
Process Maturity and Service Quality Assessment in Inland Transport Enterprises: A Model for European Green Deal Compliance

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Abstract:

Purpose: This paper proposes a comprehensive theoretical model for assessing process maturity and service quality in inland transport enterprises, aligning with the sustainability mandates of the European Green Deal (EGD). The model integrates traditional process maturity frameworks with environmental and service quality requirements specific to the inland transport sector.

Design/Methodology/Approach: The study is theoretical in nature, synthesizing literature on process maturity models, service quality, and EGD environmental standards. The proposed model incorporates five maturity levels, each integrating service quality and environmental performance indicators essential for inland transport enterprises under EGD compliance pressures.

Findings: The model provides a structured pathway for inland transport enterprises to progress through increasing levels of maturity. It addresses the dual objectives of operational efficiency and sustainable compliance with EGD requirements, ensuring that service quality is maintained as companies adapt to regulatory demands.

Practical implications: This model offers practical value for inland transport managers by providing a phased framework to assess and enhance their companies process maturity, service quality, and environmental impact. It facilitates a targeted approach to achieving sustainability goals while maintaining high service standards, thus supporting both compliance and competitiveness.

Originality: This study fills a critical gap in existing literature by integrating process maturity, service quality, and sustainability metrics into a single model, specifically designed for the inland transport sector operating under EGD requirements.

Keywords: Process maturity, service quality, European Green Deal, inland transport, environmental sustainability.

JEL classification: L91, Q56.

Paper type: Research paper.

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1. Introduction

The European Green Deal (EGD), a comprehensive policy framework, is designed to transform the European Union's economy by achieving carbon neutrality by 2050, with an intermediate target of reducing greenhouse gas (GHG) emissions by at least 55% by 2030 (European Commission, 2019). This ambitious agenda has placed the transport sector, a significant contributor to Europe's emissions, at the forefront of sustainable transformation (European Environment Agency, 2022).

Polish inland transport enterprises, which are integral to the national and European logistics networks (Jeziński, 2019), face considerable pressures to reduce emissions and improve sustainability while simultaneously maintaining high levels of service quality. These enterprises are compelled to adapt operational models and processes to align with the EGD objectives, which necessitate both environmental efficiency and resilience in service standards amidst evolving regulatory expectations (Charłampowicz *et al.*, 2024a).

To meet these regulatory demands, inland transport enterprises must innovate in both operational efficiency and environmental performance (Centobelli *et al.*, 2020). Process maturity models, which have been widely applied across various sectors (Lee *et al.*, 2019), provide structured frameworks that guide organizations in assessing and progressively advancing their operational capabilities (Tarhan *et al.*, 2015).

However, while traditional process maturity frameworks primarily focus on operational efficiency, their adaptation for Polish inland transport within the context of the EGD requires a broader approach. Such models must integrate sustainability practices that meet EGD standards, reflecting both the operational maturity and environmental objectives essential for alignment with the European Union's stringent emission reduction targets (Charłampowicz and Mańkowski, 2024).

Simultaneously, the ability to assess and enhance service quality remains a core priority, as Polish inland transport enterprises must continue to satisfy customer demands for reliability, timeliness, and flexibility (Kilibarda *et al.*, 2016). These service standards are increasingly challenged by the operational adjustments needed to comply with EGD regulations, which include shifts towards cleaner energy and optimized logistics networks (Rivas *et al.*, 2021).

Integrating service quality metrics within a process maturity framework would provide inland transport enterprises with a comprehensive model that accounts for both the pursuit of operational efficiency and the environmental requirements imposed by the EGD.

The dual challenge of attaining high levels of process maturity and service quality within the constraints of EGD requirements underscores a significant gap in existing

literature. While existing models address operational effectiveness or environmental compliance independently, few frameworks provide an integrated approach suited to the inland transport sector.

This theoretical study seeks to address this gap by proposing a new model for assessing process maturity and service quality within the context of the EGD, providing inland transport enterprises with a structured approach to achieving sustainable, efficient, and high-quality operations in an increasingly demanding regulatory landscape.

2. Literature Review

The EGD has catalyzed a surge in research exploring sustainable transformation within the transport and logistics sectors, especially in alignment with operational process maturity and service quality. Process maturity models, which assess an organization's operational capabilities and provide pathways for staged improvement, have been applied across various sectors, proving effective in enhancing systematic performance and adaptability to regulatory pressures (Lee *et al.*, 2019; Röglinger *et al.*, 2012).

However, the transport sector, particularly inland transport, requires tailored models that incorporate not only traditional operational metrics (Charłampowicz *et al.*, 2024b) but also sustainability benchmarks essential under the EGD. Inland transport enterprises are increasingly required to balance efficiency with rigorous environmental standards (Basma and Rodríguez, 2023), demanding models that go beyond standard process maturity metrics to include digitalization and eco-innovation.

Inland transport adaptation to the EGD requires a model that reflects this sector unique structural and functional demands (Kotowska *et al.*, 2020). Traditional process maturity models, such as those widely used in logistics and manufacturing, progress through stages that measure the extent of process identification, standardization, control, and optimization, often culminating in full integration and continuous improvement (Sawicki and Jaworek, 2017).

However, such frameworks are not fully equipped to capture the environmental and regulatory pressures faced by inland transport companies, as they do not inherently integrate emissions reduction, energy efficiency, or waste management requirements (Charłampowicz *et al.*, 2024a).

By comparison, maturity models adapted to logistics under sustainability agendas, such as those in environmental process maturity literature, illustrate the value of incorporating green metrics into each maturity level, enhancing process resilience while meeting regulatory and market pressures (Charłampowicz and Mańkowski, 2024; Housni *et al.*, 2022).

Service quality in inland transport, a fundamental aspect of competitiveness (Huang *et al.*, 2015) and customer satisfaction (Le *et al.*, 2019), also requires integration within a comprehensive maturity assessment framework. Service quality, in terms of reliability, flexibility, and responsiveness, is often compromised when companies implement green practices in isolation from operational improvements.

For instance, the adoption of eco-friendly practices may initially limit flexibility and increase costs, impacting overall service quality if not carefully managed alongside process improvements. Existing literature highlights that an integrated framework, where service quality metrics such as timeliness, customer satisfaction, and adaptability are set alongside environmental objectives, can yield superior outcomes in terms of both sustainability and operational excellence.

Process maturity models that incorporate service quality metrics in environmentally constrained contexts remain relatively unexplored, especially within inland transport (Bai *et al.*, 2018; Ormazabal *et al.*, 2017). By examining service quality alongside process maturity in a regulatory environment driven by the EGD, it becomes possible to provide a framework that captures the dual imperative of efficiency and service excellence.

Service quality metrics, such as delivery reliability and customer satisfaction, must align with the sustainable innovations essential under the EGD, underscoring the need for a maturity model that integrates these often-competing dimensions (Charłampowicz *et al.*, 2024a).

The analysis thus reveals a significant gap in existing frameworks for inland transport enterprises within the context of the EGD. While models exist for process maturity (Lee *et al.*, 2019) or service quality (Shen and Yahya, 2021) independently, an integrated approach is notably lacking in the literature. Addressing this gap, the current study proposes a model that combines both process maturity and service quality metrics, specifically adapted for inland transport enterprises operating under EGD requirements.

3. Model for Process Maturity and Service Quality Assessment in the Context of the EGD

The proposed model aims to integrate operational performance, service quality, and environmental sustainability dimensions (Table 1). This model foundation addresses critical EGD requirements, with sustainability integration grounded in dimensions identified the literature (Charłampowicz and Mańkowski, 2024).

The model outlines five distinct maturity levels, each describing process characteristics, service quality standards, and detailed sustainability integration components that inland transport enterprises must adopt to meet escalating regulatory and market demands.

Table 1. Model for process maturity and service quality assessment of inland transport enterprises

Maturity level	Process characteristics	Service quality	Sustainability integration (aligned with EGD requirements)
Level 1: Initial	- processes are unstructured and reactive; - minimal awareness of environmental issues; - no formal policies or procedures in place	- service delivery is unpredictable; - varying levels of reliability and customer satisfaction; - minimal focus on service quality dimensions	Environmental Policy: no formal environmental policy exists Operational Practices: environmental practices are sporadic and not integrated into operations Performance Measurement: no performance measurement; environmental impact is not quantified Stakeholder Engagement: minimal or no engagement with stakeholders on environmental issues Digital Integration: limited or no use of digital technologies for environmental management Continuous Improvement: no formal mechanisms for continuous improvement
Level 2: Identified	- basic processes are established and documented - implementation is inconsistent; efforts are reactive and compliance-driven - some discipline in process execution	- improved reliability and responsiveness - customer feedback is occasionally sought - basic attention to service quality	Environmental Policy: basic environmental policy developed, focusing on regulatory compliance Operational Practices: basic practices in place (e.g. waste management, energy conservation) Performance Measurement: basic metrics established, primarily for compliance reporting Stakeholder Engagement: basic engagement with regulatory bodies; limited interaction with other stakeholders Digital Integration: basic digital tools used for data collection and reporting Continuous Improvement: basic improvement initiatives driven by regulatory requirements
Level 3: Defined	- processes are standardized and integrated across the organization	- consistent service delivery with established performance metrics	Environmental Policy: comprehensive environmental policy established, aligned with organizational goals Operational Practices:

	- systematic approach to managing environmental impacts with defined responsibilities - processes are formalized and documented	- proactive customer relationship management - service quality dimensions are defined and managed	environmental practices systematically integrated into operational processes Performance Measurement: comprehensive set of metrics covering key environmental aspects Stakeholder Engagement: active engagement with key stakeholders, including customers and suppliers Digital Integration: digital systems integrated into environmental management processes Continuous Improvement: structured continuous improvement processes in place
Level 4: Quantitatively Managed	- processes are measured and controlled using data-driven approaches - quantitative goals are set; performance metrics are systematically collected and analyzed - advanced use of digital technologies	- high levels of service reliability and efficiency - continuous monitoring of customer satisfaction - service quality is quantitatively measured and managed	Environmental Policy: policy includes quantitative targets; regularly reviewed and updated Operational Practices: practices are optimized using performance data; sustainable technologies are adopted Performance Measurement: environmental performance is quantitatively measured; data used for decision-making Stakeholder Engagement: stakeholder feedback is systematically collected and used to inform practices Digital Integration: advanced digital technologies (IoT, big data) used for performance optimization Continuous Improvement: continuous improvement driven by data analysis and performance feedback
Level 5: Optimizing	- focus on continuous improvement and innovation - processes are optimized and adaptable to change - best practices shared across the	- exceptional service quality with personalized solutions - leadership in customer satisfaction and market responsiveness - service quality	Environmental Policy: policy drives continuous improvement and innovation; active stakeholder involvement Operational Practices: practices are continuously improved, leveraging advanced technologies and best practices Performance Measurement: advanced analytics and real-time monitoring used to continuously

	organization - full digital integration enabling real- time monitoring	continuously improved and innovated	improve performance Stakeholder Engagement: proactive and collaborative engagement with stakeholders to drive sustainability initiatives Digital Integration: full digital integration; real-time monitoring, predictive analytics, and continuous optimization Continuous Improvement: culture of continuous improvement, with innovation and excellence in environmental management
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Source: Own elaboration.

This model progressively develops maturity across operational and environmental dimensions to meet the specific sustainability targets of the EGD. The Initial and Identified levels represent the starting points, focusing on establishing basic processes and compliance-oriented environmental policies.

At the Defined level, enterprises formalize environmental strategies and integrate quality management into their operations. The Quantitatively Managed level emphasizes data-driven control, with systematic metrics to monitor both performance and service quality. At the Optimizing level, companies achieve full digital integration and real-time process monitoring, fostering a culture of continuous improvement and environmental innovation.

4. Discussion

The proposed model provides a structured framework for assessing process maturity and service quality in inland transport enterprises, aligning these dimensions with the EGD sustainability requirements (Haas and Sander, 2020). Previous research on process maturity highlights its effectiveness in enhancing systematic development and operational efficiency across sectors (Butzer *et al.*, 2017).

However, existing models largely lack integration with comprehensive environmental policies necessary under the EGD (Charłampowicz and Mańkowski, 2024). The proposed five-level maturity model builds upon traditional maturity frameworks by embedding sustainability as a core component, a critical addition given the stringent emission reduction targets and sustainability expectations now imposed on inland transport (Rivas *et al.*, 2021; Tsemekidi Tzeiranaki *et al.*, 2023).

Integrating service quality within the maturity model also addresses a key gap in literature. Inland transport enterprises face the dual challenge of operational efficiency and high service standards (Basma and Rodríguez, 2023; Schepler *et al.*, 2017), often under complex environmental regulations (European Environment

Agency, 2022). Existing research on service quality in transport highlights the importance of reliability, responsiveness, and customer satisfaction (Kankam, 2023; Shen and Yahya, 2021), yet these elements can be challenging to maintain under strict sustainability mandates. The model proposed here merges these requirements by promoting consistent service quality at each maturity level, progressively improving customer satisfaction and market responsiveness through structured, incremental advancements.

Additionally, this model distinct emphasis on digital integration and continuous improvement aligns with modern transport trends emphasizing real-time data use and stakeholder engagement to drive sustainability (Housni *et al.*, 2022; Yuen *et al.*, 2020).

The Quantitatively Managed and Optimizing levels, in particular, focus on advanced data analytics and predictive capabilities, elements often highlighted in literature as critical for achieving operational excellence and proactive environmental management (Cheung *et al.*, 2021; Parker *et al.*, 2023).

Through advanced digital integration, inland transport enterprises can engage stakeholders in collaborative sustainability initiatives, allowing for agile adjustments to service and environmental strategies based on real-time data.

This model provides a comprehensive roadmap for inland transport enterprises to enhance both process maturity and service quality while meeting environmental requirements under the EGD. Its integration of operational, service quality, and sustainability metrics addresses a significant gap in existing maturity frameworks, offering a theoretically robust, practically relevant approach to balancing efficiency and sustainability in inland transport.

5. Conclusions

The proposed model provides inland transport enterprises with a structured pathway for advancing process maturity and service quality while adhering to the environmental targets outlined in the EGD (Dickason, 2023). By progressing through defined maturity levels, enterprises can systematically improve operational efficiency, customer satisfaction, and sustainability compliance - addressing a complex set of requirements driven by both regulatory pressures and market demands.

This model uniquely integrates traditional process maturity elements with environmental benchmarks essential for EGD alignment, meeting a notable gap in maturity models traditionally focused on operational control but lacking in sustainability orientation (Charłampowicz and Mańkowski, 2024).

For managers, adopting this model facilitates a phased approach to resource allocation, operational enhancements, and compliance management. At the Initial and Identified levels, processes, basic documentation, and minimal environmental policies establish a starting point for improving reliability in service delivery.

As enterprises advance to the Defined and Quantitatively Managed stages, data-driven methods and performance measurement become central, supporting managers in making informed decisions about environmental practices, customer engagement, and resource optimization. Such structured improvements align operations with regulatory demands in proactive ways, reducing compliance risks and enabling a responsive, resilient approach to both operational and environmental objectives (Housni *et al.*, 2022).

At the Optimizing level, enterprises benefit from full digital integration and real-time process monitoring, fostering a culture of continuous improvement, environmental stewardship, and customer responsiveness. Managers at this level leverage predictive analytics to adaptively respond to changes in market demand and environmental regulations, positioning their enterprises as leaders in sustainability and service quality.

Active stakeholder engagement, enabled by digital systems, enhances customer trust and regulatory confidence, meeting EGD goals for sustainable and competitive operations (Olofsson *et al.*, 2023; Rivas *et al.*, 2021).

While this model provides a foundational framework, several limitations and opportunities for further research remain. Given that this is a theoretical model, one limitation is the absence of empirical validation, which restricts its immediate practical application. Further research should address this limitation by empirically validating the model across diverse European inland transport operators.

A recommended next step involves developing a structured questionnaire to assess each maturity dimension, process maturity, service quality, and sustainability integration. Such a tool would facilitate data collection on maturity levels within the sector, allowing for comprehensive testing and refining of the model in real-world settings.

In summary, while the proposed model is designed to address critical gaps in current process maturity frameworks for inland transport under the EGD, validating and refining it through empirical research will enhance its robustness and sector-wide relevance. This model offers a promising foundation for understanding the intersection of service quality, operational efficiency, and environmental stewardship, yet ongoing research is essential to ensure its long-term applicability and success in guiding European inland transport towards sustainable, high-quality operations.

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