# CulturalRoad: A Five-Pillar Framework for Equitable CCAM Implementation Across Europe

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## Introduction

- **CCAM** (Connected, Cooperative & Automated Mobility) aims to improve:
  - Efficiency
  - Safety
  - Sustainability
- However, benefits are **not equally distributed**
  - Risk of **transport inequality**
  - Potential to reinforce **transport poverty**

**Key Challenge**

Equity also depends on:

- **Geography**
- **Socio-demographics**
- **Cultural & psychological factors**

Existing frameworks **do not fully capture these dimensions**

## Objectives

i. Develop a framework to **assess equity of CCAM systems**

ii. Introduce the **Five-Pointed Star Rating System (FPSRS)**: A **multi-dimensional evaluation tool**

iii. Integrate:

🧍 **Inclusivity,** 🌐 **Network optimization,** ⚠️ **Safety,** 🤝 **Acceptance,** 🧠 **Psychological factors**

## Methodology: FPSRS Framework

**Approach**

**Mixed-methods design** combining:

1. **Quantitative modelling**
2. **Qualitative insights (user perspectives)**

Ensures both **system-level performance** and **user experience** are captured

**Data & Methods**

- **Analytical & simulation models:** Accessibility, efficiency, affordability
- **Surveys, interviews & focus groups:** Perceptions, trust, cultural attitudes
- **Workshops with stakeholders:** Policymakers, operators, developers

**Co-Creation Process**

1. **Stakeholder workshops** → system-level insights
2. **Focus groups** → user experiences & barriers

**Ensures** inclusion of **underrepresented groups**

**Framework Output (FPSRS)**

- Evaluates CCAM equity through: **5 integrated pillars**
- Uses **KPIs + normalization + aggregation**
- Produces a **composite equity score**


**Figure 1.** Equity pillars according to CulturalRoad's view

## CulturalRoad Research Concepts

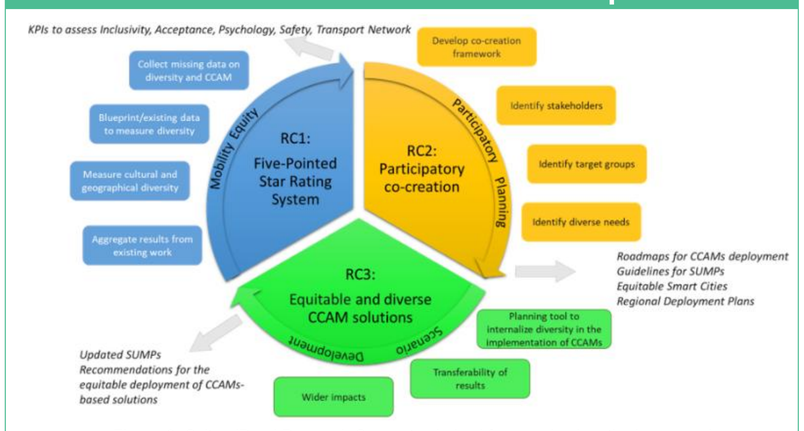


**Figure 2.** CulturalRoad Research Concepts, derived from a mixed-methods approach

## Five-Pointed Star Rating System (FPSRS)

### 🧍 Inclusivity

Access across:

- Physical
- Digital
- Economic dimensions

Focus on **underserved groups**

⍰ Prevents **transport exclusion**

### 🌐 Network Optimisation

Integration within **multimodal systems**

Balances:

- Efficiency
- Equity

→Ensures fair service distribution

### ⚠️ Safety

Evaluates **risk disparities** across users

Uses:

- Surrogate safety indicators
- Infrastructure readiness
- Addresses unequal safety exposure

→Addresses unequal safety exposure

### 🤝 Acceptance

Measures **willingness to adopt CCAM**

Based on:

- Socio-demographics
- Attitudes & perceptions

→Identifies adoption barriers

### 🧠 Psychological Factors

Examines:

- Trust in automation
- Technophobia
- Cultural attitudes

→Explains behavioural responses

**Table 1**. Conceptual alignment between FPSRS pillars and EU-CEM evaluation dimensions

| FPSRS Pillar | Related EU-CEM Evaluation Areas |
|---|---|
| Inclusivity | Accessibility, reachable activities, societal impacts |
| Network Optimisation | Traffic efficiency, multimodal integration |
| Safety | Road safety, infrastructure readiness |
| Acceptance | User acceptance and behavioural response |
| Psychological Factors | Social perception and behavioural aspects |

## Framework Integration & Evaluation

**From Indicators to Equity Score**

- Each pillar is translated into **Key Performance Indicators (KPIs)** capturing:
  - Accessibility
  - Level of service
  - Safety
  - Acceptance
  - Behavioural & cultural factors

## Framework Integration & Evaluation

**Step 1: Normalization**

- Indicators standardized (e.g., min–max scaling)
- Ensures **comparability across contexts**

**Step 2: Aggregation**

KPIs combined into:

i)**Pillar-level scores** and ii) **Overall equity score**

Flexible weighting:

Equal or **policy-driven priorities**

**Step 3: Visualisation**

**Equity Star Diagram (Radar Chart)**

Displays performance across all 5 pillars

Enables:

i. Cross-city comparisons

ii. Identification of **trade-offs & gaps**

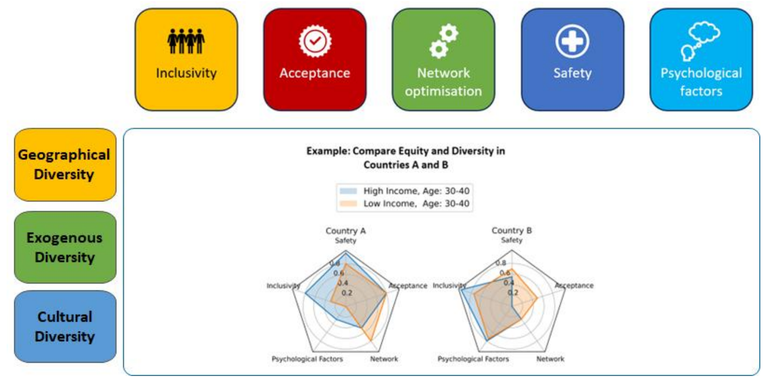


**Figure 3.** Equity evaluation and comparison through the FPSRS

## Conclusions

**Key Finding 1: Trade-offs Across Contexts**

**Urban areas**

- High **network efficiency**
- Lower **inclusivity (affordability gaps)**

**Peripheral / rural areas**

- Higher **inclusivity (coverage)**
- Lower **safety (infrastructure readiness)**

→ Highlights **equity vs. efficiency trade-offs**

**Key Finding 2: Role of Behavioural Factors**

- **Acceptance and trust** strongly influence adoption
- **Cultural attitudes & perceptions** remain critical barriers

→Technical access alone ≠ **actual adoption**

**Key Finding 3: Value of FPSRS**

- Provides a **multi-dimensional view of equity**
- Identifies: i. Gaps across regions and ii. Differences across user groups

→Supports **targeted policy interventions**

## Conclusion

•FPSRS enables multi-dimensional **equity assessment**

•Reveals **trade-offs & disparities**

•Highlights the role of **behavioural factors**

**Supports equitable CCAM deployment**

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