AGRICULTURAL ROBOTICS: PART OF THE NEW DEAL?

WITH 27 AGRICULTURAL ROBOT INFORMATION SHEETS

FIRA 2020
conclusions

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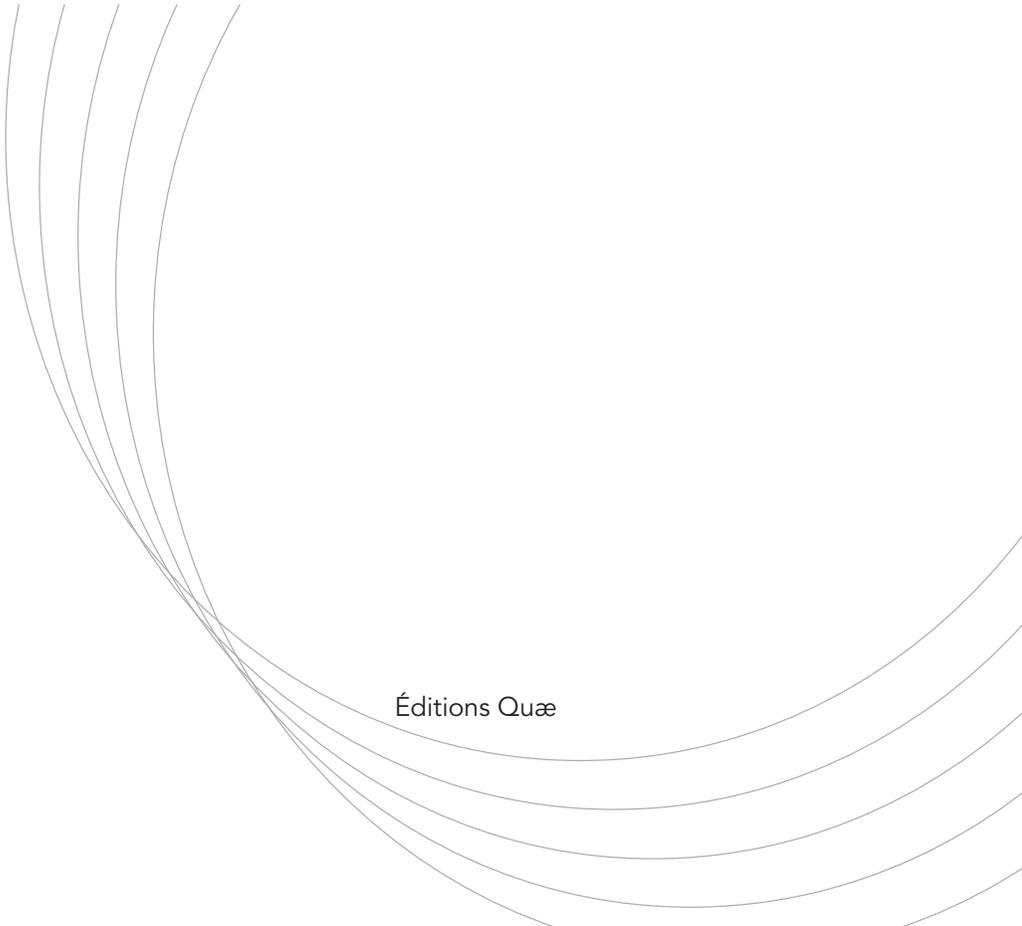
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PREFACE

One of the world's oldest professions is undergoing a massive shift. The rise of agricultural robots and other advancing technologies are helping to create a new era of farming. As farmers and producers around the world look to autonomous technologies to solve their biggest problems, the industry must rise to meet their needs.

The Global Organization for Agricultural Robots (GOFAR) actively supports the agricultural robotics sector in this endeavor by developing promotional campaigns and hosting networking events. The biggest event is the annual FIRA International Forum of Agricultural Robots, powered by VARTA AG, Naïo Technologies, the Occitanie Region and Sicoval.

This professional event brings together robotics companies and relevant stakeholders, as well as producers who seek to understand how farming continues to evolve. GOFAR and FIRA continue to prove that the great growth of agricultural robotics requires education, knowledge sharing, and collaboration.

Throughout the fifth edition of the FIRA in December 2020, more than 1,500 farmers, manufacturers, advanced technology suppliers, innovators, investors, journalists and experts from 71 countries around the world gathered to ask questions, share stories and exchange ideas. There was much to discuss.

FIRA 2020 included three days of live keynotes, workshops and demonstrations from the industry's leading pioneers. The conference recordings remained available until June 2021, making FIRA 2020 the longest running agricultural conference of the year. The Ag Robolution is alive and well. New challenges, it seems, have fostered a greater interest in these smart technologies.

The COVID-19 pandemic contributed to unprecedented changes—some welcome, others disheartening. While it pressed FIRA to pivot to an exclusively virtual conference that brought together a greater community of global participants, the pandemic also exacerbated some of the labor and food equity issues agricultural robotics are designed to address.

In addition to the complications from COVID-19, conference presenters and attendees have another big-picture problem in the back of their minds: The impending global food crisis. Producers, legislators and technology companies, in particular, are feeling the pressure to find new and innovative ways to feed the masses. Society depends on their ability to successfully and sustainably feed nearly 10 billion people by 2050.

As FIRA 2020 participants each do their part to address these larger concerns, there are many smaller issues at play. These issues include questions about the legal and ethical implications of implementing driverless tractors, whether robot bashing will prevent mass adoption of agriculture technologies and how startups and investors can work together to bring farmer-friendly solutions to the marketplace.

Each participant brings a unique perspective to the conference. Producers focus on the ways agricultural robots help them to eliminate repetitive tasks, increase efficiency and minimize their reliance on migrant labor. Startups have a vested interest in developing and marketing the solutions that potential investors will support, and farmers will actually adopt.

Technology companies work tirelessly to ensure their sensors, guidance systems and data collection platforms are precise and reliable. Legislators, attorneys and policy experts dive into the details of safely introducing advancing technologies to public and private spaces.

Taken together, these perspectives make it clear that agricultural robots are a part of the new deal. As agricultural robotics companies continue to develop innovative solutions that prepare farmers and producers to tackle the challenges ahead, GOFAR and FIRA remain dedicated to supporting and empowering the industry's future success.

INTRODUCTION

The farming and agricultural robotics industries are inextricably linked. This connection is reinforced every year at the FIRA International Forum of Agricultural Robots, where, inevitably, there are new players and new problems, bigger goals and better solutions.

As the circumstances change, the innovators, disruptors, regulators and users change, too. This growth depends on everyone's ability to pivot — whether that's to a virtual conference or to a better machine learning system. Throughout these many changes, each individual is encouraged to stay connected, both to an ever-transforming industry and to one another.

This book is a journey into an era of farming that is defined by agricultural robots. It is designed to provide a nuanced look at the industry's most pressing topics, from the over-arching impact of the global food crisis to the everyday influence of semi-autonomous tractors on a family-owned farm in Le Thillay, France. The book reveals the big picture by diving into the details. It achieves this goal by taking a deep dive into the perspectives shared by FIRA presenters and panelists.

Through their varied viewpoints, readers will better understand agricultural robots and the industry overall. These are not black-and-white problems. Armed with a better under-standing of the intersections of agriculture, technology, legislation, business and robotics, readers may come to see how effective solutions are born from the gray areas in between.

The past year provided plenty of opportunities for the world to recognize the ways in which it is undeniably interconnected. Success depends on collective knowledge, innovation and a willingness to contribute to the greater good. The FIRA 2020 conference proved that participants from around the globe were willing to show up and share their insights.

In the following pages, readers will learn not only about the ways others are making a difference, but also about how they too can lend a helping hand to move the industry forward. The book is divided into five chapters, plus a final section that synthesizes the FIRA robotics demonstrations and technical presentations into 27 information sheets that describe the features, functions and specifications of each machine.

In the first, Food and Farming are at the forefront of the conversation. "Farm machinery and sustainable agriculture must evolve together," says Josef Kienzle from the Food and Agriculture Organization of the United Nations. While robots have revolutionized farming, he explains, the future depends on their ability to do more. To that end, this section looks at the various ways that robots help farmers do their jobs sustainably, increase yields and tackle larger problems like labor scarcity, environmental waste and world hunger.

The next chapter focuses on Society. In these pages, Ag industry experts Daniel Azevedo (Copa–Cogeca), Christophe Bonno (Groupement Les Mousquetaires–Intermarché), Ole Green (AGROINTELLI) and Antoine Poupart (Bioline–InVivo) discuss the concept of robot bashing versus robot loving and how the end user's perception may impact widespread adoption of new technologies. When technology companies can provide

cost-effective and reliable robots to end users, they explain, the era of robots loving is likely to take hold. In the meantime, the technologies on the market are already making a difference. "It's important to start learning together today," Green says.

The third chapter of the book dives into Regulations and Technologies. Although advancing technologies are being developed and tested, the regulations remain a work in progress. This section examines the potential issues that may arise in the marketplace and what it means to implement robotics within this context. A huge gap remains between innovation and legislation. Robotics lawyer Andrea Bertolini and John Deere's Christophe Gossard discuss these legal and ethical considerations. They note the complexities that need to be addressed when implementing advancing technologies such as fully autonomous tractors.

In the fourth chapter, experts from various technology companies weigh in about the reliability of positioning sensors and guidance systems, while farmers and industry players use their expertise and experiences to guide a discussion about the possibility of farming without tractor drivers. The overall discussion remains focused on the bigger picture: "I believe that artificial intelligence and advanced technologies can be used to make people happier," says Hajar Mousannif of Cadi Ayyad University. "By actively contributing to the AI field, we will not only ensure a better future for us but also for other generations to come. We need to put our efforts toward building tech that really matters, that solves real issues, that improves lives and, most importantly, embraces inclusion and improves our humanity."

In the last chapter, readers Go to Market. This section shares perspectives from Ag technology experts dedicated to predicting and explaining the industry's upcoming trends and business development opportunities. Representatives from startups Ecorobotix and Naïo Technologies and investment firms Capagro and BASF Ventures explain what good governance and productive partnerships look like.

This section ends with a last look at what's happening in the agricultural robotics realm right now and where companies expect to be by the next FIRA conference in December 2021. Experts from IdTechEx, Better Food Ventures & The Mixing Bowl, Sony CSL, the Yield Lab, Wageningen University and Research (WUR), Kubuta Holding B.V.—Innovation Center and Raven Industries met to share their insights. Collectively, the panelists focused on one goal: Moving beyond shiny equipment to quickly and effectively develop commercially viable solutions that address farmers' real-life problems and grievances.

The final part of the book moves beyond the theorizing and expert opinions to showcase 27 autonomous machines. These are the agricultural robots and prototypes that technology companies are currently bringing to market and that were presented at FIRA 2020.

Together, these sections provide a holistic view of the Ag Robolution in 2020 and beyond. There will always be setbacks and unforeseen obstacles, but as the conference speakers and participants demonstrate, there will always be innovation and solutions as well. This book celebrates the ways in which these ever-present challenges prompt collaboration from the world's greatest minds and markers, ultimately advancing everyone toward a more equitable future.

1. Agricultural Robots Help Farmers Feed the World

Ever since the beginning of the agricultural revolution around the turn of the 18th Century, there have always been farmers and producers that are wary of technological innovation. These "traditionalists" often have a number of reasons for clinging to tried-and-true methodologies and tools. Some resist change, others fear the unknown or, sometimes, are befuddled by the machines themselves.

This is changing. Today, agriculture technologies advance so quickly that those who resist progress are often left behind. Lightning-fast innovation has its benefits. At a minimum, the majority of farmers have embraced the idea of agriculture robots that can weed, spray, harvest and otherwise manage their least-attractive seasonal tasks. Regardless of their personal feelings, however, advancing technologies are here to stay.

In the "How Do Agriculture Robots Impact the New Deal Economy and Social Issues?" keynote, Josef Kienzle, Sustainable Mechanization Lead for Food and Agriculture Organization (FAO) of the United Nations, and Guy Waksman, Member of the French Academy of Agriculture, presented their insights.

This section details the current state of the industry, how small-scale farmers around the world are impacted by autonomous and semi-autonomous machines, and the considerations that must be made to increase robot adoption and positively impact the global food crisis.

▌Farm Machinery Must Support Sustainable Agriculture

Kienzle kicked off the discussion on a positive note. Mechanization has come a long way, he explained, but the last 15 years have brought about dramatic improvements, including optimized design, improved digital data management and more. These improvements have also lowered costs, giving small-scale farmers increased access to autonomous and semi-autonomous technologies.

"Farm machines have revolutionized agriculture and reduced drudgery of millions of farm families and workers, but the machinery of tomorrow will have to do more than that," Kienzle says. "It will also have to contribute to agriculture that is environmentally sustainable. Farm machinery and sustainable agriculture must evolve together."

This is a key point. The global food crisis not only requires farms to produce enough food to feed more than 10 billion people by 2050, but it also means increasing food production by approximately 40 percent compared to 2012. Family farmers already supply 80 percent of the world's food.

▍The Impacts of the Global Food Crisis

The task of producing more food to meet the growing demand must be accomplished sustainably, with farmers considering how best to manage scarce resources. The result of failing to sustainably maximize food production is two-fold: If the status quo continues, there will be more than 840 million hungry people by 2030 and fewer available resources with which to address the problem.

"The COVID-19 pandemic is intensifying the vulnerabilities and inadequacies of global food systems," Kienzle says. "COVID-19 has added additional pressure and poses a serious threat to food security. It is estimated that as many as 130 million will be added to the total number of hungry people in 2020."

Beyond having enough food, Kienzle explains, the food must also be healthy. Producing affordable, nutritious food is already a major problem. Today, more than 2 billion people cannot sufficiently or consistently access safe, nutritious food, and 3 billion people cannot afford the cost of a healthy diet. Some parts of the world experience these impacts more than others.

"If recent trends persist, the distribution of hunger in the world would change substantially, making Africa the region with the highest number of undernourished people," Kienzle says. "Innovation creates global solutions."

When there is collaboration between the public and private sectors, entrepreneurs and civil society, he adds, there is an opportunity to create the best possible solutions for the world's biggest challenges.

Figure 1: Average percentage of the population who could not afford a healthy diet in 2017 (FAO, IFAD, UNICEF, WFP and WHO. 2020. The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets. Rome, FAO. https://doi.org/10.4060/ca9692en), Joseph Kienzle, FAO.

No data   < 10%   < 10-25%   < 25-50%   < 50-75%   < 75-100%