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SESSION REPORT AND SUMMARY: VALUE CREATION BY PUBLIC FUNDING OF RESEARCH, DEVELOPMENT AND INNOVATION

by Peter Pickel (CoB Management Committee, Germany) – Session Chairman, Hao Gab (University of Tennessee, USA) – Session Rapporteur

1. Talk 1: International Trends for the European Research, Development and Innovation Landscape

Speaker: Andrew Lynch, Chief Innovation Officer, Irish Manufacturing Research (IMR)

1. Ireland's Manufacturing Sector:

- Manufacturing contributes over 30% of Ireland's GDP.
- Ireland exports more medical devices (besides Germany), ICT products, and other unique items than many other nations.

2. European Manufacturing Overview:

- Europe's manufacturing sector represents €7 trillion in turnover, employing close to 30 million people, mostly SMEs.
- Europe's evolution across different industrial revolutions, including the current focus on Industry 4.0 (automation, AI, quantum computing) and Society/Industry 5.0 (focusing on human-centric, sustainable, and resilient technologies).

3. Policy and Industrial Shifts:

- European policy is moving from "shareholder value" to "stakeholder value," aiming for inclusive benefits from technological advances.
- A key focus is Europe's Green Deal, likened to "Europe's man on the moon moment," which aims to achieve the world's first net-zero industrial base.
- Global competition: the U.S.'s Inflation Reduction Act, Japan's industrial investments. Europe need to compete more coherently in a global context.
- It is clear a plan to rescue the European economy is much more diverse than simply 'common market'.
- Europe is looking at reshoring and circular economy models to recover critical raw materials and reduce reliance on external suppliers.
- A requirement is to press ahead with recyclable material built into product.
- It is clear, materials sourced in raw state should have a shelf life.
- Emerging technologies, including bio-stimulants and bio-resonance, are being explored for future industrial applications, demonstrating new opportunities for innovation.

2. Talk 2: EIT Food – Catalyst for the Transformation of Our Food System

Speaker: Elvira Domingo, European Institute of Innovation & Technology (EIT) Food

1. Introduction to EIT Food:

- EIT Food is part of a community addressing major societal challenges, particularly transforming the food system.

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- The goal is to support innovators, startups, entrepreneurs, and research institutions to improve food sustainability and address global food challenges like hunger, obesity, and food waste.
- EIT Food supports startups, helping bridge the gap between research and the market, especially since 9 out of 10 startups fail in this process.
- Their community has grown from 50 partners in 2016 to over 150, including universities, research centers, SMEs, corporates, and startups.

2. Achievements:

- Over 1,000 farmers trained, 1,600 entrepreneurs supported, and 40,000+ students educated.
- Investments attracted by startups have exceeded €200 million in 2023 alone, with EIT Food investing over €70 million in innovation initiatives.

3. Opportunities for Participation:

- EIT Food offers several participation avenues including:
 - Impact Funding Framework: Funding for single and collaborative programs, with up to 70% co-funding and a focus on bringing research to market.
 - Internship Programs: Paid internships for students lasting 3-6 months.
 - Expert Communities: Providing peer support and collaboration opportunities for companies and experts.

4. Focus Areas:

- Healthy Nutrition: Promoting healthy diets.
- Sustainable Food Systems: Focusing on packaging, traceability, protein diversification, and regenerative agriculture.
- Resilient Food Systems: Aiming for fairness and adaptability in food production.

5. Key Initiatives:

- Regenerative Agriculture Program: Launched in 2018, training farmers to implement sustainable agricultural practices and monitor soil and plant health. The program, co-funded by companies like Cargill and Danone, aims to reduce fertilizer use and improve crop rotation.
- Test Farms Program: Startups collaborate with farmers to test new technologies in agriculture.

3. Talk 3: R&D opportunities for industrial companies with US grants

Speaker: Brij Singh, IEEE Fellow, John Deere Fellow and Electrification R&D Manager

1. U.S. Government Funding:

- It is an intense, competitive process to apply for U.S. government-funded grants. Only a small percentage (2%) receive funding.

2. Some Successful Projects at John Deere:

- Power America Project (at John Deere), initiated during the Obama administration, focusing on developing silicon carbide inverter technology. This project involved a \$114 million U.S. manufacturing initiative and significantly improved drivetrain component supply chains.

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- John Deere's role in developing silicon carbide inverters for vehicles: it was among the first to produce and implement this technology. These inverters are critical for making powertrains more efficient.
- Various projects were highlighted, including the Power America Project and hybrid powertrain development, which involves reducing engine size and utilizing batteries. Another major initiative focuses on developing more efficient, reliable chargers for electric vehicles and advanced materials like gallium nitride.
- The diesel-electric hybrid powertrain project was emphasized, aiming to improve vehicle efficiency while reducing emissions.

3. Challenges and Future Outlook:

- The importance of battery technology development, particularly in optimizing chargers and extending battery life through techniques like pulse power charging.
- Ongoing development of mobile power chargers and gallium nitride inverters: aim to address energy resource management and support more multifunctional energy systems.
- Business value of these government-funded projects: talent development, creating intellectual property (patents), and advancing John Deere's technological capabilities.
- U.S. government grants have significantly boosted John Deere's R&D efforts, allowing them to engage top talent, develop cutting-edge technology, and remain competitive in global markets.

Session 1 Panel Discussion and Q&A Session - Key Sentences:

- The challenge for human centered engineering in agriculture is the large variation in agricultural enterprises. In terms of size, type of production, age and education level of the farmer. Of course these may change in time, but then one must plan for the future, but at the same time take care or try to have a number of policy measures that make that the small or farmers in less developed regions don't feel left behind. This can mean that efforts have to go into actively approaching each group to get them really involved.
- We need to overcome current crises (military wars, trade wars, cybercrime, climate change EU bureaucracy).
- Electrical power for farm equipment looks like a promising energy source for the future. This is probably not the same challenge as for electric power for individual passenger cars. There are scaling challenges, challenge of bringing the energy source to the machine rather than the machine to the source. How can test farms incorporate all these new developments and show the most appropriate mechanization form for individual farmers. There may not be a standard "one solution for all (or many)".
- R&D opportunities in the US appear to receive funding from Government but to large companies only.
- Need to develop SME so that large receiving companies have satellites downwards to fund via pyramid.
- Most SME have innovators, and the funding should find its way to them, but it is complex administration.
- There was a debate on the role of government funding in R&D, particularly around intellectual property (IP) and patents. Some argued that taxpayer money should not be exclusively used for large corporations' benefit without broader societal benefits. However, others defended the role of government funding in maintaining technological leadership, especially in the U.S., where this support helps promote manufacturing and creates jobs.

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- The challenge of integrating electric vehicles (EVs) in agriculture was mentioned, particularly around battery capacity, charging efficiency, and the cost of batteries.
- The future of precision agriculture, particularly in Eastern Europe, and its impact on smaller farms and aging populations was addressed.
- The need for robotic solutions and smart farming practices to improve efficiency, reduce manual labor, and make farming attractive to younger generations.
- Help to farmers is key but how do we encourage them to participate in schemes.
- A new generation of farmers are tech aware, but do they have time to keep up with everything.
- Need to see more of crop rotation projects to enable entrepreneurs to develop.
- The current price of batteries (around \$250 per kWh) and projected that by 2030, battery prices could drop to \$60 per kWh, making them more competitive with diesel engines.
- The concerns about the sustainability of battery production, the carbon footprint, and the recycling of battery materials.
- The potential of hydrogen as an alternative fuel source, particularly for off-road vehicles, was noted. With hydrogen prices expected to drop, it could become a more attractive option compared to electric, especially for industries where battery electric technology may not be viable.
- The importance of ecosystems, collaboration, and networking in advancing innovation was emphasized.
- The value of governmental RDI (Research, Development, and Innovation where innovation covers 'commercialisation' what goes beyond R&D) funding is much more than monetary contribution. It is: Networking; Getting ideas and inspiration by others (esp. in collaborative projects); Additional value added by new products from new ideas; Talent identification and recruiting; Reducing time to market; Succeeding projects; Residual value of demonstrators; Reputation by publications and marketing support.
- Research, Development and Innovation policies must be devised to encourage growth in all sectors in agriculture, horticulture and agricultural engineering manufacturing.
- Future policy must become an integral part of the policy decision-making process and incorporate a long-term plan.