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Inland Transport Enterprises Process Maturity Assessment – Theoretical Aspects

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Abstract:

Purpose: *The critical function of inland transport enterprises within the expansive domain of the global maritime container supply chain is acknowledged. The responsibility for managing terrestrial segments of the supply chain, in conjunction with the multifaceted entities impacting the maritime segment, contributes to the complexity of integrating and coordinating the entire supply chain. The effectiveness of processes executed in various activities across the supply chain is instrumental in determining the allure and competitive edge of specific participants and the supply chain at large. Owing to the broad spectrum of tasks and obligations bestowed upon inland transport companies, the necessity for adopting an apt process-oriented management system is underscored. Process maturity is characterized by a framework in which individual processes are formalized in terms of their definition, identification, measurement, adaptability, and efficiency. Regrettably, the literature evidences a dearth of process maturity models applicable to inland transport firms. Thus, the aim of this study is to introduce a theoretical framework for assessing process maturity in inland transport entities.*
Design/Methodology/Approach: *The investigation employed several research methodologies, including a review of existing literature, the questionnaire method, and a process maturity evaluation model.*
Findings: *The proposed process maturity assessment model for inland transport companies is segmented into various levels and dimensions, offering enhanced insights into the augmentation of process maturity within enterprises.*
Practical impliations: *The process maturity model for inland transport enterprises is presented as a reference model that managers might utilize for benchmarking purposes, as well as a compilation of recommendations.*
Orginality: *This study represents the inaugural endeavor to formulate a process maturity model tailored to the needs of inland transport companies.*

Keywords: *Process maturity model, inland transport, process management*.

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1. Introduction

Historically, the transport sector is highly sensitive to market fluctuations and disruptions. Presently, the volatile market environment significantly contributes to the diminished performance and efficiency of numerous transport entities.

The COVID crisis resulted in a major decrease in global trade (WTO, 2020). Relatively fast recovery, which was also one of the reasons for congestion in US ports, confirmed that transport-related companies are resilient (Notteboom *et al.*, 2021).

In the intricate web of the global maritime supply chain, the maritime container terminal assumes a pivotal role as an integrator, highly sensitive to disruptions in adjacent segments of the chain (Charłampowicz and Grzelakowski, 2022). This critical nexus sees shipping lines, transporting an extensive array of containers, interfacing with a diverse array of land-based entities including land carriers and freight forwarders (Kotowska *et al.*, 2020). Given the operational dependence of land carriers on the mandates of freight forwarders, this study amalgamates these entities under the umbrella of inland transport companies.

The widespread distribution of stakeholders within the terrestrial segment of the supply chain poses significant challenges in achieving synchronized integration and coordination. In this context, inland transport companies are not merely crucial elements of the transportation network but also play a significant role in the wider economic framework. They serve as indispensable links that ensure the continuous flow of goods, thereby influencing the efficiency of the entire supply chain.

Processes underlie all activities and services, and the capacity to replicate process outcomes signifies the implementation of a process-based management system. The degree of system adoption is referred to as process maturity (Charłampowicz and Grzelakowski, 2022). Disruptions within inland transport have a cascading effect throughout the system, impacting not only logistical operations but also economic productivity and stability.

An increase in the share of road transport, recorded as the highest in the past decade, was observed, while rail transport's share also saw a marginal rise in 2021 compared to 2020, yet not reaching its highest point of the last decade (Eurostat, 2023). This shift in the modal split offers valuable insights into the evolving dynamics of freight transport, signalling changes in preferences and utilization of different transportation modes.

The growing predominance of road transport exemplifies a significant alteration in freight transport tendencies. These variations are not merely indicative of shifts in transport preferences but also have substantial implications for the process maturity of inland transport companies. Moreover, road transport is the second largest mode

of freight transport in EU (Charłampowicz, 2023; Eurostat, 2023; Thalassinos *et al.*, 2013).

In response to evolving dynamics within freight transport, companies specializing in inland transportation are compelled to enhance their process maturity. This necessitates a reassessment of operational strategies, development plans for infrastructure, and environmental policies. Specifically, the growth in the road transport sector demands a reevaluation of logistical efficiencies, route optimization, and fleet management. Moreover, this increase highlights the imperative for these entities to augment their process maturity to accommodate heightened demand and optimize operations amidst these shifts.

Accordingly, these transformations in the modal split and freight transport patterns require a strategic reassessment by inland transport companies. This reassessment should aim at enhancing process efficiencies, aligning with emerging transport policies, and considering environmental impacts, which are pivotal for the logistics industry's strategic planning.

The performance of these inland transport organizations is critical not only to the supply chain's effectiveness but also to the broader economic framework, underscoring their vital role in sustaining both supply chain integrity and economic health. Therefore, gauging the process maturity level of inland transport companies emerges as a critical component in the efficiency of global supply chain management.

Even though, the process maturity assessment has been widely studied in the literature (Becker *et al.*, 2009; Tarhan *et al.*, 2016; van Looy *et al.*, 2011), there is no model dedicated to the inland transport sector. Therefore, the main purpose of this paper is to present the multicriteria model for process maturity assessment for transport sector entities.

The paper is structured as follows: the first section is dedicated to a literature review concerning the process maturity assessment model. The second chapter presents the results of the research. The last chapter includes the conclusions.

2. Literature Review

Many publications that relate explicitly or implicitly to the inland transport operations, or process maturity assessment can be found during literature study. Therefore, the following text includes mains results of the literature review.

In the majority of studied publications, the category of process is defined by both its internal relationships, encompassing its logic, and all interactions with the environment. These interactions include internal relations, such as those with other

processes within the company, as well as external relations, such as those with customers and the market (Sawicki and Jaworek, 2017).

Shifting to the next category - process maturity, it is usually perceives as a measure for evaluating the capabilities of an organization in the context of the degree to which processes are identified, measured, managed, and improved (Sliż, 2018). The principal aim of process maturity is to ascertain the level of organizational advancement and the trajectory for progression.

Looking in process maturity process maturity from modelling aspect, the maturity model is defined as a conceptual framework comprising distinct maturity levels for the category of processes within one or more organizations, or business domains (Becker *et al.*, 2009; Tarhan *et al.*, 2016). Presented usually in table form, the model of process maturity delineates an envisioned, desired, or typical evolutionary trajectory for organization's processes. Numerous standards expound on varying maturity levels, contingent on the specific domain to which they are applied.

A great number of literatures focuses on the issues related to methodological aspect of process maturity assessment (Röglinger *et al.*, 2012; Tarhan *et al.*, 2016). Hence, methodologies for evaluating business process maturity level, are pertinent to highlight the initial model developed for process assessment, namely the Capability Maturity Model (CMM), created by the Software Engineering Institute (SEI) from 1986 to 1991 (Butzer *et al.*, 2017). The original CMM model facilitated maturity assessment across five levels.

However, the model's limitations in assessing the entire organization presented practical challenges. As a result, the model was expanded to support the optimization of business processes across the entire organization.

Under the framework of the Capability Maturity Model Integration (CMMI), all organizational processes were methodically categorized, with 22 process areas being designated to them (Butzer *et al.*, 2017). The increasing abundance of designed and published process maturity models has progressively complicated the selection and application of an appropriate model (Röglinger *et al.*, 2012). In the literature, although there is a plethora of process maturity models, only a limited number have been subjected to verification and practical implementation (Tarhan *et al.*, 2016).

A common feature observed across all models is the absence of process identification at the lowest level and the influence of organizational culture on process improvement at the highest level. Long-term characteristics are typically indicated by value, with higher values representing advanced levels, or by letter, where the letter "A" usually signifies the highest level of process maturity (Becker *et al.*, 2009; Charłampowicz and Grzelakowski, 2022; Röglinger *et al.*, 2012; Sliż, 2018; van Looy *et al.*, 2011; Kadlubek *et al.*, 2022).

Furthermore, it is crucial to establish multiple levels and dimensions within a specific process maturity model. In terms of the short-term dimension, it is possible to identify three distinct levels: development (+), stagnation, and atrophy (-) (Sliż, 2018). Development is associated with the ability to maintain or attain a higher level of process maturity. Stagnation indicates that the organization remains at its current level. Atrophy refers to circumstances in which further efforts are directed towards abandoning process-oriented solutions in favor of a functional approach.

Even though, the problem of process maturity assessment has been widely described in the literature (Becker *et al.*, 2009; Butzer *et al.*, 2017; Röglinger *et al.*, 2012; Sliż, 2018; Tarhan *et al.*, 2016; van Looy *et al.*, 2011, Lee *et al.*, 2007; Bai *et al.*, 2018; Moutchnik, 2015; Ormazabal, Rich, *et al.*, 2017; Ormazabal, Sarriegi, *et al.*, 2017; Raschke and Ingraham, 2010; Tarhan *et al.*, 2015), very little space has been devoted to the process maturity dedicated for the transport sector (Charłampowicz and Grzelakowski, 2022; Sawicki and Jaworek, 2017; Thalassinos and Zampeta, 2012).

Some of the developed process maturity assessment models have general characteristics (Sliż, 2018), however, they could not be successfully implemented in inland transport companies, or the transport sector in general, due to, among others, the lack of emphasis on environmental issues.

Additionally, the literature has not sufficiently addressed issues related to the determination of the trend (pathway) in process maturity, which allows for the assessment of such maturity over both short and long-term horizons. It is pertinent to mention a general model (Sliż, 2018) that introduces such a crucial managerial concept. The division into short and long-term horizons employed in the general model proposed by Sliż (2018) has been adopted in the authors' proposed model for evaluating process maturity for inland transport enterprises.

3. Results - Proposed Model of the Process Maturity Levels for Inland Transport Companies

The proper measurement of the current and future path of an organization in the context of process improvement requires not only to develop levels of process maturity but also identification of dimensions, which are the characteristics of short-term development of the given objects of assessment (Sliż, 2018). If there is a "+" after the long-term designation (letter value), then the characteristic of the short-term dimension is "development". If there is "-" it means atrophy. If there is no object after the long-term designation, then this parameter is dedicated to stagnation.

In the context of the transport sector, both sector-specific (Dewi and Mahendrawathi, 2019; Ormazabal *et al.*, 2017) and general models (Lee *et al.*, 2019; Moutchnik, 2015) found in the literature, though potentially applicable, fail to conform to the specific criteria of this sector.

This non-conformity leads to a misalignment with the operational conditions of land transport enterprises. Such conditions are defined by the imperative to comply with increasingly stringent environmental regulations and the substantial interdependence of the land transport sector on other economic sectors.

Therefore, as a result of research works linking the theory on inland transport characteristics with the methodology of process maturity assessment, the model of process maturity levels for inland transport companies was elaborated. The structure of the model is presented in the table form (Table 1).

Table 1. *Model of the process maturity levels for inland transport companies*

Level	**Dimension**	**Characteristics**
Level 4 - Improvement of processes	L4 A+	The inland transport enterprise demonstrates considerable sophistication in enhancing process efficiencies.
	L4 A	The capability of the inland transport company to refine processes is enhanced by the adoption of advanced management techniques. This enterprise actively mitigates its environmental impact through comprehensive attention to both major and minor processes. Every team member is engaged in driving and fostering improvements, with a process-oriented organizational structure firmly in place.
	L4 A-	There is a lack of a cohesive long-term strategy for process enhancement across the board. Client demands catalyze modifications, and knowledge is considered a vital asset. By endorsing staff development, the inland transport company encourages employees to engage in and facilitate internal training sessions to disseminate new knowledge and skills.
Level 3 – Management of processes	L3 B+	The company manages and optimizes primarily large-scale processes based on performance metrics. Employee development programs, including further education such as postgraduate or MBA courses, are adjusted in anticipation of market shifts, emphasizing the acceleration of staff growth.
	L3 B	Environmental management is increasingly prioritized within the inland transport company, though the adoption of standards such as those in the ISO 14000 series remains suboptimal. Training linked to current organizational needs and mandatory professional development are integral to the strategic and operational planning, with management playing a key role in facilitating and monitoring knowledge transfer and skill acquisition.
	L3 B-	Despite process metrics being recorded, management decisions are not consistently informed by these data. Participation in qualification enhancement training is voluntary.
Level 2 – Measurement	L2 C+	The company measures processes related to customer relationship management to gauge client satisfaction.

of processes		Training programs are implemented for both managerial and new staff, with department heads actively involved in problem resolution during processes.
	L2 C	Process metrics are analyzed in terms of revenue impacts within operational, strategic, risk, and security management domains. Employees are viewed as autonomous team members who contribute to ongoing improvements. Training is both mandatory and elective, tailored to specific departmental needs.
	L2 C-	Process metrics are superficially monitored, primarily focusing on the operational and strategic management aspects of time and cost. Employees are also tasked with initiating improvements within their respective roles. Training follows a predefined schedule set by the company's headquarters and varies in its implementation and intent.
Level 1 – Identification of processes	L1 D+	Processes within the inland transport company are identified and formalized, albeit measurement is sporadic and inaccurate. Employees are primarily tasked with executing assigned activities.
	L1 D	The inland transport enterprise effectively utilizes the concept of 'process,' defining it as a structured, repetitive sequence of actions aimed at generating value. However, only major and some minor processes are formally recognized and mapped.
	L1 D-	Although the inland transport company employs process terminology, its application is hampered by frequent misidentifications with procedures, standards, or tasks. Despite identifying and structuring major processes, the management perspective remains largely focused on tasks.
Level 0 – Functional organization with poor process preorientation	L0 E+	The inland transport company is actively exploring innovative management strategies, moving away from traditional functional management to embrace process-oriented approaches. This transition is highlighted by the internal adoption of quality management standards like the ISO, driven by intrinsic organizational needs.
	L0 E	The inland transport company shows limited engagement with process-oriented management practices, with little evidence of a forthcoming shift in management focus during future initiatives.
	L0 E-	Characterized by a traditional functional management structure, the inland transport company exhibits a layered hierarchical organization that limits process-oriented thinking. Long-term observations indicate no imminent change in management practices, with a continued preference for a task-driven approach over a process-oriented framework.

Source: *Own elaboration.*

To attain a higher level of process maturity, an inland transport company must first satisfy the minimum criteria established for the preceding level, according to the methodology developed. For the inaugural level of the proposed framework, the organization is required to accurately define and utilize the term "process." Additionally, it must properly identify both mega processes and certain auxiliary processes.

Progressing to the second level necessitates the measurement of processes associated with safety, operational, strategic, and risk management. Fulfillment of these conditions qualifies the organization as having achieved the first level of process maturity as defined by this model.

Elevation to the third level of maturity within this model requires that specific criteria be met: managers should actively promote knowledge sharing within departments, and the organization should provide a range of training programs, both internal and external, designed to enhance employee qualifications.

To ascend to the fourth and highest level of process maturity, the inland transport company must prioritize environmental considerations. This includes the implementation of environmental management systems and the diligent monitoring and measurement of environmental performance.

Moreover, the integration of advanced management techniques such as lean management, process capability analysis, or the ABC method is essential. The structure of the organization plays a crucial role in facilitating rapid advancement in process maturity, particularly when a clearly defined process architecture is in place within the organization.

4. Discussion and Conclusions

The literature review revealed a significant gap in research pertaining to process maturity assessment within the transport sector. While existing studies predominantly concentrate on universal models (Röglinger *et al.*, 2012; Sliż, 2018; Tarhan *et al.*, 2016; van Looy *et al.*, 2011), there has been minimal focus on the transport sector, particularly within the Transport-Freight forwarding-Logistics (TFL) sector (Sawicki and Jaworek, 2017).

Despite the comprehensive nature of the previously mentioned study, it omitted considerations related to the environmental impacts of transport activities. This paper addresses this oversight by proposing a model to assess process maturity specifically tailored for inland transport enterprises.

Process maturity evaluation is an essential aspect of contemporary management. The capability to accurately assess an organization's process maturity offers insights into necessary actions for organizational enhancement. To reach a higher level, the

enterprise must satisfy the requirements of the preceding level, as reflected by its position within a dimension linked to long-term development.

Classification of the organization across various long-term dimensions is achieved through a comparison of the total points accrued against the criteria necessary for adaptation to a specific level with the point ranges that facilitate classification within a long-term dimension. It is indicated that the cumulative points garnered by the organization do not directly dictate classification into a definitive level of process maturity. Nonetheless, within specified levels, these points serve as indicators of the long-term dimension.

Future research directions involve the empirical testing of this model across various companies within the Transport-Freight forwarding-Logistics (TFL) sector. The implementation of this model could provide significant benefits for both practical application and theoretical development, serving as a reference for various purposes such as benchmarking, recommendations, improvement, certification, and IT support.

A principal limitation of the research is the reliance on self-assessment by the organizations, which introduces a subjective element. This subjective perspective should be balanced with more objective, quantifiable metrics such as revenue, tonnage, and the number of transported TEUs.

The findings from applying the process maturity model to inland transport companies highlight the critical role of environmental management practices in enhancing process maturity. It is essential for these companies to integrate sustainable practices into their operations to comply with regulations and gain a competitive advantage in a market increasingly sensitive to environmental issues.

Additionally, embracing digital transformation technologies is key to advancing process maturity. The use of advanced data analytics, the Internet of Things (IoT), and Artificial Intelligence (AI) can greatly improve operational efficiency, decision-making, and customer service. These technological enhancements, together with a strategic commitment to sustainability, equip inland transport companies to meet the dynamic demands of the global supply chain and play a crucial role in maintaining economic vitality and promoting environmental responsibility.

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