

<p>Club of Bologna www.clubofbologna.org</p>	<p>SESSION REPORT <i>"A sustainable mechanization for the future"</i></p>	<p>Report S1 <i>Bologna (Italy)</i> <i>October 2021</i> <i>Page 1</i></p>
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SUMMARY AND REMARK: SESSION 1: A SUSTAINABLE MECHANIZATION FOR THE FUTURE

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Session 1 had two presentations by Prof. Gavioli G. and Henning-Possenti F., and a round table with the session participants. In this report, the summaries of two presentations and overall remarks/key sentences by session participants are provided in separate headings.

1. Presentation 1: A sustainable Mechanization for the Future by Gavioli G. (Gavioli Consulting LLC, USA)

1.1. Introduction

Global warming has been accelerated due to human activities, not by natural events. Sustainability is now a global issue. Global priorities to achieve sustainability include reducing greenhouse gas (GHG) emissions, resolving environmental pollution, and stopping bio-diversity destruction. In Paris Agreement 2015, United Nations Climate Change Conference (COP26) agreed to net-zero GHG emissions by 2050 and asked for making plans and taking actions towards the global priorities. In order to make positive changes in our planet, we need a 'Paradigm shift' or 'Revolution' driven by emergency. Climate change should be considered as an opportunity to change what we do and how we do human activities. The first step can be to shift our perspective on the ecosystem. For example, humans are a part of Gaia -the living planet, which is an organism including ecosystem, water, air, and other species. Positive human actions will lead to positive feedbacks from other segments on the planet. Agriculture has been responsible for a substantial amount of GHG emissions of the world. We need to take actions to make agriculture more sustainable towards our goal: sustainability in our planet.

1.2. Supercharging Precision Agriculture

Precision agriculture enhances the sustainability of agricultural production through more efficient use of inputs, such as land, water, and fuel. The motivation for developing advanced precision farming tools is on the right track, but the speed of technology adoption by the industry has not been fast enough. The agricultural industry needs to stop focusing on optimizing their profit only but also provides efforts to accelerate greater investment. Especially, it is necessary to boost the adoption of precision agriculture in the fields described below.

(1) decoupling agriculture from fossil fuels: we need to make commitment to replace fossil fuels to more environmentally friendly energy such as biodiesel (still can negatively impact biodiversity), biomethane (typically derived from organic waste), hydrogen-based energy (most likely to be the future energy). We also need to adopt green electricity and batteries for completely redesigned machinery.

(2) Embracing digitalization in agriculture: the potential of artificial intelligence (AI) to change the way currently agricultural production is conducted is enormous. Most notable technologies in this area include digital twin (virtual model of existing objects to simulate physical world and connect to agricultural machinery for actual field operations based on a decision made by AI), and blockchain (tool for traceability of information)

(3) Using digital platforms: digital platforms can create a digital ecosystem interfacing various applications and data services, and physical machines in the field. The digital platform is a way to democratize knowledge and information.

1.3. Finance and Sustainability

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We need to remind ourselves of the principles of shared values by Michael E Porter (2011) and apply to agriculture. The shared values involve creating economic value in a way that also create value for society. According to World Economic Forum (WEF), companies need to restructure their business models to maximize company's return on three vital forces: people, planet, and profit. In the Living Planet Report, WWF analysed that biodiversity has a significant economic value over a half of global GDP (\$43 trillion) and should be included in national accounting systems as below.

(1) Ecosystem Services: ecosystem provides many benefits to humans. This benefit should be quantified and included in the accounting system. For example, bee accounts for 75% of pollination in a global food crop. 70% of antibiotics and drugs for cancers are derived from natural substances or biomimicry of nature substances (synthetic substances inspired by nature). In addition, biological sequestration can remove a third of GHG from the atmosphere annually by plants and micro-organisms. The services provided by the ecosystem should not be forgotten and taken for granted.

(2) Social cost of Carbon: this refers to additional costs of services and products needed for real impact from increased GHG emission. The key metric that we should include is "emission per dollar of GDP"

1.4. Conclusion

Global warming has been rapid and intensifying in recent decades, and climate change is clearly documented with scientific proof. There is a rising concern for the decline of biodiversity. Governments started initiatives to resolve the issues on the sustainability of the earth such as Paris 2015. Companies in all sectors must recognize the urgent need for extensive transformation, a 'paradigm shift for the green future. Agricultural industry including agricultural machinery manufacturers needs to accelerate adopting new technologies for better sustainability in agriculture.

2. Presentation 2: Sustainable Mechanization for the Future Challenges and Chances by Henning-Possenti F. (John Deere).

2.1. Introduction

The challenges that we need to resolve exist in all areas including exponential growth of the world population, new dietary and other non-food product demands for increased world population, sustainability, urbanization, political challenges, limited natural resources. Strategies for determining the best technologies and information systems need to be established by considering an ethical aspect of the technologies to increase productivity without degrading the environment. Beyond precision agriculture, precision solution approach utilizing AI (application, data, analysis, and autonomy) provides a vast opportunity for society.

2.2. New AI Regulation Draft by EU

AI and autonomy technologies can be disruptive to society without regulations. The new AI regulation by the EU is an effort to establish a framework for AI and increase confidence in the new technologies by people and government. EU's AI regulation draft utilizes a risk-based approach with different levels of risks associated with AI: (1) prohibited AI, (2) high-risk AI, (3) regular-risk AI. The prohibited AI is difficult to define but includes products that may impact children, or harm people. The high-risk AI applications include areas that could be dangerous if abused but have significant potentials to benefit society and are required to comply with a set of regulations such as risk management system, data governance requirement, and transparency obligations. The regular risk AI may include applications with safety functions such as mobile phone applications, autonomous tractors, etc. Failure to comply with the regulation will result in a large amount of fines imposed by the EU. **Table 1** summarizes the pros and cons of the new regulation for the sustainable development of AI.

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2.3. Artificial Intelligence Application Liability

Ethical understanding of AI is a very difficult subject. Identifying liability of failure can be extremely difficult because machine learning involves various phases of application development, and it is hard to spot an exact reason for unintended failures. For example, many people can be involved in data acquisition process such as data labelling and data quality assurance. Also, there could be a discrepancy between actual results and intended results. In case of ownership of dataset or algorithm is ambiguous, it is even more difficult to discover the liability of the AI failure.

2.4. Conclusions

The AI is advancing fast. It is important to construct overall solutions to maintain good aspects of AI for the future, and control side effects of AI failures. The main points to be discussed for the positive future of AI includes liability of AI failure, intellectual property of data and algorithms, ethical requirements and societal acceptance of AI, cyber security of technology and data, legal protection, law, and justice regarding AI.

3. General Remark and Key Sentences from the Session Participants

Global warming and climate change has been global issues. Humans are a part of an ecosystem, and we receive enormous benefits from it. Therefore, we need to take clear and effective actions to preserve the ecosystem. Holistic change of human behaviours in economy, technology, and society is necessary to stop global warming and climate change. Various precision agriculture technologies such as digitalization and green energy can improve sustainability and environmental pollution. Artificial intelligence and autonomous technology can change the way how farming is conducted and play a key role in the sustainability of agriculture. However, the adoption of the technologies by farmers is still low. Farmers are the major player in this paradigm shift. If farmers do not participate, nothing will change. Farmers should be involved in the entire process towards this effort so that they can trust the new technologies. Strong action must be taken to boost technology adoption and support farmers' investment in the technologies. In addition, the agricultural industry should take social components into account when developing business models in order to have a positive impact on society: a less dangerous and safer workplace for farmworkers. The companies must connect companies' success with societal progress. We also need to focus on sustainability aspects of agricultural mechanization from low/mid-income farmers and countries. Sustainable mechanization in the future will create new jobs and opportunities as well as challenges for young people. For example, the use of AI and machine learning opens new questions on legal responsibility, data ownership, and liability. To mitigate the issues, it is necessary to impose legal regulations on agricultural autonomous machines and AI applications. Initiating a legal framework for autonomy and AI applications is necessary to give an idea of the possible impact of AI in society. Because exact reasons for unintended failure of the AI are difficult to identify, it is needed to shift regulations from causality-based to risk-based. Regulations should not be a bottleneck for AI development and technological improvements for farmers in the field. We should provide legislators and policymakers with all possible elements to understand all aspects of new technologies.

TABLES

Table 1 - pros and cons of the new EU regulation.

Pros	Cons
<ul style="list-style-type: none"> • Provides a framework for AI to be used in agricultural applications • Enhances confidence in new technologies • Increases digitalization in every sector • Provides a framework for further legislative development • Starts the discussions on the legal aspects of AI 	<ul style="list-style-type: none"> • Too broad definition of AI • Needs adjustment to take account of specific requirements in each sector • Requirements are partially very difficult, costly, or impossible to achieve • Alignment and coordination with other legislations and jurisdictions • Doubts in applicable law in case of change of the product nature