



System-to-System Data Communication and Farm Management Information Systems (FMIS)

Workshop on Modernising Agricultural Statistics
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General idea

4.4.1 Fosfaatproductie in dierlijke mest per landbouwgebied in 2016

kg fosfaat per ha
■ Minder dan 35
■ 35 tot 65
■ 65 tot 100
■ 100 of 120
■ 120 of meer



Oogstraming

0002345678
4567979
Controler of informatie in het venster zichtbaar is
Periode
Statistiekjaar
Inhoudatum
PARAMETER
Correspondentnummer
RZ3861 - 123



“Why do I still have to do this manually?”

Pre-filling:
How to make this work?

Pilot with
 JOHN DEERE

Pre-fill

A Oogstraming akkerbouw 2016

Dag en productie	Totale productie	Percentage
Geografische opbrengste	(Sluit niet per hectare)	
Gransen met korrel		
Wintertarwe		
Zomertarwe		
Wintergroen		
Zomergroen		
Rogge		
Haver		
Triticale		
Kornstelsel		

Technoboer heeft de toekomst

200+ registries

Techno farmer has the future

Smart industries
Smart farming



©John Deere

MyJohnDeere data



- Data: operations per field (event-based)
- Almost 100% overlap with data in Crop Yield Survey questionnaire
> MyJohnDeere is (potentially) a good source!

A Crop yield survey

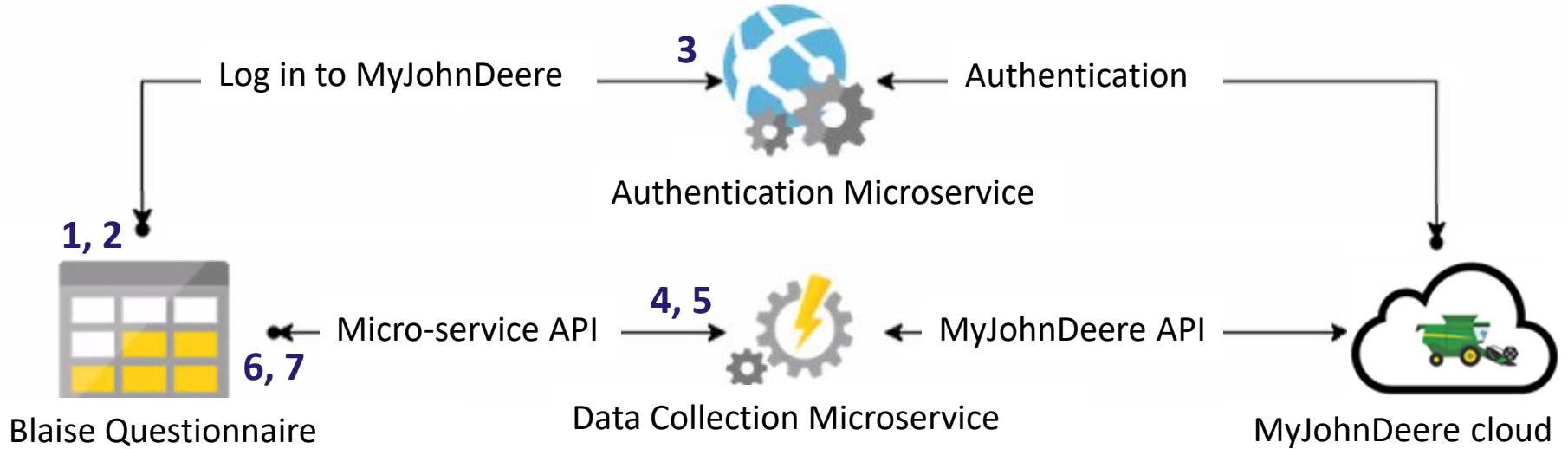
	Yield			Crop failure
	Harvested area	Total yield	Moisture content	Area not harvested
A1 Grains	hectare	Tons	Percentage	hectare
Winter wheat	<input type="text"/>	<input type="text"/>	<input type="text"/> %	<input type="text"/>
Summer wheat	<input type="text"/>	<input type="text"/>	<input type="text"/> %	<input type="text"/>
Winter barley	<input type="text"/>	<input type="text"/>	<input type="text"/> %	<input type="text"/>
Summer barley	<input type="text"/>	<input type="text"/>	<input type="text"/> %	<input type="text"/>
Rye	<input type="text"/>	<input type="text"/>	<input type="text"/> %	<input type="text"/>
Oats	<input type="text"/>	<input type="text"/>	<input type="text"/> %	<input type="text"/>
Triticale	<input type="text"/>	<input type="text"/>	<input type="text"/> %	<input type="text"/>
Grain corn	<input type="text"/>	<input type="text"/>	<input type="text"/> %	<input type="text"/>

▼ **calculated_crops:**

- ▼ winter_wheat:
 - harvest_area_ha: 70
 - production_t: 700
 - no_harvest_area_ha: 5
 - humidity_prct: 5
- ▼ rye:
 - harvest_area_ha: 4
 - production_t: 40
 - no_harvest_area_ha: 1
 - humidity_prct: 5
- ▶ corn: {...}
- ▶ seed_onion: {...}

vervolg op volgende pagina

System-to-system data communication



The farmer's completion process:

1. Comprehension
 2. Data retrieval
 3. Computation
 4. Evaluation and reporting
- } Automate



System-to-system data communication

1



Blaise Questionnaire

The farmer's completion process:

1. Farmer logs in to Q

System-to-system

1



Blaise Questionnaire

The farmer's completion process:

1. Farmer logs in to Q

The image shows a sequence of screenshots from the CBS website. The top screenshot is the login page for the 'Centraal Bureau voor de Statistiek' (CBS). It features the CBS logo and the text 'Log in'. There are input fields for 'User name:' (containing '123456') and 'Password:' (containing six dots). Below this is a smaller, semi-transparent version of the same login page. The bottom screenshot is the 'Crop Yield Survey 2022' questionnaire interface. It has a blue header with the title 'Crop Yield Survey 2022'. Below the header, there are fields for 'Due date: 1-1-2023', 'Company name 1', 'Contact person 1', and 'Respondent number 1'. The main content area contains the following text:

Welcome to this questionnaire

How to Complete
We recommend filling out this questionnaire on a desktop computer or laptop.

Explanations
The "?" button indicates additional explanations. Press this button to show these explanations.

Saving
Data is saved automatically only when navigating between pages. If you work for a long time in one page, it is therefore advisable to save the data regularly yourself by pressing the 'Save' button at the top right corner of the page. You can interrupt the fill in process of the questionnaire with 'Save and close' button. Your previously completed answers will then be saved. The "?" button indicates additional explanations. Press this button to show these explanations.

Printing
You can create a PDF of the questionnaire at any time using the "Print" button and save and/or print it for your own use.

If you have any questions
Please visit www.cbs.nl for frequently asked questions about this survey.
If the answer to your question is not listed here, please call us at (045) 570 6400 or send an e-mail to contactcenter@cbs.nl, quoting the correspondence number: 123456789.
We are available from Monday to Friday between 9.00 am and 5.00 pm.

Now press 'Next' to start the questionnaire.

At the bottom of the questionnaire interface, there are two buttons: 'Back' and 'Next'.

System-to-system data communication

1, 2



Blaise Questionnaire



MyJohnDeere cloud

The farmer's completion process:

1. Farmer logs in to Q
2. MyJohnDeere?



System-to-system data communication

1, 2



Blaise Questionnaire

The farmer's completion

1. Farmer logs in to Q
2. MyJohnDeere?

First design

Crop Yield Survey 2022

Due date: 1-1-2023

Company name 1
Contact person 1
Respondent number 1

Authentication



You can use your information from the John Deere Cloud.

Would you like to use this option?

Yes

No

Click on the green button below

 **JOHN DEERE**

Back Next



re cloud



System-to-system data communication

Revised design

1, 2



Blaise Questionnaire

- The farmer's complete
1. Farmer logs in to
 2. MyJohnDeere?



Crop Yield Survey 2022

Due date: 1-1-2023

Company name 1
Contact person 1
Respondent number 1

Authentication

You can use your information from...

Would you like to use this option?

Yes
 No

Back Next



Crop Yield Survey 2022

Due date: 1-1-2023

Company name 1
Contact person 1
Respondent number 1

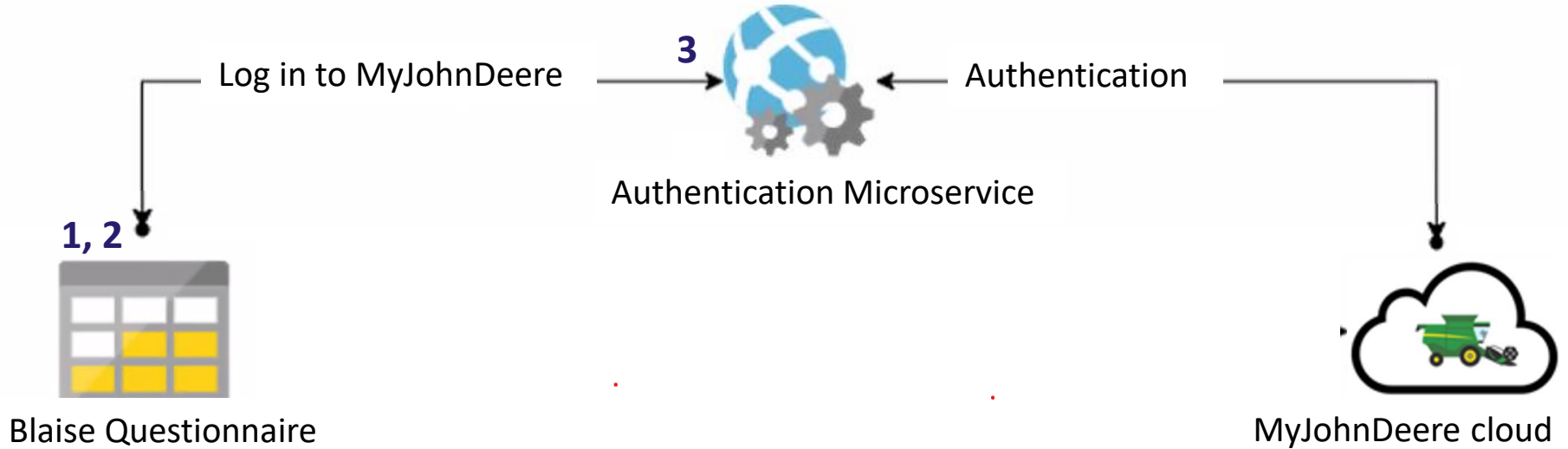
Authentication

Click on "Login to John Deere" to login to John Deere. You will be redirected to John Deere.

Login to John Deere

Back

System-to-system data communication



The farmer's completion process:

1. Farmer logs in to Q
2. MyJohnDeere?
3. Authentication
Import data?



System-to-system data communication

In practice:
more complex
process

1, 2



Blaise Questionnaire

The farmer

1. Farmer logs in to Q
2. MyJohnDeere?
3. Authentication
Import data?

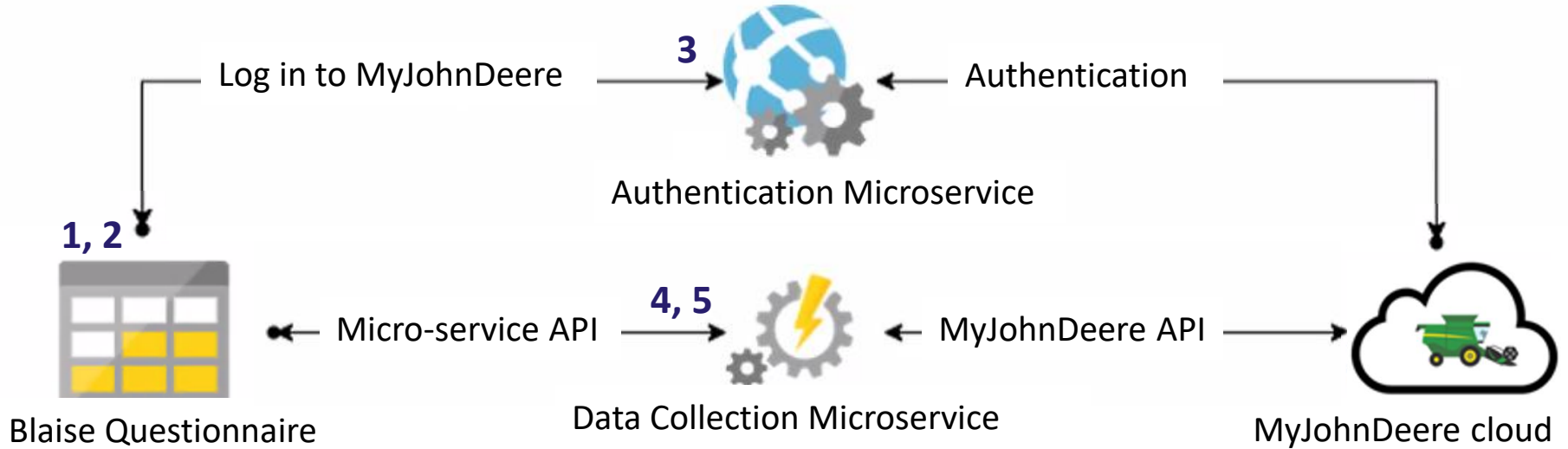
Authentication



more cloud



System-to-system data communication



The farmer's completion process:

1. Farmer logs in to Q
2. MyJohnDeere?
3. Authentication
Import data?
4. Blaise Q <-> Microservice <-> John Deere
5. Data are pre-filled



Crop Yield Survey 2022

Due date: 1-1-2023

Company name 1
Contact person 1

Ophalen data John Deere

Result calculated crops Standard

wintertarwe

harvest_area_ha

production_t

no_harvest_area_ha

humidity_prct

zomertarwe

harvest_area_ha

production_t

no_harvest_area_ha

humidity_prct

wintergerst

harvest_area_ha

production_t

no_harvest_area_ha

humidity_prct

zomergerst

harvest_area_ha

production_t

no_harvest_area_ha

humidity_prct

rogge

harvest_area_ha

production_t

no_harvest_area_ha

humidity_prct

Farmers didn't recognise these totals

▼ calculated_crops:

▼ winter_wheat:

harvest_area_ha: 70

production_t: 700

no_harvest_area_ha: 5

humidity_prct: 5

▼ rye:

harvest_area_ha: 4

production_t: 40

no_harvest_area_ha: 1

humidity_prct: 5

▶ corn: {...}

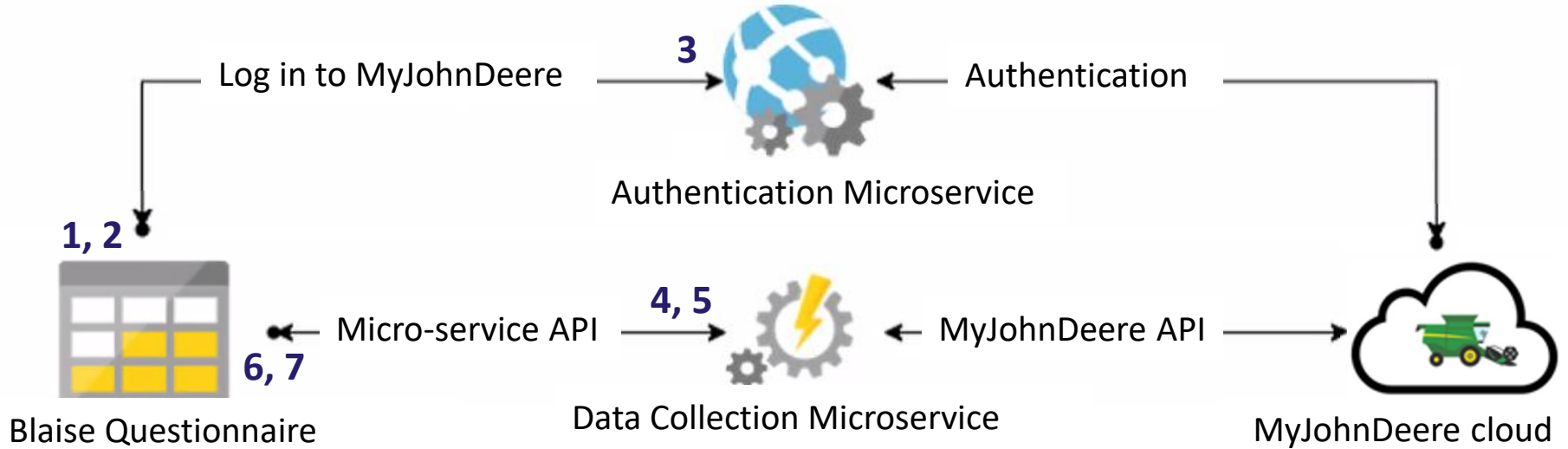
▶ seed_onion: {...}

led

Calculated answers by
Data Collection Microservice
(JSON output)



System-to-system data communication



The farmer's completion process:

1. Farmer logs in to Q
2. MyJohnDeere?
3. Authentication
Import data?
4. Blaise Q <-> Microservice <-> John Deere
5. Data are pre-filled
6. Check, edit, and add
7. Submit



Crop Yield Survey 2022

Due date: 1-1-2023

Company name 1
Contact person 1
Respondent number 1

Winter wheat estimates

Production data from 2021

- Please complete all answer fields and make an estimation if necessary. Enter a 0 in the fields that are not applicable.
- Round up area questions to two decimal places and other questions to one decimal place.

Harvested area of winter wheat

Indicate the total area harvested or to be harvested.

70,00 ha

Total winter wheat

Indicate the total gross weight of all the crops harvested or to be harvested.
The weight of the crop left in the field should not be included.

700,00 ton

Yield per hectare

The yield per hectare seems improbable

Please correct your answer on the total grain corn yield.
Please provide a short explanation otherwise.

10,00 ton/ha

Percentage moisture content

Area not harvested

Area with crop that has not been or will not be harvested.

5,0 %

5,00 ha

Back

Next

on

ion

API



MyJohnDeere cloud

Crop Yield Survey 2022

Due date: 1-1-2023

Company name 1
Contact person 1
Respondent number 1

Submission

This is the end of the questionnaire. Press the "Submit" button to submit the answers to Statistics Netherlands.

Back

Submit

3. Authentication
Import data?

6. Check, edit,
7. Submit

Sandbox

It worked!

- Open data from John Deere
- Virtual farm
- Next:
Technical test:
In theory the system works!



Research questions

Expected effects:

- Reduced response burden
 - Cost reduction
 - Real-time statistics
 - Better data quality
 - More data, more details
- Is this the case?
Assumption: JD data are correct!
- Small-scale pilot**
- How does it work in practice?
 - Farmers: data from the correct farmers (units), contracted businesses, time to extract data, linking the data, trust, user experience
 - Stats NL: legal issues, system adaptations, maintenance, ...
 - Road map for future projects > Conclusions

Pre-test with farmers

- Hard to recruit farmers
 - Farmers who responded to past Crop Yield Survey
 - Via John Deere dealers
 - Farmer's organizations
 - Asking colleagues
 - Via project members
 - Via the Wageningen University & Research in the Netherlands
- 5 farmers
- Interview protocol:
 - Farmers were asked to complete the questionnaire themselves without assistance and think aloud

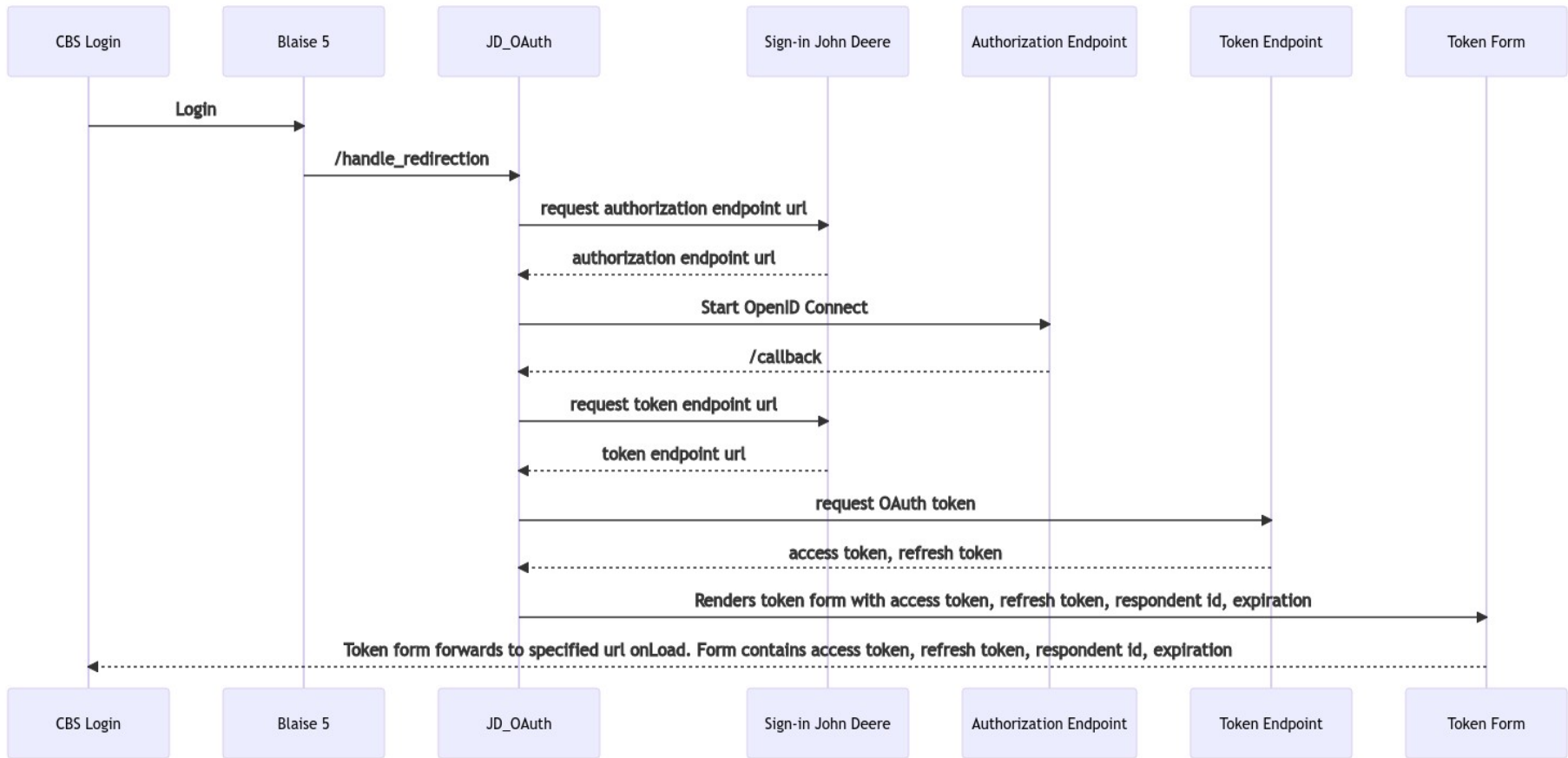


Pre-test with farmers

- Pre-test results:
 - Technical and organizational issues
 - Usability issues (the farmer/user's perspective)
 - Perceived workload
 - Trust
 - Data quality issues
 - General attitude

Pre-test results

- Technical issues:
 - Authentication did not work as intended
 - External MyJohnDeere authentication prior to logging in onto the Q: unwanted two-step login procedure!
 - Major issue!
 - The system showed to be instable in practice
 - Communication between the systems was unreliable at times
 - Communication between departments
 - Not all retrieved data were shown in the questionnaire:
 - System errors
 - winter/summer crops not shown at all



Pre-test with farmers


- Usability issues:
 - The “John Deere” button was not recognized as button
 - How to use the “Back” and “Next” buttons

Crop Yield Survey 2022

Due date: 1-1-2023

Company name 1
Contact person 1
Respondent number 1

Authentication




You can use your information from the John Deere Cloud.

Would you like to use this option?

Yes

No

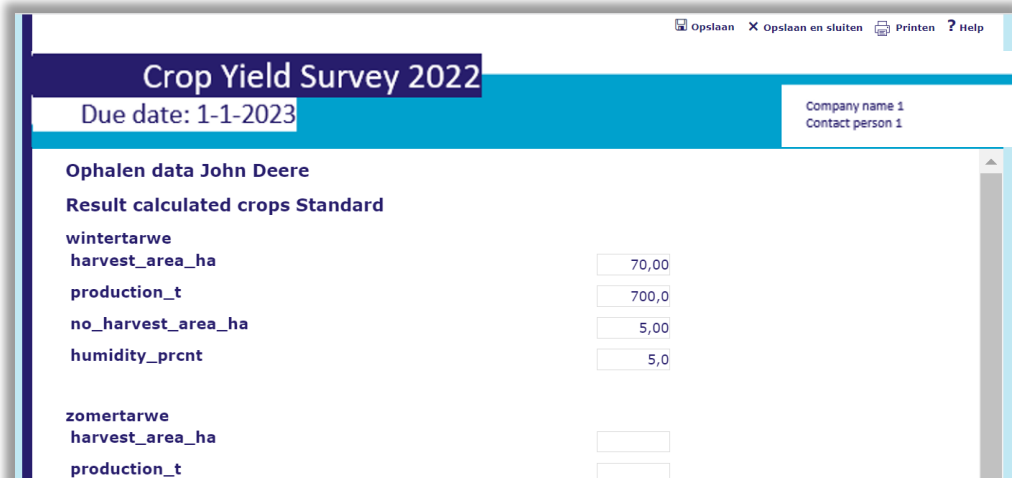
Click on the green button below



[Back](#) [Next](#)

Pre-test with farmers

- Usability issues:
 - Time needed to upload the data was quite long: 15-30 seconds
 - Presentation of the retrieved data to the farmer:
 - they did not recognize their data
 - “This does not make it easier, does not reduce the workload, but makes it more complex.”



Opslaan X Opslaan en sluiten Printen ? Help

Crop Yield Survey 2022

Due date: 1-1-2023

Company name 1
Contact person 1

Ophalen data John Deere

Result calculated crops Standard

wintertarwe	
harvest_area_ha	70,00
production_t	700,0
no_harvest_area_ha	5,00
humidity_prcnt	5,0
zomertarwe	
harvest_area_ha	
production_t	

Pre-test with farmers

- Perceived workload:
 - “This doesn’t make it easier.”
 - “This doesn’t reduce the time I need as compared to filling in the questionnaire in the usual way.”
- Trust:
 - Trust in the government
 - Farmers don’t trust the government with their data: data are NOT shared
 - Trust in the system
 - Safe and secure data communication
 - Farmers are unaware of safety measures being taken:
penetration test (to find leaks, prevent hacking)



Pre-test with farmers

- Data quality issues:
 - Farmers indicated that data in “MyJohnDeere” may not be correct:
 - not calibrated (sensor calibration)
 - data in MyJohnDeere cannot be edited
 - MyJohnDeere is not designed to be a Farm Management Information System; primary purpose is for machine maintenance
 - Farmers used their FMIS to check the data (Dacom & AgroVision)
 - Missing data:
 - Crops harvested with machines not connected to MyJohnDeere: JohnDeere tractors, other brands
 - Crops harvested by contractors
 - Unit issues:
 - Data from neighbours: helping out
 - Selectivity:
 - Market share (small; FMIS: 50% of arable farmers) and take-up rate



Pre-test with farmers


General conclusions:

- General attitude:
 - These farmers were positive about the S2S approach
 - It could work, but improvements are needed to make it work in practice
- Selective group of farmers:
 - Innovative farmers
 - Positive attitude towards data and innovations
 - They are the early adopters!
- “Use FMIS systems instead”: better source to connect to!



Conclusions

- Go/No-Go decision:
not implemented in the Crop Yield Survey
 - Too many issue: the risks of failure weres too high.
This operationalisation was not efficient for farmers
 - Low market share and low take-up rate
 - Production issues for this operationlisation of the methodology:
maintainability, scalability, and costs were not met, compared to
the assets
 - No time / resources for improvements
- Still: we have a working proof-of-concept



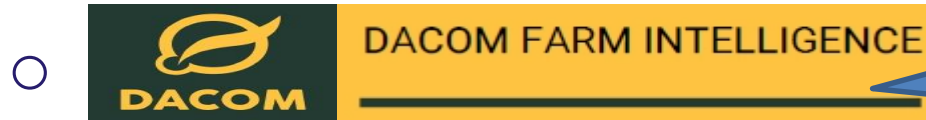
This was
the goal of this
project



Next step

Farm Management Information Systems (FMIS):

- Two most-used systems in Netherlands:



CropX: globally used
Agronomic Farm Management System



Also in Belgium and Denmark

- ± 50% of farmers
- 2nd project: connect to these systems
using S2S data communication
> positive business case!

Example

The screenshot displays the CropVision Professional software interface. At the top, there is a navigation bar with tabs for 'My Company', 'Communication', 'Registration' (active), 'Inventory', and 'Lists'. On the right side of the navigation bar, there are icons for 'Help' and 'CBS Bedrijf CBS'. Below the navigation bar, there are four main sections: 'Map', 'Registrations', 'Survey', and 'Reports'. The 'Map' section is currently active, showing a satellite-style map of a rural area with several agricultural plots highlighted in different colors (orange, red, yellow, green). A pink road labeled 'A76' runs diagonally across the map. A scale bar in the bottom left corner indicates 100 meters and 200 feet. In the bottom right corner of the map area, it says '© OpenStreetMap contributors'.

Left Panel: Cultures

Cultures	Area (ha)
2023	
Single select	
Select all	
Mais_11053559.... Forage maize	0.71 ha
Grasland, perm... Pasture (perm...)	4.00 ha
Grasland, tijdel... Pasture (temp...)	3.23 ha
Aardappelen, p... Potato (Seed)	1.69 ha
Aardappelen, c... Potato (Ware)	3.68 ha
Uien, zaai_1108... Seed onion	1.74 ha
Sulkerbiet_110... Sugar beet	1.29 ha
Wintertarwe_1... Wheat (Winter)	2.17 ha
Culture	

Map layers

Background

- Map
- BRT (only NL)
- Aerial photos (only NL)
- Aerial photos (only BE)

Reference layer

- None
- Own field plots
- Fields

Netherlands | 2022

- Topographic fields NL (RVO)
- Own crop fields NL (RVO) on date 15-05-2023
- Unconnected plots

Extra map layers

- Fertilization survey
- N-Mineral survey
- Near Natura2000 area
- Groundwater protection area

Labels

- Culture name
- Area
- Dimensions
- Markers

Right Panel: Action Icons

- Basagran
- Emblem Flo.
- Evaluation
- Fertilizat...
- Harvesting
- Irrigation
- Memo
- Miscellan...
- Observat...
- Seeding/Planting

FMIS in the Netherlands

Dacom and AgroVision:

- In collaboration with **AgroConnect**:
 - “AgroConnect is a consultation platform for making agreements on data sharing and data exchange in Dutch agricultural & food sector.”
 - “AgroConnect participates in the European CenAgro consultations and UN/Cefact, contributing to the development of international standards.”
- Use **EDI-crop standard**



EDI-Crop Message Types

- Three types of messages:
 - Cultivation plan messages: EDI-Crop-CroppingScheme
 - Crop growth messages: EDI-Crop-CropRecording
 - Crop advice messages: EDI-Crop-CroppingAdvice
- Each message contains the same basic elements
- Depending on the type of message, some fields are required, optional, or forbidden



EDI-Crop Message Structure (simplified)

- XML format:
 - The concepts in a message (Farm, Field, CropField, etc.)
 - The fields in each part of the message (begin data, area, crop type)
 - The type of each field (number, text, date, etc.)
 - Which field is required or allowed
 - The relationship between concepts (A farm has one or more fields)
- Data communication:
 - EDI-crop API
- **All data we need!**

EDI Crop Message

Exchanged Document

Issuer

Sender

Receiver

Farm

Field

BeginDate/EndDate

Border

CropField

BeginDate/EndDate

Border

Task

Operation

TreatmentZone

Border

ProductAllocation

ProduceAllocation

Batch

Task

Operation

BatchTreatment

ProductAllocation

ProduceAllocation

Organizing and running the JohnDeere project

- The course of the project:
 - long and winding road: a long start (2020-21), project (2022-23)
 - Set ultimate goal: spot on the horizon!
 - > This is clear; the road to achieve it is not
 - Decisions were taken along the way
 - Good communication with stakeholders / managers in crucial positions
 - > their support is vital
 - Testing proved to be essential:
 - > we did not do enough at an early stage



Organizing and running this project

- Project team: developed along the way
- Project organization:
 - Monthly project meetings, later weekly meetings
 - Goals for the next period were set + resources needed
 - Agile way of working:
 - Short-time goals: go from there
 - Frequent communication with managers in crucial positions: results, capacity, IT issues

