Sustainable innovation processes in the asphalt paving sector: analysis of actors, interactions, and institutions

Angie Lorena Ruiz Robles, João Santos, Joanne Vinke-de Kruijf, Leentje Volker, André Dorée
Construction Management and Engineering
University of Twente, Netherlands

The implementation of sustainable innovations in the asphalt paving sector is slow, uncertain, and more challenging than expected despite being eagerly promoted by governments.

Knowledge gap
Existing literature:
• Emphasis on the technical dimension
• Project-based innovations
• Endogenous process within single organizations
• Social dimension has been overlooked

Objective
• To explore the social and managerial aspects that shape sustainable innovation processes.
• To identify influential topics or concepts across the distinct actors involved in the process, and the connections among them.

Research approach
Theoretical lenses:
System innovation and Multi-actor Perspective to view the Dutch asphalt paving sector as a socio-technical system, where actors and institutions interact to shape the sustainable innovation process.

Methods:
• Case study
• Semi-structured interviews
• Thematic analysis
• Semantic network analysis (SNA)

Results Thematic Analysis
• The innovation process is triggered and shaped by national sustainable goals (climate-neutral agenda) and economic factors.
• Testing and validation assessment criteria are conservative, unharmonized, and unclear, creating bottlenecks with multiple tests prolonging the process duration.
• Decisions in the process are made from a project perspective.
• The public sector’s influence in the process is substantially high (main framework setters, evaluators, and consumers).

Results Semantic Network Analysis
• Most prominent concepts across multiple metrics: "public sector," "framework setters," "evaluation tools," "testing and validation," and "private sector"

• Main concepts per sector:
  • Public: testing and validation, durability, and assessment tools (commitment to robust solutions)
  • Private: investment, profit, trust (profit-driven approach)
  • Third: environment (commitment to social and ecological values)

Innovation is steered by distinct values across sectors. A harmonious innovation system requires aligning priorities and evaluating trade-offs.

Clusters:
Cluster 1:
• Explores system interactions, emphasizing cooperation and communication.
• Emphasizes testing and validation as pivotal stages.
• Advocates for a broader role for evaluators, urging them to not just assess innovations but also redesign criteria to aid system adaptation.

Cluster 2:
• Focuses on early process stages like idea generation and adaptation.
• Highlights managerial and specialized staff roles in these stages.

Cluster 3:
• Exploring system interactions, emphasizing cooperation and communication.
• Explores testing and validation as pivotal stages.
• Advocates for a broader role for evaluators, urging them to not just assess innovations but also redesign criteria to aid system adaptation.

Takeaway Points
• The public sector is the main concept of the network, suggesting that it is currently the most relevant actor in the process.
• Monitoring is another key concept, and results show that it is lacking at both the project and sector levels.
• Agency imbalance at organizational and sector levels underscores the necessity to harmonize diverse actors’ interests for sustainable solutions.
• Innovation roles are underestimated (coordinators and evaluators).
• There is awareness of collaboration, but communication and cooperation initiatives are limited to best practices exchange.
• Efforts should be focused on actors’ engagement, clear task, and responsibilities division, and trust-building.

To make the system innovation process more efficient we must understand better the actors’ roles and dynamics for re-distributing tasks and responsibilities, overcome the project perspective and address the lack of system monitoring.