Claudia Luksch, TUM/HEF, 7.2.2020

Kick-off meeting Dürnast Digital Crop Farm

February 5th, 2020
14:30 – 16:00
Office of TUM Agrimechatronics, Dürnast 2, Freising

Participants: J. Migende (BayWa), M. Leinfelder (BayWa), M. Deyerler (BayWa), F. Schöppl (BayWa), J. Bühler (BayWa), E. Becker (BayWa), A. Wiener (BayWa), C. Kratzer (BayWa), M. Leinfelder (BayWa), W. Angermair (FarmFacts/Vista), B. Völkl (AGCO), T. Oksanen (TUM), H. Bernhardt (TUM), H. Amon (TUM), C. Luksch (TUM/HEF)

- **Welcome and introduction of attendees**

- **Presentation of Dürnast Digital Crop Farm concept**
  T. Oksanen (Presentation in the attachment)

- **General discussion**

Expectations/Input BayWa

- As a model: Swiss Future Farm (www.swissfuturefarm.ch)
- also see Trial Station, see BayWa Versuchsstation Gründl (https://www.baywa.de/pflanzenbau_obst/ackerbau_gruenland/versuchswesen/versuchsstandorte/gruendl/)
- scientific research & Public relations, with PR being an important factor
- For testing machinery, there is a cooperation with Ruhstorf.
- Ruhstorf (LfL) and Triesdorf (HSWT) are too far away from Munich.
- Dürnast would be perfectly located and could function as an international show room for industry, farmers and politicians.
- Show room/demonstration farm for showing new technology on the market:
  - ⇒ scientific context is important to illustrate the accuracy of techniques
  - ⇒ offering an independent view on innovations for farmers
  - ⇒ Opportunity to bring good ideas from science to market more efficiently
- Missing in the concept are the aspects of
  - ⇒ social impact,
  - ⇒ economical impact and
  - ⇒ ecological/sustainability impact of digital transformation.
- The concept offers a great chance to monitor a digital transition of a farm from the early beginning on -> Communication from the beginning on would be desirable.
- Initiative “applied AI” in Garching as a good example (https://appliedai.de/frontpage/about-us/): For a fee, facilities and rooms can be used by companies.
  (TUM: not enough space available in Dürnast for a comparable arrangement)

Expectations/Input TUM

- Dürnast with research on small plot trials and a “normal crop farm”.
- Focus on integration of new techniques in scientific field trials.
- Integration of all sensor data into farm management.

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Further discussion points/questions

- Requirements for managing data from small field studies are very different from those for normal farmers.
- Robot trials? -> In this concept we focus on mainstream off-the-shelf technology for precision farming, robots are not part of this concept.
- Suggestions: Annual events in Dürnast for public relations purposes

Software

How to handle the data? -> off the shelf solutions

Using FarmFacts with connection points to an own data network for scientific small plot trials
Using AgriRouter for integrating data (AgriRouter as a hub)
AgriRouter can also be used to output raw data from the system that can then be processed in other systems.
Processing in FarmFacts data network

Suggestion: establish a common BayWa-TUM project with TUM being a developing partner for FarmFacts software -> FarmFacts use free of charge for TUM
On VISTA basis, there is already a cooperation with Prof. Hülsbergen (TUM)

Questions to be addressed:
- Data security regarding scientific data
- Data ownership

NEXToffice = on-premise solution
BayWa has to give clear guarantee regarding data ownership
TUM data security officer to next meeting

Machinery

Not big machines, but smart machines
Fleet needed
Seed Drill (3m, for cereal crops)
Sprayer, mounted (12m/15m/18m)
Fertilizer sprayer (15-24m)
300-500er series Fendt tractor (to match with the above)

Important: collaboration in data connection/connection to same data systems, also important when using contractors

Buying or renting?
When machinery is bought by TUM there has to be a quotation for machines if prices exceed certain amount.
Machine lending as an option?
New machine every few month -> disadvantage?
In the case of rental machines, a regulation has to be found to ensure that there is always a machine available at TUM.

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Machines in collaboration with manufacturer?

Tractor -> Fendt ?
Fertilizer spreader -> Rauch ?
Seed Drill -> Horsch ?
Sprayer -> Maschio Gaspardo ?
Tillaging -> Horsch ?, Pöttinger ?, Lemken (no contract with Baywa) ?
Plough with ISOBUS?

<u>Further questions regarding machinery</u>

- Soil cultivation and soil testing?

Soil/soil structure will play important role in the future.
In Dürnast, soil tests are carried out every 5 years in standard grid (H. Amon)
- More detailed, refined soil data would be desirable in the beginning of this project.

BayWa offers soilzone sampling.
Manufacturer Lemken offers an ISOBUS plough (not distributed by Baywa, but contact established via FarmFacts).
Manufacturer Pöttinger has no ISOBUS, manufacturer Horsch has no plough.

- Field service partner

Contractor in Dachau for site specific corn sowing, works with maps from BayWa

Next steps/next meetings

1. Letter to manufacturers (=> J. Migende)
2. Meeting with manufacturers (Dürnast or Schwandorf)
3. Technical workshop with FarmFacts (software/software modules/ what data/ data security,…)
   - As soon as project manager for digital crop farm is hired

TUM Dürnast Digital Crop Farm – Concept Idea

Prof. Timo Oksanen

Prof. Urs Schmidhalter

Prof. Heinz Bernhardt

Dr. Franz Xaver Maidl

Prof. Thomas Kolbe

Prof. Kang Yu

Claudia Luksch

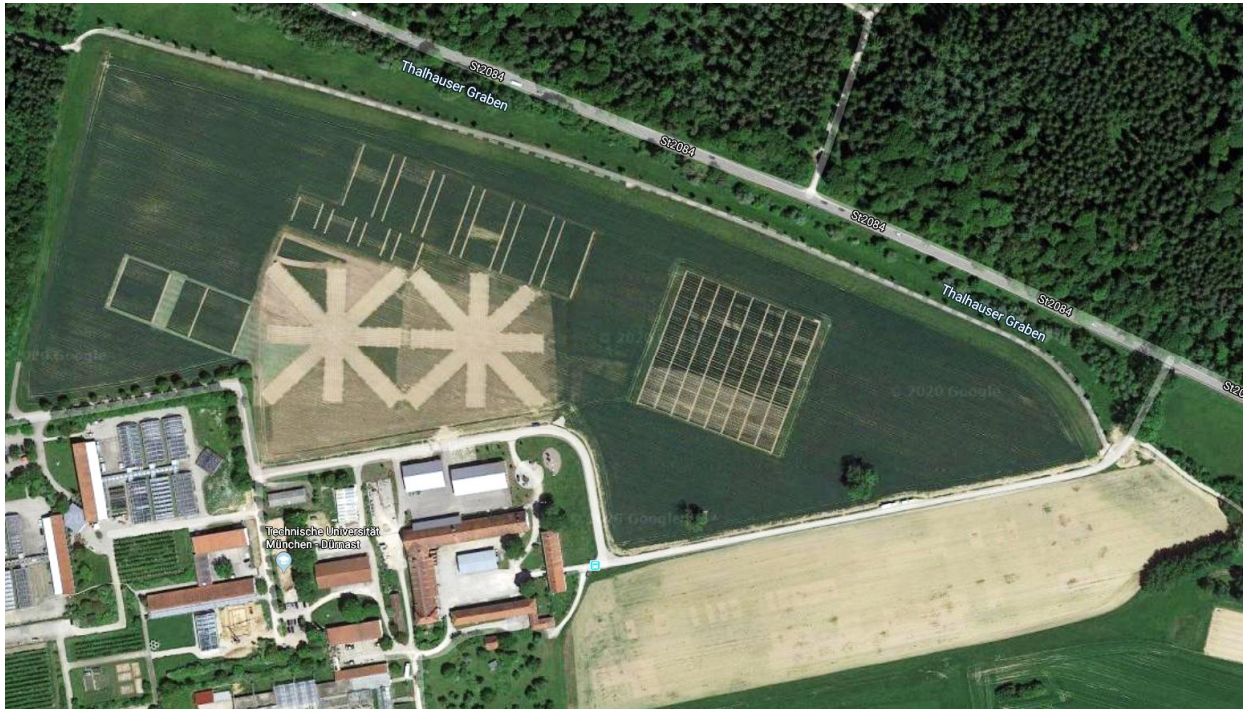
5.2.2020

Background

- TUM has **research farms**
  - **Dürnast**, Thalhausen, Viehhausen, Veitshof and Roggenstein
  - Each farm for different purposes
- TUM WZW decided to concentrate some professors in Dürnast
  - **Agrimechatronics** (Oksanen, *new*)
  - **Precision Farming** (Kang Yu, *new*)
  - **Agrarsystemtechnik** (Bernhardt)
  - .. and a bit of **Digital Agriculture** (Senthold Asseng, *new*)
  - ”good for research (next to fields), bad for education (far from)”
- Each professor works with their own projects, but we wanted something in common, a common long-term project (~10 years)
  - the result was ”digital farm” or ”precision farm in practice”
  - each professor has a different viewpoint on the topic

Background

- Field operations in Dürnast can be divided into two categories
  1. scientific experiments
     - in small plot trials
     - whole fields
  2. normal crop farming in the fields that are not in experiments per year



Background

- Machinery for operations in Dürnast / Thalhausen is not latest tech
  - oldest tractor in use is from 1978 and the newest 2007
    - average age: 1997
    - average hours: 6610
  - the same with implements; latest investments ”grubber”
- TUM Weihenstephan has had some uncertainty in past 15 years where to go in agronomy & technology
  - limited investments, mainly replacements for worn out items
  - we need to have a vision, digital compatibility, future plan
- No ISOBUS compatible machines right now

Concept Idea

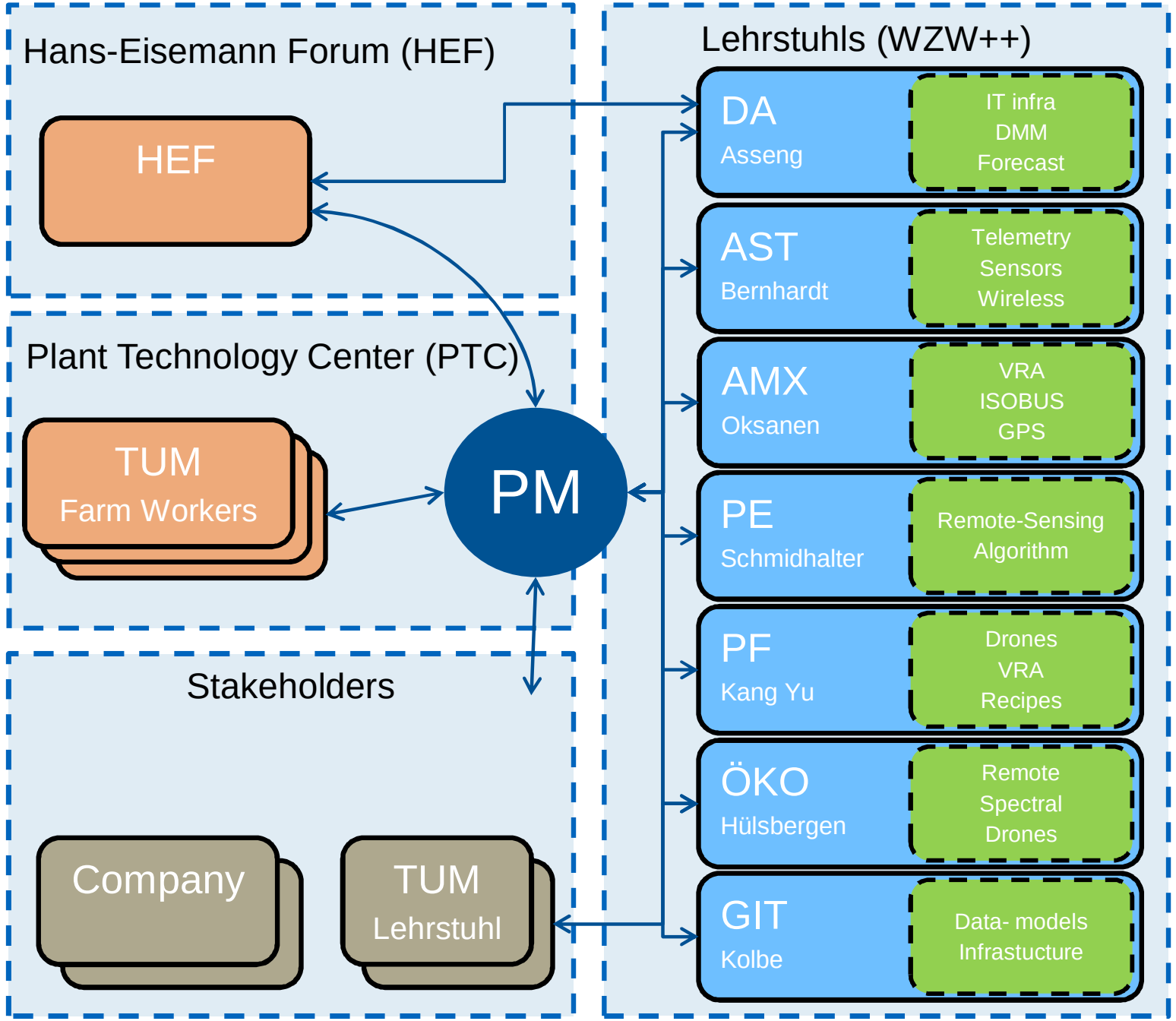
- Today, all basic components for digital precision farming are available for any farmer in Bavaria, off-the-shelf technology
- In Dürnast, currently we miss everything:
  a) machinery
  b) software and digital management
  c) digital skills of workers
- Conversion from the current state to the desired state requires
  1. conversion process (2-3 years)
  2. a new Project Manager (PM) to manage this conversion process
  3. motivated professors and scientific staff
  4. motivated farm workers
  5. machinery
  6. software (internal / external)
  7. training of farm workers

Objective

- To test Digital Farming as Farm
  - professors along with your normal Chair activities
- To develop all Dürnast farming operations towards
  - digitally documented (as automatic as possible) and
  - digitally planned work (as automatic as possible)
- Integration Testbench for related companies, for components
- 10 year-long programme

- TUM motivations:
  - To allow digital platform for Small Plot Trial planning
  - To have a clearly defined collaborative element for Chairs

TUM plan


Hans-Eisemann Forum (HEF)
HEF
Plant Technology Center (PTC)
TUM
Farm Workers
PM
Stakeholders
Company
TUM
Lehrstuhl
Lehrstuhls (WZW++)
DA
Asseng
IT infra
DMM
Forecast
AST
Bernhardt
Telemetry
Sensors
Wireless
AMX
Oksanen
VRA
ISOBUS
GPS
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Schmidhalter
Remote-Sensing
Algorithm
PF
Kang Yu
Drones
VRA
Recipes
ÖKO
Hülsbergen
Remote
Spectral
Drones
GIT
Kolbe
Data- models
Infrastucture

Founding principles

- Member Chairs attending the Project provide their
  - special expertise for the Project as part of daily business
- Normal field work is carried out by the workers of TUM farm
- All ”normal” field operations (except Small Plot Trials or machinery trials) in Dürnast that aim at real harvest
  - are part of this Dürnast Digital Crop Farm
- Chairs doing Small Plot Trials
  - may or may not attend with their experiment data to the project
- Project Manager (PM) takes care of development process