DSS tests

K0-CRS tests

Tests performed at Deltares, RUB Bochum, NGI



# Learning from lab and field testing - sand liquefaction



**Challenge:** first time in Europe taking soil samples in frozen sand

Testing in special Triaxial setup in temperature controlled conditions for liquefaction sensitivity

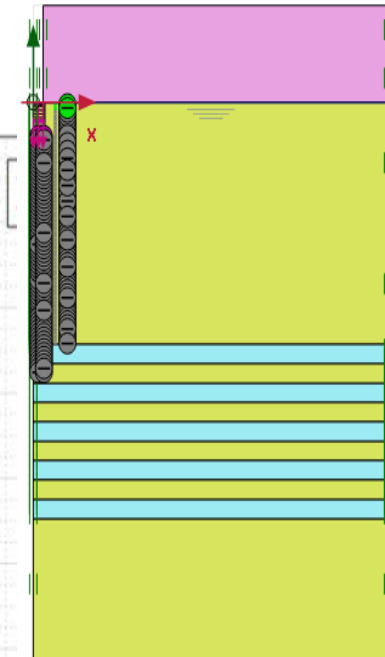
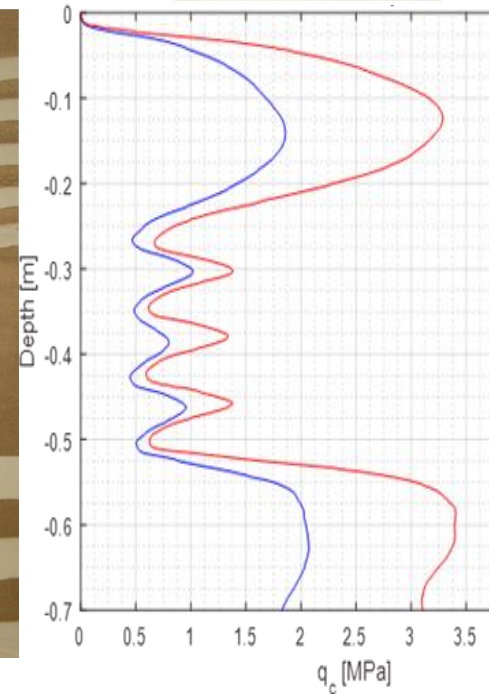
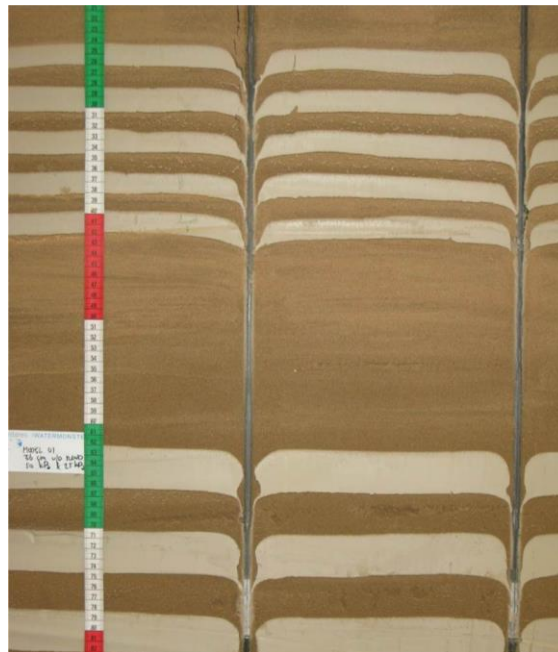


# Learning from lab and field testing

## - layered soil



CPT in sand layers influenced by presence of clay layers (and v.v.)  
Important for liquefaction triggering assessments



# Learning from pilots



Open voor publiek

Bouwbesluit staat uit

Validatie van methodes  
& materialen

Er wonen & werken  
mensen

The Green Village is als proeftuin een aantrekkelijke locatie in het hart van de TU Delft

**THE GREEN  
VILLAGE**

# Challenge: Circulair bouwen

legt u het fundament?



Funderen op water met zelfhelend beton?

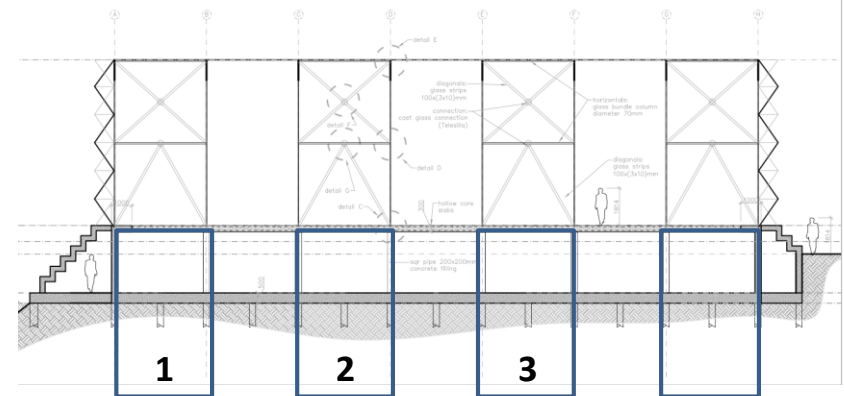
Fundering op staal met grondverbetering?

3D-print fundering?

schroefpaal-fundering met vijzelsysteem

Prefab paal met 100% gerecycled beton?

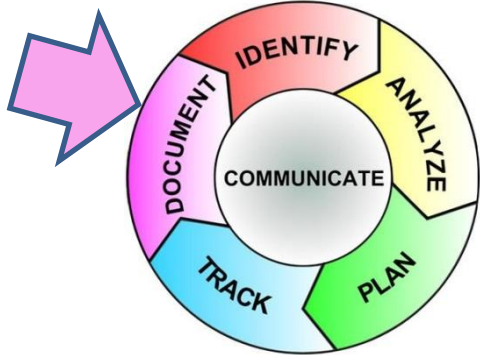
**uw innovatie?**



# Summary Challenges



- Reflect and learn - close the loop



Start reflecting actively:

perform learn scans!

Give your feedback on how you would like to learn in the Deltares booth

- Circular construction methods for foundations

Participate and register at booth of Ministry of Infrastructure and Water





# One last bonus challenge:



6 dagen, 600 km, 6.000 hm

Februari 2019

Ontdek de parel van Afrika

## Uganda Challenge Highlights

<http://africaclassic.nl>

Zie met eigen ogen het werk van Amref Flying Doctors

Ervaar de rijkdom aan flora en fauna

Overnacht aan Murchison Bay in Lake Victoria

Fiets door de sloppenwijken van Kampala

Spot de laatste 20 neushoorns van Oeganda

Rijd door het regenwoud met talloze apen in de bomen

Maak een boottocht over de Nijl tussen de nijlpaarden

Kampeer aan Lake Albert met uitzicht op Congo

Ga op fiets safari tussen de leeuwen, olifanten en giraffen

Raise  
money  
for  
AMREF  
Flying  
Doctors

**My Challenge:** find 10 company teams  
(60 people) to join the Uganda Challenge





Thank you very much for your attention!

Let's get started on the challenges **today**

