Opportunities for nanotechnologies, advanced materials and technologies 2030 and beyond

**CLIMATE ACTION**
- Low carbon mobility and communication
  - Smart mobility services
  - Low emission power trains
  - Zero energy communications

**RESOURCE SUFFICIENCY**
- Renewable materials
  - High performance materials
  - Zero environmental impact processes
  - Agile material-product integration

**GOOD LIFE**
- Disruption of work
  - Productivity, competitiveness and wealth by Artificial Intelligence
  - Sharing and platform economy
  - Agile and learning society

**SAFETY AND SECURITY**
- Securing critical supplies
  - Water resilience
  - Resource flows in super connected ecosystems

**INDUSTRIAL RENEWAL**
- Design for future
  - Customer as a designer
  - Artificial Intelligence as a designer
  - Design for life-cycle excellence

**ENERGY INTELLIGENCE**
- Energy users as producers
  - Value from energy system flexibility
  - Energy storages everywhere

**SUSTAINABLE NON-RENEWABLES**
- Mineral materials from secondary resources
  - Material substitution

**CITIZEN CENTRIC CARE**
- Preventive health support
  - Predictive diagnostics and care
  - Healthcare process optimization

**CYBER SECURITY**
- Seamless security
  - Secure communication networks
  - Critical infrastructure protection

**LOW CARBON MOBILITY AND COMMUNICATION**
- Future renewable energy solutions
  - Future nuclear energy

**LOW CARBON ENERGY**
- CO₂-derived energy carriers
  - Carbon cycle in forest industry
  - High-value products from CO₂ compounds

**SMART BUILT ENVIRONMENT**
- Urban intelligence
  - Cognitive built environment
  - Future proof cities

**SECURED AUTONOMOUS SYSTEMS**
- Autonomous transport hubs
  - Safe autonomous operations
  - Controlled autonomy

**CLIMATE NEUTRAL INDUSTRIAL PROCESSES**
- Zero-C industry

**FOOD 4.0**
- Re-think agro-food processing
  - Food without fields

**DISRUPTIVE BUSINESSES**
- Operational excellence as a service
  - Data as business
3D PRINTING OF BIOMATERIALS

- On-demand production
- Rapid prototyping / concepting
- Personalized products
- Mass customization
- Complex geometries
- Light-weight structures
- Efficient material usage

Wood materials
- Native lignocellulose materials
- Cellulose derivatives
- Thermoplastic lignocellulose materials

Biomaterials
- Polylactid acid (PLA)
- Starch
- Foodstuff

Photo by Kirsti Kataja

Shoe demonstration. Upper material is strong, cellulose based nonwoven textile, made by material researchers from VTT. The brown texture is made by 3D printing cellulosic paste. Demonstration is designed and made by Saara Kinnunen, HAMK. Contact person Jukka.Ketoja@vtt.fi.