

Session 1 - Industry 4.0 and the Impact on Agriculture 4.0

by Axel Munack, Chairman of the Session

After a short introduction by the Session Chairman, *Axel Munack*, Germany, three oral presentations were brought forward in this Session, followed by a discussion.

1. Industry 4.0: Impact on Both Development and Product, by *Massimo Ribaldone*, SDF Group, Italy
2. Smart Logistics for Effective Processes, by *Franco Oliaro*, ROJ, Italy
3. Agriculture 4.0 - The Challenges Ahead and What to Do About Them, by *Ulrich Adam*, CEMA, Brussels, Belgium

The term "Industrie 4.0" was first used during the Hanover Industrial Fair of the year 2011. It means that after mechanization, mass production and automation, we are now facing the 4th industrial revolution which means the introduction of cyber-physical systems. It is heavily based on communication where the Internet of Things (IoT) denotes connections between parts, machines and factories, while the Internet of Services (IoS) connects people with data-bases, virtual reality, remote diagnostic functions for the products, etc. Both IoS and IoT are changing the engineering and operation of information systems and, beyond that, the economy as a whole. The convergence of IoS and IoT empowers new types of software-intensive systems which, among others, facilitate real-time observation and adaptation of intra and cross organizational processes.

In his contribution, *Massimo Ribaldone* pointed out that, for the SDF Group, "4.0" does always mean Industry 4.0 in combination with Agriculture 4.0. It has an impact not only on processes and products, but also already on the development of the product, e.g. by new means like virtual reality and 3D printing. The key points of 4.0 IoT are smart sensors which are always connected and can send information about the status of components, machines, and processes; high-speed connectivity everywhere and continuously; big data - high quantity of data with fast and easy access. A good example of interactions among sensors, connectivity and data is the field of predictive maintenance. This allows to be able to realize when a component is near to the failure and to change it before the final breakdown. This does not only reduce the cost of the repair but also increases the safety of the operators. 4.0 will allow improved development, design, production, features, operation and maintenance of agricultural machines and processes.

Franco Oliaro demonstrated by the example of the ROJ company, a design and production company for mechatronic systems, how the introduction of industry 4.0 really works and which benefits can be obtained by it. He described the implementation of a smart logistic system, i.e. a warehouse management system (WMS) into the enterprise resource planning (ERP). For the WMS three different departmental solutions were chosen. The material flows in the production process are tagged, so that traceability is guaranteed, and automatic storage and dispatching can take place. As a result, the company could observe reduced occupied spaces, reduced defectiveness of components, reduced delivery times, and increased value added per head (thanks to the reduced manual handling). In the concluding remarks it was stated that industry 4.0 offers great opportunities, if the company invests into employees' education, continuously updated technology, and LEAN thinking (reduction of low value activities, scraps, stocks, spaces, ...)

Ulrich Adam gave a comprehensive figure of Agriculture 4.0. He pointed out that 4.0 provides information technology for the masses and that this brings up a lot of new players, also for the AgEng business. A hot topic is big data, where ownership issues become important. It needs to create trust

by establishing rules and ensure safety and security. Finally, a fair balance must be guaranteed between “openness” and “closeness”. Furthermore, communication links with other sectors, like road traffic, must be established. CEMA's plan for Europe's Agricultural Machinery Industry “AgriTech 2030” was presented. It comprises three areas of work: (1) Maximizing the industry's contribution to highly productive, competitive, sustainable farming methods with high safety standards, (2) Bringing European farming to the forefront of digital & precision agriculture, (3) Strengthening Europe's industrial and technological leadership in advanced farm equipment. For details, visit www.cema-agri.org.

In the *discussion* the participants pointed out that both Industry 4.0 and Agriculture 4.0 comprise the broad fields of production, products and services, leading to new ways of thinking and working. They will result in increased productivity and convenience as well as products' quality. Furthermore, better safety and avoidance of accidents are predicted. A transition is going to occur from deterministic model based management to the use of statistical experience, gained from big data. The digitalization opens the AgEng community to new players.

The ownership question for big data is a crucial one. A fair balance between sharing the information and protecting the sensible information must be found; this is essential for acceptance of the new techniques by farmers. On the other side, farmers can really profit from the feedback of reliable information, gathered from various farms, to their decisions to buy new equipment, their improvement in the efficient use of the technology and their extended use for farm management. The acceptance of these techniques by the society is another issue, as society means to a great extent: the urbans. Here, traceability is regarded as a real benefit for the consumer which must be emphasized as an advantageous feature of the new technology.

The area of education and training was also addressed by several participants. Producers, farmers and dealers need sufficient training to remove internal obstacles and resistance against the new technologies. Only this will allow their full deployment and the exploitation of their benefits. In the universities, new curricula should be created for education of “IT-AgEng” engineers.

Sensors play an important role in Ag 4.0. New or existing sensors on machines can be used to improve statistical fundamentals for design, dimensioning and testing of agricultural machines as well as customizing and predictive maintenance.

Is Ag 4.0 only applicable to big farms and cooperatives? No - several participants pointed out that they regard the new technologies as also being well suited for small farms. The technology will become affordable (and necessary) also for small and medium enterprises, provided that the educational problems can be solved.

Finally, there were many more questions that could not be discussed due to the limited time. This demonstrated once again that the three lecturers had given their contributions to highly relevant and interesting topics.