

Based on previous studies and the description of the task in the DoA, we have identified the following **functional stages of the CCAM value chain**. This approach helps clarify how different occupations contribute to the development, deployment, operation, and support of CCAM systems.

The value chain proposed below integrates not only the technological dimensions of CCAM, but also its social, regulatory, educational, and commercial aspects. This holistic perspective ensures that the development and deployment of CCAM systems are inclusive, economically viable, and aligned with societal needs and expectations.

Value Chain perspective

1. Research & Innovation¹ (Excluded from the scope, see footnote)

2. Design & Development

- Technological Development: Roles involved in conceptualizing, engineering, and programming CCAM technologies,
- Service & Business Design: Roles focused on service design, user experience, accessibility, and business model innovation, ensuring CCAM solutions are socially inclusive and economically viable

3. Manufacturing & Assembly

Roles involved in producing and assembling vehicles, infrastructure, and components, including customization for service delivery and user accessibility.

4. Recycling & Circular Economy

Roles focused on the reuse, recycling, and sustainable disposal of vehicles, components, and infrastructure.

5. Infrastructure Deployment & Operations

Roles that plan, manage, and deliver mobility services, including freight and passenger transport, customer support, remote operations, and personalized travel assistance.

6. Mobility Services & Logistics

Roles that plan, manage, and deliver mobility services, including freight and passenger transport, customer support, remote operations, and personalized travel assistance.

7. Policy & Regulation

Roles that define legal frameworks, ensure compliance, and manage risk in CCAM operations and systems, including social impact analysts, ethics experts, and community engagement officers.

¹ Researchers are not included in the analysis as research roles are inherently exploratory and future-oriented, focused on emerging technologies, and long-term innovation. These roles are not directly impacted by CCAM deployment, but rather influence its development. Their evolution is not a consequence of CCAM, but a driver of it.

8. Market & Commercial Development

Roles that promote, sell, and manage CCAM services and platforms to support adoption and growth, including business development, marketing, and public relations professionals who shape public perception and user engagement.

9. Training & Education

Roles involved in training and educating users and professionals in CCAM systems, including simulator instructors, accessibility trainers, and curriculum developers for inclusive mobility education.

By systematically reviewing outputs from various European research projects and job advertisements, a total of **108 distinct job profiles have been identified** as being impacted by the implementation of Connected, Cooperative, and Automated Mobility (CCAM). These profiles encompass both existing and emerging roles and are detailed in the accompanying **Excel** document. Each job includes a concise description, along with a classification based on transport mode and mobility type.

Furthermore, a preliminary mapping of each job to the ISCO-08 occupational codes and corresponding skill levels² has been conducted. This classification aims to ensure alignment with other tasks within the project and to facilitate the subsequent phase of Task 3.1.

Given the impracticality of working with an extensive list of more than 100 individual job profiles in subsequent project activities, a consolidated set of **33 job families** has been developed. This grouping is based on shared characteristics in terms of ISCO-08 occupational codes and corresponding skill levels, enabling a more structured and manageable framework for analysis and alignment with other project components. The Excel document can be accessed at [Mapping of jobs v7.xlsx](#).

The following job families reflect the multifaceted nature of CCAM deployment, encompassing not only technical roles but also those critical to its social acceptance, regulatory compliance, business viability, and inclusive education. This classification supports a holistic understanding of the workforce transformation driven by CCAM.

Job Families

Design & Development

1. Engineers

Skill Level: 4

- Manufacturing

Includes: Automotive, Battery, Powertrain, Robotics, AI, Smart Infrastructure Engineers, Software, Additive Manufacturing.

² ISCO-08 is an international classification system developed by the International Labour Organization to organize occupations based on the tasks and responsibilities they involve. It includes four skill levels, ranging from basic manual roles (Level 1) to highly specialized professional and managerial positions (Level 4), determined by the education and training typically required for each job. This framework supports consistent labor market analysis and policy development across countries.

ISCO-08: 2144 (Mechanical Engineers), 2149 (Engineering professionals not elsewhere classified), 2152 (Electronics Engineers)

2. Service & Business Design

Includes Mobility Service Designer.

ISCO-08: 2421 (Management and Organization Analysts)

3. Software & Systems Development

Includes: Software Engineers, Backend Developers, App Developers, Autonomous Systems engineers, Simulation-based AM Developer.

ISCO-08: 2511 (Systems Analysts), 2512 (Software Developers), 2513 (Web and multimedia developers), 2519 (Software and Multimedia Developers and Analysts Not Elsewhere Classified).

4. Cybersecurity & IT Protection

- Telecommunications & Connectivity engineers

Includes: 5G/6G Engineers, IoT Developers, Protocol Managers

ISCO-08: 2152 (Electronics Engineers), 2153 (Telecommunications engineers)

Skill Level: 4

- Cybersecurity & IT Protection Experts

Skill Level: 4

Cybersecurity Architect, Information Security Analyst, IT security consultant

ISCO-08: 2519 (Software and Applications Developers and Analysts Not Elsewhere Classified)

- Cybersecurity & IT Protection Technician

Skill Level: 3

ISCO-08: 351 (Information and Communication Technicians)

5. Data Science & Analytics experts

Includes: Data Scientists, Mobility Data Analysts, Predictive Maintenance Analysts

ISCO-08: 2511 (Systems Analysts)

Skill level: 4

6. HMI, UX & Human Factors Experts

HMI designer, Mobility Behavioral scientist, Human Factors & HMI Researcher

ISCO-08: 2166 (Graphic and Multimedia Designers) and 2634 (Psychologists)

Skill Level: 4

Manufacturing & Assembly

7. Manufacturing & Assembly Technicians

Includes: Vehicle, UAV, Shipbuilding, Sensor Technicians, Additive Manufacturing Process Technician.

ISCO-08: 3114 (Electronics Engineering Technicians), 3115 (Mechanical Engineering Technicians)

Skill level 3

Recycling & Circular Economy

8. Decommissioning & Recycling technicians

Disassembly Technicians, Battery Lifecycle Managers, Recycling Specialists. Includes spare parts management, Recycled Material Filament Technician.

ISCO-08: 3119 (Physical and Engineering Science Technicians Not Elsewhere Classified),

Skill level 3

9. Recycling and waste management operators

Disassembly technicians, battery sorting workers

ISCO-08: 8131 (Chemical Products Plant and Machine Operator)

Skill level 1-2

Infrastructure Deployment & Operations

10. Maintenance & Repair operators

Includes: Mechanics, Sensor Maintenance Assistants, Predictive Maintenance Technicians, digital maintenance operators, AM-Enabled Maintenance Technician. Includes basic maintenance, scheduled maintenance and repair.

ISCO-08: 7231 (Motor Vehicle Mechanics and Repairers)

Skill level 2

11. Construction workers

Upgrading and maintaining roads and highways, warehouses and hubs

ISCO-08 9313

Skill level 1, 2

THIS ROLE WILL EVOLVE. Use of automated machinery, robotic paving systems, and drone-based inspections will reduce manual labour but increase the need for technical oversight. Workers may shift toward machine supervision, remote operation, and system diagnostic. This requires basic digital literacy. Some roles may shift from Skill Level 2 to Level 3, especially where technical troubleshooting is required, workers interact with automated systems and data logging and digital reporting become standard.

12. Emergency & Incident Management

Emergency response coordinators

ISCO 1349

Skill level 3

13. Urban Planning, including Physical & Digital Infrastructure

Includes: Urban Planners, physical and digital Infrastructure Technicians, Digital Infrastructure Monitors

ISCO-08: 2164, 2142, 3114

Skill level 4-3

Mobility Services & Logistics

14. Remote Mobility Support Roles

Remote Customer Support Agents, Electric Car Battery Support Agent, ticket issuers, toll collectors, Remote Mobility Support Specialist.

ISCO-08: 4222 (Contact Centre Information Clerks), 4323 (Transport Clerks)

Skill level 2

15. On-Site Mobility Assistance Roles

Includes: Travel attendants, Car Rental Agents, Smart mobility assistant, valet operator, Door-to-Door Mobility Assistant.

ISCO-08: 5111 (Travel Attendants and Travel Stewards), 5249 (Vehicle Rental Agent)

Skill level 1-2

16. Surveillance Operators

Includes: (Public) Transport Surveillance Operators, parking enforcement officers and traffic violation officers

ISCO-08: 5414 (Security guards)

Skill level 2

17. Mobility and services platform managers

Includes: MaaS Managers, AV Fleet Managers

ISCO-08: 2421 (Management and Organization Analysts)

Skill level 4

18. Remote Operations

Includes: Remote Vehicle Operations Technician

ISCO-08: 3154 (Electronics Engineering Technicians)

Skill level 3

19. Drivers

Drivers (truck, bus, taxi, rail, metro). Role will evolve with automation levels

Currently ISCO-08: 83 Drivers and Mobile Plant Operators

Skill level 2

As the level of automation increases, the role will evolve from traditional manual operation to technologically augmented and supervisory functions. This will likely lead to new ISCO codes and higher skill level classifications

20. Freight, Warehouse & Port workers

Includes: Dockworkers, delivery handlers, warehouse workers

ISCO-08: 9333 (Freight handler working manually or with semi-automated systems).

Skill level 1

Transitional Role: Logistics Automation Assistant

ISCO-08 4321 (Stock Clerks) or 4323 (Transport Clerks)

Skill Level 2

Tasks:

Monitor automated systems (e.g., AGVs, conveyors).

Input and verify data in warehouse management systems (WMS).

Coordinate with technical teams for system alerts or errors.

21. Logistics managers

Includes Urban Logistics Manager, global freight manager, warehouse operations manager

ISCO-08: 1324 Supply, Distribution and Related Managers

Skill level 4

22. Traffic Control & Signalling

Includes: Signallers(rail) Rail Traffic Controllers, Autonomous Traffic coordinators

ISCO-08: 4323 (Transport Clerks)

Skill level 3

23. Human Resources & Organizational Development

Remote HR Specialist.

ISCO-08 2423

Skill level 4

Policy & Regulation

24. Legal & Regulatory professionals

Includes: Lawyers, Compliance Specialists, Policy Designers

ISCO-08: 2619 (Legal professionals not elsewhere classified)

Skill level 4

25. Policy makers (local, municipal, regional, national, EU levels)

ISCO-08: 2422 (Policy Administration Professionals)

Skill level 4

26. Insurance & Risk Assessment professionals

Includes: Insurance Specialists, Liability Risk Assessors, Data Privacy Officer

ISCO-08: 2412 (Financial and Investment Advisers), 2619 (legal professionals not elsewhere classified), 2421 (Lawyers)

Skill level 4

27. Ethics & Philosophy experts

Includes: Ethics Experts, Transport Philosophers

ISCO-08: 2633 (Philosophers), 2632 (Sociologists)

Skill level 4

28. Socioeconomic & Impact Analyst

Transport economists, Social Impact Analysts.

ISCO-08: 2631, 2635

Skill level 4

29. Health, Safety & Ergonomics

OSH experts

ISCO-08 2263

Skill level 4

Market & Commercial Development

30. Sales workers:

Includes Vehicle sales representatives, Charging Station Attendants and car rental agents (sales and handover)

ISCO-08: 5249

Skill level 2

31. Sales & Marketing specialists

Includes: Vehicle Sales, Marketing Specialists, Business Development Managers, Business Developer / Service Designer.

ISCO-08: 2431 (advertising and marketing professionals), 2432 (Public relations professionals).

Skill level 4

Training & Education

32. Trainers

Includes: Driving Instructors, Simulator Trainers, AV Safety Operators, CCAM operations trainers, AM Training Specialist (Mobility Sector).

ISCO: 5165 (Driving instructors) This role is expected to evolve as automation penetrates.

Skill level 2

ISCO: 4323 (Transport clerks)

Skill level 2 or 3

33. Educational Program Developers

Curriculum Developers (all levels of education), Simulation-Based Learning Developers

ISCO-08: Group 23 (Education Specialists),

Skill level 4

Additional: Job families reorganized into four domains to highlight the social, regulatory, business, and educational dimensions:

Technical

- Engineers
- Software & Systems Development
- Cybersecurity & IT Protection
- Data Science & Analytics Experts
- HMI, UX & Human Factors Experts
- Manufacturing & Assembly Technicians
- Decommissioning & Recycling Technicians
- Recycling and Waste Management Operators
- Maintenance & Repair Operators
- Construction Workers

Social / Regulatory

- Emergency & Incident Management
- Urban Planning (Physical & Digital Infrastructure)
- Legal & Regulatory Professionals
- Policy Makers
- Insurance & Risk Assessment Professionals
- Ethics & Philosophy Experts
- Socioeconomic & Impact Analysts
- Health, Safety & Ergonomics
- Surveillance Operators

Business / Commercial

- Mobility and Services Platform Managers
- Freight, Warehouse & Port Workers
- Logistics Automation Assistant
- Logistics Managers
- Traffic Control & Signalling
- Sales Workers
- Sales & Marketing Specialists
- Remote HR Specialist
- Remote Mobility Support Roles
- On-Site Mobility Assistance Roles
- Remote Operations
- Drivers

Educational / Training

- Trainers
- Educational Program Developers