# 1.3 Research Question and Objectives

Guided by the gaps outlined in the previous problem statement, this study frames one overarching research question and five specific objectives. Together they steer the empirical design, data collection, and analytical choices developed in later chapters.

## Research Question

How does Industry 4.0 transform supply‑chain activities, value chains, and sustainability, and what challenges do major industry players face in adopting these technologies?

## Research Objectives

1. Evaluate the impact of Industry 4.0 technologies on supply‑chain efficiency, resilience, and agility within the selected companies.

2. Examine how value‑chain processes are re‑configured through digital technologies in the logistics, consumer‑goods, and automotive cases.

3. Quantify the influence of Industry 4.0 adoption on sustainability metrics such as energy consumption, greenhouse‑gas emissions, and material waste.

4. Identify and compare company‑specific organisational, technological, and ecosystem challenges that constrain successful adoption.

5. Develop data‑driven recommendations for scaling Industry 4.0 solutions across diverse industrial contexts based on the empirical findings.

These objectives collectively operationalise the research question by translating a broad inquiry into measurable constructs and comparative assessments. They also provide a clear template for evaluating whether Industry 4.0 initiatives deliver simultaneous gains in operational performance and sustainability, and under which conditions such gains are most likely to persist.