

**SESSION 1****REMOTE MACHINERY REPAIR, MAINTENANCE AND ASSISTANCE**

*by the Session Coordinator and Chairman: Peter Pickel (Germany)*

**CONCLUSIONS****Chairman Session Conclusions**

The parallel development of industrial production towards Industry 4.0 and the adaptation of its structural and technological principles in agriculture leads to merging of early and late life time phases of agricultural machines. Products and components can continuously be monitored and serviced from early production state till end of life. Some CoB members see a high potential for new and even revolutionary business models for agricultural machines in manufacturing as well as in operation. There is a change of business going on from selling machines to selling machine plus services. Product life in manufacturing and in operation and related remote services are seen in this summary as belonging together and building the integral fundament of Industry 4.0 and Agriculture 4.0 (I&A4.0).

The CoB members share diverse views on applicability and on the timeline for introduction of respective I&A4.0 technologies from being close to market launch to lying in the far future. One statement even was positive on applicability in lower developed countries. Generally, the applicability in practice was identified rather for disturbance management, maintenance and assistance than for repair. This will improve timeliness and reliability of machine operation. Market penetration was seen starting on large machines and smaller machines as followers.

Several CoB members raised concerns about critical development factors:

1. Methods for data analysis are still missing or better speaking there is a critical question still open: how to create information from data sampled? One opinion was that the knowledge and experience of a well-educated (human) agronomist cannot be replaced by other means at all.
2. The topic of additional or changed education models needed was intensively discussed. Engineers are currently not yet prepared for designing, developing and introducing respective methods and products. On the user side, today missing IT skills of (especially older) farmers are likely critical hurdles for launching respective technologies. Simplicity of systems is principally required and user interfaces need to be designed for top level of User Experience. While skills of older farmers might not be sufficient to handling new generation digital tools, these new opportunities in agriculture might improve reputation of farming in young generations and thus be helpful to improve employment.
3. One CoB member was concerned about safety issues resulting from higher level of integrated or automated operation

4. The communication infrastructure is not available yet (especially and also globally in many rural areas). It could be a task for all CoB members to request support of communication infrastructure from policy makers in their countries.

*List of key sentences*

- Lost employment can be (re)gained by identification and exploitation of new sources of added value esp. in whole-life-cycle-services (PP)
- We need reliable communication -> political demand (PP)
- Good contributions to define the structure of digital farming (PSL)
- Data analysis is the challenging task to digital farming (PSL)
- The public and private sectors should be encouraged to develop communication infrastructure in agricultural areas to facilitate remote maintenance and repair (JS)
- Universities and other educational institutions must educate on such topics as maintenance, repair, remote assistance, and life cycle analysis (JS)
- No doubt, the repair, the maintenance, and the assistance for the agricultural machinery are of fundamental importance ...! (GG)
- Also based on my experience, I do not believe that adequate assistance is given in general to agricultural machines bought by farmers (GG)
- Normal customers are practical people. So remote repair and maintenance must be understood by them und not complicated. (EG)
- Big maintenance enterprises have a trend to be too theoretical while other manufacturers behave at a practical level. (EG)
- Sensors produce many data (cloud) – bottlenecks in analysis should be tackled / analysis improved. (KR)
- Improve the customer's experience. A control room installed for total remote control of the agricultural production system. (KR)
- Remote machinery repair, maintenance, and assistance services are becoming very important in the mechanized agricultural production, through: timeliness and downtime of field operations as well as post harvesting operations leading into highest quality of products and may be least costs of production. (BS)
- The farm data ecosystem should help in meeting the needs of increasing crops yields and quality. (BS)
- Such services may encourage young people to go to farming. (BS)
- ICT can be leveraged globally for agriculture even in less developed countries but is important to focus on a farmer-centric approach that emphasizes how ICT can help the farmer in his context as well as have a positive impact on the environment. (AH)
- The value is moving from the Machine towards Machine+Services ('almost' real-time). Industry 4.0 is changing the workflow of maintenance & repair procedures, reducing leading times and possible machine stops. (PG)

- In order to improve reliability, machines become more complex with the introduction of sensors (which however could be subject to failures): is this solution advantageous in all countries? (PG)
- At the present stage of this item I'm finding two criticizes: (DP)
  1. A limit of the repairing and maintenance efficiency if they are carried out in remote. Monitoring is undoubtedly very useful but some physical limits have to be taken into account for repairing.
  2. A problem about the operator's privacy due to the continuous need of localization tracking of the machine
- What Industry 4 really also needs is the good agronomist and combined with good agricultural practices. This feeling for what needs to be done when remains human domain. (JK on CNH)
- What does it cost to be a premium partner? How much service does a normal partner get? (JK on Grimme)
- Product service in digital age is the future for manufacturing industries, but I do not think it is nearest future for the reasons listed below. (PF)
- Farm data ecosystem in some cases can be the present, but in others is still the future, especially when the operator's safety is involved (see list below). (PF)
  1. Data collection -> sensors -> efficiency
  2. Data continuous monitoring
  3. Data analysis
  4. Data transfer to the machine
  5. Remote transfer to the machine
  6. Network 24h efficiency
  7. Every thing needs to be perfect or the operation or the operator safety will be in danger
  8. I think at present this is the realistic approach:
    - The case study described in the paper innoservicePro (regarding potatoes harvesting, from Grimme group) seems to be a good example of what mentioned before
  9. T&Trac: Remote assistance, traceability (by Caffini). Again I.T.; again the list mentioned before
  10. All very interesting! But:
    - Which farm size we are talking about?
    - Which field size (scattered) we are talking about?
    - Which farmer age we are talking about?
    - WHICH CROP7CROPS7CROP ROTATION we are talking about?
    - How hard will it be to train farmers?
    - How expensive (in time and money) will it be to train farmers?
    - What about farmers over 50ies?
    - Which future we are talking about?

- Machine size and price have an effect on the relative costs of the predictive maintenance. As the installed base on large machines increases, then it may become affordable for small machines. (JdB)
- Machine manufacturers collect data that also contains yield level and quality of harvested product. By aggregating this over all the equipment/machines and farms there is market supply information. Can this be shared with the farmers? (JdB)