**[Attachment 3]**

2022 Detail themes for overseas technology demand surveys

| **PD field** | **themes** | **themes instruction or examples** |
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| Bio | ① Develop future infectious disease prevention and treatment manufacturing process technology  ② Development of waste plastic decomposition technology using bio-materials  ③ Continuous production process technology development based on quality based design | ① Vaccine core technology development (production, supply, commercialization) that can quickly respond to future infectious diseases such as COVID-19,  Disease prediction/diagnosis technology, customized prevention and targeted treatment technology development  ② Development of biomaterial-based low-cost and fast degradable transparent plastic technology,  Development of petroleum plastic property degradable low-cost microorganisms,  Ultra-low cost disposable biodegradable plastic (improvement of biodegradability and cost reduction) technology development  ③ Continuous pharmaceutical production technology with global competitiveness based on big data and ICT convergence technology for the production of low-cost, high-quality pharmaceuticals |
| System Semiconductor | ① Composite-based power semiconductor device and process technology development  ② Semiconductor design and device technology development for Automobile (ex, MCU performance improvement etc.) | ① Develop core technologies related to power semiconductor devices and processes based on composites such as silicon carbide (SiC), gallium nitride (GaN), gallium oxide (Ga2O3), and GaN-on-GaN  ② Semiconductor device design technology development such as Automobile MCU and ECU performance improvement, infotainment semiconductor technology development |
| Knowledge Service | ① Online or Un-contact service technology development (realistic, customized, personalized)  ② Edutech (Education + tech) technology development (focused on remote education/learning)  ③ Digital engineering technology development for Carbon reduction (intelligent design and predictive maintenance) | ① Remote collaboration task based on intelligent technologies such as AI and realistic technologies such as AR/VR,  Online or Un-contact service technology such as education and training, virtual cultural experience, home-based serive.  ② Personalized remote education, training, and learning service technology using AI, emotional diagnosis and sympathetic technology  ③ Technology that can use intelligent technologies such as AI, IoT, etc. to determine in advance the presence or absence of equipment in the production process,  Digital transformation technology between parts and processes for carbon reduction |
| Autonomous Vehicle | ① Autonomous vehicle recognition prediction sensor technology and advancement  ② Autonomous driving computing platform (multi-artificial intelligence software, route prediction optimization technology)  ③ Communication technology with enhanced security in automobile and with the outside of the automobile . | ① Enhanced awareness and prediction technology of surrounding conditions (dynamic, static, traffic conditions, etc.) during autonomous driving  ② Self-driving collision avoidance and reduction technology,  Autonomous driving response fallback and fail operation technology,  Support development of remote automobile control technology for unmanned autonomous driving  ③ Technology to enhance security and safety of communication technology in autonomous vehicles and communication technology with the outside of the autonomous vehicles. |
| Robotics | ① Logistics picking/handling technology using robots  ② Household support robot in daily life  ③ Rehabilitation/treatment robot (including wearables)  ④ Intelligent algorithm and parts such as robot self-recognition and clustering function | ① Picking and handling of objects, transfer/loading technology in logistics warehouse, factory logistics, and daily life logistics  ② Housework assistant robot to move in the home and work on housework,  Robot and operation/handling technology capable of picking/manipulating atypical objects  ③ Robots capable of nursing assistance, rehabilitation, and treatment for patients such as upper limb palsy/stroke (including wearable robots)  ④ Cluster autonomous navigation technology,  Last mile shipping robot technology,  Logistics robot intelligence/remote control technology and core parts for robots |
| Advanced Machinery | ① Electric construction machinery parts(including charging, battery, inverter motor, etc.)  ② Low Global Warming Potential refrigerant based heat pump technology | ① Components and parts technology such as electric drive system, electric motors, inverters, converters, battery packs, etc for small construction machines or agricultural machines.  ② High-efficiency heat pump design and technology using a low Global Warming Potential refrigerant |
| Advanced Equipment | ① High-power laser/electron beam multi-complex processing system  ② Process innovation and intelligent technology of manufacturing equipment  ③ 3D printing microstructure manufacturing process and equipment  ④ Functional special material manufacturing technology and convergence technology for lamination molding  ⑤ 3D printing applied core parts performance evaluation and reliability verification technology | ① Technology to improve the reliability of laser processing equipment and core parts,  High-power electron beam oscillation and stabilization technology,  Development of electron beam-based 3D printing process technology and reliability technology  ② Equipment technology that innovates the process or converges intelligent technology to improve the productivity and quality of the existing manufacturing process.  ③ Design and demonstration technology process/equipment that supports DfAM design, such as 3D printing fine lattice structure/surface structure design  ④ Convergence technology such as manufacturing technology, process, equipment, and control of functional special material for lamination molding  ⑤ Automatic control through process monitoring data analysis for advanced 3D printing process, AI-based real-time condition abnormality diagnosis and prediction technology development |
| Manufacturing Process | ① Development of advanced manufacturing technology of high strength brass alloys and oilless bearing with high surface pressure of over 100 MPa  ② Sheet metal stamping technology with AI-based real time die feedback control for reducing the product quality scattering of automotive components  ③ High functional and low frictional nanocomposite coating for electrical vehicles (EV)  ④ Development of manufacturing technology to improve the performance and reliability of flexible device  ⑤ Development of electrode system for Li-free secondary ion battery and module assembly with joining of multiple cells for electric vehicle  ⑥ Development of molding technology to manufacture high-performance bipolar plate and gasket for fuel cell stack | ① World-leading manufacturing technology of both high strength brass alloys with tensile strength of over 950 MPa and oilless bearing with surface pressure of over 100 MPa to be used in the automotive industry and construction machinery  ② Intelligent and smart manufacturing technology for reducing the product quality scattering due to the material deviation by the AI-based mechanical property measurement and die feedback control in realtime during the sheet metal forming process of automotive components  ③ High functional nanocomposite coatings for a sensor to detect the emission of the hazard gases or to identify some damage of critical parts in EV. Low fictional nanocomposite coatings for the improvement of durability and the reduction of friction coefficient of powertrain and driving parts in EV. Alloying design, property evaluation, and studies on application fields for new coating systems.  ④ Development of surface treatment technology of silicon elastomer and manufacturing technology of thin film flexible electrode device to improve elongation and electrical conductivity of flexible electronic devices  ⑤ Development of electrode system including cathode and anode for Li-free secondary ion battery, and joining technology for cage-type battery assembly with high reliability under driving conditions for electric vehicle  ⑥ Film-based continuous production technology for graphite materials, bipolar plate molding technology, and dispenser-based gasket forming technology for mass-production |
| Smart Manufacturing | ① Industrial IoT  ② Intelligent parts and system SW  ③ Virtualization-based intelligent equipment and system SW | ① Highly reliable IoT technology used in various industries, which satisfies robustness, connectivity, security, and economics applicable to various environments  ② Built-in artificial intelligence technology for intelligentization of industrial parts․equipments and reliable technology for industrial application  ③ Base technology for intelligent manufacturing equipment system and efficient application of industrial system enhancement |
| Shipbuilding | ① Development of a simulator for safe operation of ice-class vessels operating in polar regions  ② Offshore wind blade condition diagnosis and surface erosion /peel repair robot development  ③ Oil carrier VOCs collection and fuel conversion system  ④ CO2 Hub facility design and construction core technology  ⑤ Machine Learning for Offshore system operation | ① Technology development related to ship simulator and operation guideline in consideration of polar environmental conditions (ice, etc.)  ② Development of technology based on remote repairs such as robots and condition diagnosis technology of blades to reduce wind turbine maintenance cost and increase work efficiency.  ③ Crude oil carrier VOCs (Volatile organic compounds) collection (reliquefaction) and fuel conversion equipment technology development,  VOCs analysis and processing system development and certification technology development  ④-1 System operation technology for CO2 injection and monitoring  ④-2 Hub facility infrastructure construction technology for CO2 transportation/injection  ④-3 Development of carrier technology capable of simultaneously transporting CO2/LNG  ⑤ Machine learning technology and database construction to optimize the offshore system process and improve performance,  Machine learning algorithm development and verification for predictive maintenance of major facilities. |