European Research Studies Journal
Volume XXVII, Issue 1, 2024

pp. 39-49

Inland Transport Enterprises Process Maturity Assessment – Theoretical Aspects

Submitted 15/12/23, 1st revision 12/01/24, 2nd revision 22/01/24, accepted 10/02/24

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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*.

JEL classification: *L15, M10, M16, R49.*

Paper type: *Research paper*.

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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, its impracticality for assessing the entire organization led to challenges in practical application. Consequently, this model underwent an expansion to facilitate the optimization of business processes organization-wide.

Within the framework of the Capability Maturity Model Integration (CMMI), all organization processes were systematically categorized, with 22 process areas being assigned to them (Butzer *et al.*, 2017). The profusion of designed and published process maturity models has made the selection and application of an appropriate one progressively more challenging (Röglinger *et al.*, 2012). In the literature, despite the abundance of models in the domain of process maturity, only a limited subset has undergone verification and practical implementation (Tarhan *et al.*, 2016).

A shared characteristic found in all models is the lack of process identification at the lowest level and the impact of organizational culture on process improvement at the highest level. The long-term characteristic is denoted by value (usually the higher value is the higher level) or by letter (usually letter "A" denotes 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).

Moreover, it is essential to introduce various levels and dimensions of a particular process maturity model. According to the short-term dimension, it is possible to distinguish three such levels: development (+), stagnation, and atrophy (-) (Sliż, 2018). Development is connected with the possibility to sustain or achieve a higher level of process maturity. Stagnation means that the organization is staying at its current level. Atrophy is a situation, where further actions are dedicated to discontinuing the implementation of a process-oriented solution and orientation towards 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 shows exceptional maturity in the area of process improvement.
	L4 A	High inland transport enterprise ability to improve processes thanks to the use of modern management methods. The entity manages the impact of its activities on the natural environment not only in terms of mega-processes and main processes. All employees of the inland transport enterprise are initiators and stimulators of changes and improvements. The process organization structure is implemented in the organization.
	L4 A-	No long-term improvement strategy for all processes. Customer requirements are the driver of changes. Knowledge is treated as a key resource, and the inland transport enterprise, by supporting its employees, causes them to initiate internal training to transfer the acquired knowledge and/or skills.
Level 3 – Management of processes	L3 B+	Measured processes are managed, and mainly mega-processes are improved. Training is carried out in response to the forecast changes in the market, moreover, the inland transport enterprise pays more attention to supporting and accelerating the development of employees, e.g. by referring them to postgraduate or MBA studies.
	L3 B	Within the inland transport enterprise, more and more attention is paid to environmental management, but the implemented standards systems from the ISO 14000 series or similar are not functioning. The growing importance of the implementation of training resulting from the current needs and changes in the organization as well as obligatory training increasing qualifications - training is treated as an element of the strategic and operational plan of the organization. The manager supports the transfer of knowledge and skills between employees and also controls and intervenes in the event of failure to achieve the set

		goals.
	L3 B-	Despite the measurement of the processes, there are no management decisions based on the results obtained. Internal training on raising qualifications is optional.
Level 2 – Measurement of processes	L2 C+	Process measurement is carried out in the area of relationship management in terms of customer satisfaction. The inland transport enterprise conducts training for management staff and conducts training for new employees. Managers of individual departments are involved in solving problems during the process.
	L2 C	Process measurement is carried out in the areas of operational, strategic, risk, and security management in terms of the value of revenues generated by the processes. The employee is treated as an independent member of the team that stimulates improvement throughout the inland transport enterprise. The training is integrative, obligatory, and optional and is dedicated to employees of particular departments.
	L2 C-	Process measurement is carried out superficially, mainly in the area of operational and strategic management in terms of time and cost. An additional role of the employee is to initiate improvements in the position held. The training is carried out following the training cycle planned by the company's headquarters, they are treated as an incentive or are not carried out at all.
Level 1 – Identification of processes	L1 D+	Within the inland transport enterprise, processes have been identified and formalized, process measurement is random and distorted. The role of the employee is to perform the tasks entrusted to him.
	L1 D	The inland transport enterprise correctly employs the term 'process,' signifying a coherent, recurring sequence of sequentially executed activities to create added value. Within the entity, only mega processes and select auxiliary processes are formally recognized. This extends to the formalization of processes through the use of process maps.
	L1 D-	The inland transport enterprise does employ the concept of processes; however, the application is marred by misidentification. Processes are frequently conflated with procedures, standards, or tasks. Even though mega processes (or core processes) have been identified and formally structured, the management approach remains predominantly task-centric.
Level 0 – Functional organization with poor process preorientation	L0 E+	The inland transport enterprise is actively exploring novel management approaches. The prevailing functional management framework steers its focus towards functions and tasks. Over an extended temporal horizon, strategic initiatives are underway to deviate from the conventional top-down management structure. This shift is exemplified by the internal adoption of quality management systems,

		such as ISO standards, prompted by the organization's inherent requirements.
	L0 E	The inland transport enterprise displays minimal indicators of incorporating the process approach. There are no discernible factors that might facilitate a shift in the future management orientation during forthcoming managerial endeavours.
	L0 E-	An inland transport enterprise characterized by a predominant functional management approach exhibits a multi-level hierarchical structure that inhibits horizontal pre-orientation. Over an extended timeframe, there is an absence of any isolated indicators suggestive of a shift in management orientation. The entity refrains from embracing the concept of a process-driven framework.

Source: *Own elaboration.*

In the order to achieve a higher level of process maturity, according to the developed methodology, the minimum criteria for the previous level must be met. To achieve the first level of the proposed model the inland transport company needs to fulfil the following conditions: within the organization term “process” is correctly defined and used. Moreover, the mega processes and selected auxiliary processes are correctly identified.

To achieve level 2 it is essential to measure the processes connected with safety management, operational, strategic, and risk management. If these conditions are met, then the organization can be considered as one on the first level of process maturity according to the presented model.

To categorize an inland transport company at the third level of the presented model, specific conditions must be fulfilled: the manager should facilitate knowledge transfer within the department, and the organization should offer various internal and external training programs aimed at enhancing employees' qualifications.

For an inland transport company to be classified at the highest fourth level of process maturity, careful attention should be given to environmental considerations, encompassing implemented environmental management systems and aspects related to the monitoring and measurement of environmental operations.

Additionally, effective management methods like elements of lean management, process capability analysis, or the ABC method should be integrated. The organizational structure can play a significant role in accelerating process maturity improvement, particularly when a well-defined process structure operates within the organization.

4. Discussion and Conclusions

Based on the literature review a research gap concerning process maturity assessment for transport sector organizations has been identified. Most papers focused on universal models (Röglinger *et al.*, 2012; Sliż, 2018; Tarhan *et al.*, 2016; van Looy *et al.*, 2011), and the very little place has been devoted to the transport sector with special attention paid to Transport-Freight forwarding-Logistics (TFL) sector (Sawicki and Jaworek, 2017).

However, in the aforementioned research, there was a lack of issues concerning the environmental issues of transport activity. This paper attempts to fill this gap by developing a model for process maturity assessment for inland transport companies.

Process maturity evaluation is a vital feature of modern management. The possibility for accurate assessment of the organization's process maturity could provide knowledge concerning further activities, that need to be taken for organization improvement. To attain a higher level, the enterprise must meet the criteria of a lower level, as indicated by its placement in a dimension associated with long-term development.

The organization's classification across various long-term dimensions is determined by comparing the total points obtained in criteria for adapting to a specific level with the point ranges that enable classification in the long-term dimension. This implies that the total sum achieved by the organization does not directly determine classification into a specific level of process maturity. However, within specific levels, it functions as an indicator of the long-term dimension.

Further research directions are connected with empirical verification of this model in various TFL companies The ability to implement this model could be beneficial both for practice and theory as a reference model for many application purposes (benchmarking, recommendations, improvement, certification, IT support).

The main research limitation is the necessity for self-assessment made by a particular organization. This subjective point of view should be confronted with more objective, quantifiable indicators such as revenue, tonnage, number of transported TEUs, etc.

Incorporating the insights from the developed process maturity model for inland transport companies, it becomes evident that integrating environmental management practices constitutes an indispensable dimension of process maturity enhancement. This observation underscores the imperative for inland transport entities to embed sustainable practices within their operational frameworks to not only meet regulatory demands but also to foster a competitive edge in an increasingly environmentally conscious market landscape.

Furthermore, the adaptation to digital transformation technologies emerges as a crucial factor for process maturity escalation. The deployment of advanced data analytics, IoT (Internet of Things), and AI (Artificial Intelligence) can significantly augment operational efficiencies, enhance decision-making processes, and elevate customer service levels. These technological advancements, coupled with a strategic focus on sustainability, position inland transport companies to thrive amidst the evolving demands of the global supply chain, thereby reinforcing their pivotal role in sustaining economic vitality and environmental stewardship.

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