Club of Bologna

STUDY GROUP REPORT

SG 3 - "Ethics in Agricultural Mechanization"

ETHICS OF THE FUTURE AGRICULTURAL MECHANIZATION DEVELOPMENT

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Summary

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1 - Background and basic commitment of agricultural engineering

The overarching challenges for agriculture and thus also for agricultural engineers are to contribute to long term food safety and security (including a fair access to food for everybody) as well as to sustainable primary food production. Agricultural engineers generally as well as (new) agricultural technologies (further jointly referred to as agricultural engineering) must comply with economical, ecological and social requirements and mitigate social unbalance in different parts of the world. For this, agricultural engineering must contribute to increase the level of agricultural mechanization esp. in developing countries. Furthermore, it is a core task of agricultural engineering to mitigate the impacts of climate change. The European association of agricultural equipment and machinery producers (CEMA) has defined "Producing More with Less" as a guiding principle for agricultural engineering[2].

Automation for highly precise applications and autonomy (or robotics) are keys to CEMA's guideline promising high potential for improving production for the afore mentioned goals and for better quality of work and products. Automation and autonomy enable work to be completed at the best time of day or season or crop cycle with no working day restrictions. Treatments can be more targeted with precise variable application rates and spot applications to minimize inputs such as water, fertilizers, other chemicals and energy while economically optimising yields. A specific interest is to manage the upcoming problem of water shortages through new precise irrigation systems. Also work conditions can be improved significantly, such as by eliminating dull repetitive jobs or tasks with health and safety risks.

Global societies are changing due to the ongoing structural trend of urbanization which consequently leads to available workforce reductions in rural areas. Automation and autonomy shall also contribute to *more* production with *less* workforce. Overall, the level of productivity shall be increased significantly. While this is a principal goal of development activities, the community of agricultural engineers and scientists shall be committed to respecting and protecting local cultures and environments.

In the long run, the principle of "Producing More with Less" will not suffice for truly sustainable food production. Sustainability of production will not be achieved so long as limited resources such as fossil fuels or land are degraded or being consumed through agriculture. Thus, the long-term challenge and obligation for agricultural engineering is to create a circular agricultural economy or to establish agriculture as a part of a circular economy.

2 - Identified technologies

It is commonly agreed that new information and communication technologies (ICT) combined with new sensing and monitoring technologies will enable revolutionised control of machines, processes, farms and even the whole food production chain. These technologies are cloud computing, artificial intelligence (AI), big data (BD), 5G, internet of things (IoT) and others which extend existing control technologies. These ICT

1 Study Group Coordinator.

2 See for example in: CEMA: Digital Farming - what does it really mean? And what is the vision of Europe's farm machinery industry for Digital Farming? 13 February 2017. Link found on Nov. 2nd 2018: http://cema-agri.org/sites/default/files/CEMA_Digital%20Farming%20-%20Agriculture%204.0_%2013%2002%202017.pdf

and sensing technologies will be accompanied by introduction of electrified actors replacing or complementing conventional mechanical, hydraulic or pneumatic machine sub-systems. Electric actors will be fundamental for farm robots and autonomous machines.

3 - Concerns & recommendations for ethical conducting

Upcoming technologies are in many cases truly disruptive. These technologies are in most, but not in all, cases connected to new ICT comprising AI, BD, and other methods dealing with data and information. There are related, partially unknown, risks since impact and side effects of these new methods are not fully explored. Highly automated or even fully autonomously machines and robots are powerful observers and data generators. New sensing technologies, including some carried by drones or satellite observers, are additional data and information sources. Thus, ICT might drive data and information manipulation or abuse. Specifically,

1. data and information privacy
2. data and information integrity, and
3. data, information and system security

will be critical in novel production systems. Point 1 tends to be a legal issue which is mainly addressed by the new EU General Data Protection Regulation (GDPR). In many cases a technical implementation or technology will be needed which represents or fulfils goals and rules of GDPR. The aspects of integrity and security are technologically challenging and might hurt significantly the interests of individuals and of larger parts of society if no appropriate technology is implemented in new production systems. Additionally, new ICT methods such as AI or BD might lead to wrong decisions. ICT guided or controlled machinery, systems, or robots might act or react in an unforeseen way. All these issues oblige agricultural engineers to be aware of even unknown risks and to minimize hazards to human beings and to environment. At the same time, agricultural engineers must undertake all efforts to exploit potential benefits from new technologies for the sake of all stakeholders of farming (farmers, manufacturers, and society).

In 2001 the Cub of Bologna (CoB) presented a "Code of ethics for the agricultural machinery - manufacturing sector"[3]. The values to be committed listed therein are mainly: integrity, compliance, fair competition, conservation of natural resources, ecological standards, fair and equal treatment of people (employees), health and safety, labor standards, social justice, high quality of products as well as documentation of development and products. The document addresses the industrial developers and producers. STUDY GROUP3 of the CoB recommends adopting the principles of this document also for agricultural engineers and scientists as individuals.

New technologies require some amendments to the COB's code of ethics from 2001. These are specifically ICT-related issues regarding data and information handling. Ten professional European associations related to agriculture (COPA and COGECA, CEMA, CEETTAR, ESA, Fertilizers of Europe, FECAC, ECPA, EFFAB, CEJA) agreed on a joint code of conduct on agricultural data sharing by contractual agreement[4]. The code of conduct defines relevant principles for data ownership (staying with the data generating person or farm), data sovereignty, rights of use, and data privacy. STUDY GROUP 3 of CoB recommends following this EU code of conduct.

3 Y. Sarig, L. Clarke, I. De Alencar Nääs, R. Hegg, A. Munack, G. Singh: Code of ethics for the agricultural machinery - manufacturing sector. Club of Bologna, 2001

4 COPA and COGECA, CEMA, CEETTAR, ESA, Fertilizers of Europe, FECAC, ECPA, EFFAB, CEJA: EU Code of conduct on agricultural data sharing by contractual agreement. 2018

4 - Final statement

In 1905, Max Eyth complained about pure scientific communities claiming KNOWLEDGE as the exclusive outstanding characteristic of mankind. While this is truly an outstanding characteristic, Eyth said there is a second one: the ability or SKILL to apply knowledge (in German "das Können") for creating progress for human beings[5]. Eyth sees language as an instrument of human spirit representing its KNOWLEDGE side. But the second instrument of human spirit is the SKILL he also called the TOOL (also could be called the ability of creating technology).

About language (as the instrument of knowledge), Eyth said: "Language claimed to be the only instrument of human spirit and mankind started to believe" while the instrument technology (SKILL) tends to be neglected. Today, we are facing new upcoming technologies as AI or BD or others. These new technologies (SKILLs) will enable for autonomous decision making with still unknown consequences. Engineering must be committed to keep control over new technologies. In extrapolation and adaptation of Eyth's statements from the past into the future we should claim: *Any technology is and must stay an instrument of (human) spirit which itself must not be overruled by the spirit of the instrument*.

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[2] **Jovane F., Westkämper E., Williams D.,** (2006). The Manufuture Road – towards competitive and sustainable development; Springer Verlag Berlin Heidelberg

[4] **Zahn E.,** (2011). Strategisches Management globaler Produktionsnetzwerke. Kemper, H.-G.; Pedell, B.; Schäfer, H. (Hrsg.): Management vernetzter Produktionssysteme: Innovation, Nachhaltigkeit und Risikomanagement. 1. Auflage. München: Vahlen, 2011, S. 9–24

5 Max Eyth: Lebendige Kräfte. Sieben Vorträge aus dem Gebiet der Technik, Springer-Verlag Berlin Heidelberg 1905. Reprint ISBN 978-3-642-89662-0 – from paper „Poesie und Technik" (poetry and technology), page 16