

Strategic procurement management of railroad rolling stock in the European Union

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Abstract

Purpose – Like a well-designed procurement strategy, a well-designed rolling stock strategy promotes the development of a railroad company and contributes to its competitive advantage. Effective implementation of the rolling stock strategy enhances the likelihood of enjoying the benefits of the strategy's design. A successful implementation relies on the strategy being known, understood, controlled and communicated to the entire organization.

Design/methodology/approach – The research consists of an extensive literature review as well as a series of workshops with rolling stock suppliers, railway authorities and representatives and rail users.

Findings – This paper presents a collection of solutions for passenger rail rolling stock procurement. The authors offer guidance to the strategic procurement of rolling stock in the European Union (EU) and propose key performance indicators to measure the effectiveness of a rolling stock strategy.

Research limitations/implications – While this study presents a thorough evaluation of rolling stock procurement practices, it is limited by its geographic isolation. Future studies should compare the procurement practices discussed here to others in the EU, as well as in North America, South America and Asia. Additionally, this study focused on the passenger rail segment. Passenger transport is an important function of the rail network in the EU, but future research should expand the assessment of rolling stock procurement strategies to freight rail as well.

Originality/value – Overall, this work provides visibility into common rolling stock procurement practices in complex EU railway markets. This work expands the literature through a review of these practices and through enabling research into best practices or a commonly accepted procurement model.

Keywords Management, Railway, Procurement

Paper type Research paper

Introduction

Growing competition in the European Union (EU) railway sector has presented the rail transport market with challenges (Pantazi & Vlachos, 2019). The Fourth Railway Package of

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2016, comprising six EU regulations and directives, is a legislative instrument that aims to create a single European railway area by revitalizing the railway sector and increasing its competitiveness relative to other modes of transport. The EU plans to accomplish the above by removing administrative and technical barriers, establishing a common approach to safety and interoperability provisions, reducing administrative costs, accelerating standardization and certification and preventing hidden discrimination ([Nikitinas & Dailydka, 2021](#)) [1].

The plans are to achieve a defined traffic level of the rail system while maintaining appropriate safety and cost metrics. However, placing passenger rolling stock on the market to facilitate these aims is complicated and costly ([Ćwil, Bartnik, & Jarzębowski, 2021](#)).

The “technical pillar” of the Package strives to reduce technical obstacles for carriers and rolling stock manufacturers, which result from different national standards and procedures ([Holma, Vesalainen, Söderman, & Sammalmaa, 2020](#)). The pillar comprises three documents discussing repealing regulation, rail system interoperability and railway safety. The “market pillar” focuses on improving service for travelers by increasing competition and opening the market to new operators.

Rolling stock buyers have begun to include quality in their metrics along with cost. Purchasing activities impact value creation through the acquisition of the necessary resources later in the supply chain ([Lysons & Farrington, 2006](#)). Supply chains strive to achieve their goals via their constituent organizations, with market value creation being a key aim.

The procurement of rolling stock is often accompanied by uncertainties because regulations and standards do not control the purchasing process. Extra-regulatory standards can help clarify these doubts. This is no small problem, as rolling stock availability affects the railway system’s service levels and efficiency ([De Simone et al., 2023](#)). This study analyzes and synthesizes best practices for rolling stock procurement in Europe. We examine the existing delivery models of rolling stock, define directions for strategic rolling stock procurement, specify key performance indicators, provide managerial implications from this work and designate avenues for future research. The EU’s implementation of the Fourth Railway Package makes this article significant because it illustrates the state of rolling stock procurement in Europe.

Materials and methods

Overview

The research for this article consisted of two phases. The first phase included a review of the literature, which evaluated academic studies and industry publications. The analysis of the rolling stock market focused on Poland, Germany, Italy, France and Spain due to these EU countries’ rail complexity. The evaluation of purchasing documents followed pre-defined metrics, focusing on bid evaluation criteria. Since rolling stock procurement is a public purchasing process, documentation was available in the appropriate offices in each country.

Phase two consisted of data collection and analysis following the Delphi method. Data collection involved a series of workshops with rolling stock manufacturers, rail authorities, local representatives and end users. The workshops performed during the InnoRail Project [2] pertained to general areas of railway use and included an overview of the rolling stock situation from the perspective of manufacturers. The discussion focused on the countries mentioned above. There were two types of workshops: the first centered on stakeholders, which allowed us to collect data for analysis and build rolling stock procurement strategies. We comprehensively analyzed rolling stock procurement processes to synthesize the information collected, paying particular attention to auction decision-makers. The second round of workshops – conducted with buying authorities – focused on the resulting strategies from the first round and included the metrics identified in the process.

Literature review

An effective purchasing strategy can mitigate supply chain risks (Mena, Van Hoek, & Christopher, 2018) by reducing operating costs, increasing revenues and limiting current and fixed assets. Such measures, in turn, reduce the net working capital and fixed capital (Christopher & Ryals, 1999). Purchasing departments should consider reducing total product life cycle costs (LCC) as their key responsibility, and they can accomplish this goal by involving suppliers in the design and development stages of the process (Ocicka, 2019). Good purchasing practices, such as accurate needs specifications, standardization, careful supplier selection and professional management of contracts and supplier relationships, reduce costs and improve the quality of delivered materials (Ocicka, 2019). This forms part of purchasing management, which we define as managing the company's external resources so that the demand for products, services, skills and knowledge resources necessary for the organization's functioning and for managing its activities is provided under the best possible conditions (van Weele, 2010). Many perceive purchasing management as a potential source of the company's competitive advantage (Tchokogue, Nollet, & Robineau, 2017) and value (Malacina *et al.*, 2022). We should emphasize that internal and external resources alike build a competitive advantage. These resources include the company's suppliers, knowledge and skills, as well as products and services (Rutkowski, 2013).

Suppliers represent one of the three main areas of supply chain cooperation discussed in the literature, the others being customer cooperation and internal cooperation (Flynn, Huo, & Zhao, 2010). Ongoing improvement is a task for entire supply chains, not just individual enterprises (Antonowicz & Jarzębowski, 2018). Supplier cooperation is essential from the purchasing perspective because it allows focal firms to engage suppliers early in the bidding process (Giri & Bardhan, 2014). Organizations should recognize that purchasing decisions motivate suppliers faster than actions within the organization (Mena, 2014). Procurement plays a strategic role and is integrally connected to forming trading partnerships (Zsidisin & Siferd, 2001).

Enterprises that recognize the importance of purchasing develop the concept of strategic purchasing management. Key factors of this approach are defined by Carter and Narasimhan as follows: the empowerment of purchasing in the organizational structure, its support provided by the top management, interactions with other business functions and external suppliers and the competencies of purchasing managers (Carter & Narasimhan, 1996). This article defines strategic procurement management as the process of planning, implementing, evaluating and controlling strategic and operational purchasing decisions, as well as directing purchasing activities to take advantage of market opportunities that further the enterprise's long-term goals. Moreover, Mena (2014) suggests that sustainable development should be integral to strategic procurement management (Snider, Halpern, Rendon, & Kidalov, 2013).

The long-term value creation focus reflects the professionalization of purchasing and the change in philosophy toward the purchasing function (Rutkowski, 2013). This aspect relates to the interdependence of costs associated with maintaining stocks, purchasing supplies, fulfilling orders, buying components and arranging transport (Lambert & Stock, 1993; Beier & Rutkowski, 1997). Taking specific actions within the enterprise may reduce certain costs while increasing others.

The purchasing strategy defines the decision-making framework for the material and service acquisitions needed to support the firm's activities (Watts, Kim, & Hahn, 1992). Table 1 shows the iterative principles of strategy building.

The purchasing *policy* is a set of rules that employees engaging in purchasing functions should follow. The policy defines the main direction of purchasing development and facilitates employees' consistent communication with stakeholders. In this context, the purchasing policy enables the development and implementation of the purchasing strategy (Brzezinski & Rudnicka-Reichel, 2020).

Purchasing leverage is a purchasing management concept used in the context of the consulting market. [González-Benito \(2007\)](#) and [Hesping and Schiele \(2015\)](#) position purchasing leverage at the tactical level, below the purchasing strategy. The concept helps expand purchasing and enhance the buyer profession in organizations ([Viale, Ruel, & Zouari, 2022](#)). The literature analysis demonstrates various concepts and insufficient consistency in the terms used ([Hesping & Schiele, 2015](#)). Furthermore, the process of distinguishing individual leverages is problematic, with some authors identifying three ([Day & Lichtenstein, 2006](#)), some four ([Narasimhan & Das, 2001](#)) and some as many as fifteen ([Büscher, 2011](#)) or sixteen ([Schuh, Kromoser, Strohmer, Perez, & Triplat, 2009](#)).

We conclude that purchasing leverages are sets of methods and tools used to increase the value of the purchasing function ([Rzeżacz, 2016](#)). The leverages originated in the practice of consulting companies and later transferred to the academic field ([Schuh & Bremicker, 2005](#)). The definition of levers is more general – they do not mean specific actions but refer to a group of methods and tools according to their area of influence.

The authors hope that the above discussion of the literature helps explain procurement processes. The literature includes four articles describing supply chain management, fourteen articles focusing on procurement strategy, four articles explaining procurement measures and three articles describing procurement leverages.

Data collection

We extended the literature review with an analysis of the rolling stock market. We analyzed rolling stock procurement procedures in four selected EU countries: Poland, France, Germany and Italy. These countries have the longest railroads in the EU and the most complex rolling stock infrastructure in the EU ([Dyr & Welnic, 2006](#)). The research goal was to gain a broader understanding of the views of railroad professionals about the rolling stock procurement strategy through qualitative research.

We arranged exploratory workshops to include a sample of leading manufacturers and buying entities according to the predesigned scenarios identified by various stakeholder groups. We selected eight manufacturing companies. This sample represented 80% of rolling stock manufacturers in the European market. Sixteen regional deputies of public entities in Poland represented the buying side in instances where regional governments managed the rolling stock. Each deputy represented one Polish region. Geographical limitations prevented the participation of representatives from other countries.

We performed interviews during eight face-to-face workshops. Two senior managers represented each manufacturing company. Separate workshop sessions ensured the discretion and confidentiality of the material presented by the informants. The discussions followed a specially prepared agenda. The interviewers transcribed the sessions and analyzed the transcripts. The analysis complied with prespecified metrics, which focused on purchasing models in the EU. A content analysis suggested that procurement procedures in Europe are in need of improvement. [Section 3: Results](#) discuss this indication.

Table 1.
Strategy building
methodology

Level 1	Enterprise development strategy
Level 2	Functional purchasing strategy
Level 3	Purchasing category strategies
Level 4	Purchasing levers
Level 5	Strategies towards suppliers

Source(s): [Hesping and Schiele \(2015\)](#)

Results

Directions for rolling stock development

The rail sector must meet passengers' needs to be competitive with other transport sectors. Manufacturers must produce rolling stock that offers a comfortable means of conveyance for passengers while reducing energy consumption costs and adapting themselves to ecological requirements. They can achieve these goals through the use of zero-carbon technologies, secondary raw materials, energy-efficient operations and reduced dependence on fuels with high particulate emissions ([Ćwil et al., 2021](#)).

During the workshops, interviewers discussed purchasing procedures in the European market with rolling stock manufacturers, suppliers, railway authorities, local representatives and rail users. Further discussions focused on public procurement laws, the most advantageous procurement methods for producers and the establishment of procurement procedures. Producers shared their knowledge of the financing models used by contracting authorities when purchasing rolling stock. In addition, interviews covered the advantages and disadvantages of different purchasing and delivery models used in rolling stock procurement. Moreover, attention was paid to bid evaluation criteria and the use of vehicle LCC as purchasing criteria. Notably, life cycle assessment (LCA) methods incorporating LCC have gained substantial importance as a purchasing tool ([Vidal & Núria Sánchez-Pantoja, 2019](#)).

[Table 2](#) presents a summary of the purchase directions emphasized by manufacturers. We identified eight topics.

Manufacturers stated that discussing technical details with rolling stock purchasers is not a standard practice, and this generates technical barriers to matching the bidding criteria. As such, suppliers do not participate in bids because their technical specifications are more modern than the requirements in the invitations to tender. Therefore, despite having newer technological solutions, producers have their bids rejected because the technical specification of the procurement request does not consider many technological aspects. Manufacturers stated that buyers usually used the "construct only" delivery procurement method. Interviewees suggested the "construct and maintain" option as the best delivery model. As presented in [Table 3](#), interviewees mentioned the existence of recorded practices of alliance contracting used to build procurement leverage against suppliers.

Manufacturers pointed out that an innovative solution to reduce the costs associated with rail vehicle maintenance is equipping the rolling stock with a system that continuously monitors the vehicle's condition, including the usage of consumables. This solution allows users to plan maintenance work during technical inspections, which translates into lower downtime for a given vehicle, reduced required storage space and financial savings.

Procurement processes

Methods for awarding contracts are currently evolving in every purchasing category, with awarding entities continuing to gather experience. Public buying entities are introducing tools to facilitate the award of contracts, while regulations facilitate implementing innovative ecological solutions ([Rogerson, 2017; Day & Merkert, 2021](#)). The analysis of rolling stock procurement procedures ([Table 4](#)) in the four selected countries demonstrates a clear trend toward using negotiation procedures. This outcome departs from the classic one-off delivery in favor of supply contracts with long-term maintenance and service and a proliferation of framework contracts. We chose the procurement processes described in [Table 1](#) according to information about procurement process selection criteria and their specificity. The dominant procedure is standard competitive bidding. The documentation for rolling stock purchasing processes is available at the appropriate public office in each country. Many contracting authorities purchasing passenger rolling stock are local governments for which the basic

Group	Sup-group – discussion topic	Direction	Quantitative evaluation
Type of drive	Hybrid vehicles	All manufacturers in their portfolio offer passenger trains in hybrid technology (fuel cells or traction batteries + internal combustion engine)	6/6
	Hydrogen drive	One manufacturer has in its portfolio a developed technology for powering trains with hydrogen propulsion	1/6
Passenger needs	Adaptation of interior design	6/6 manufacturers ensure that the interior of the car is adapted to the requirements of the ordering parties.	6/6
	Passengers' tests	2/6 of the manufacturers conduct their own research in the field of passenger requirements for the interior of the train	2/6
Purchasing procedures	The producers' experience	All producers confirm that they have experience in Polish and European procurement procedures	6/6
	Collective purchase of trains	Producers unanimously assessed that the creation of purchasing groups would allow to generate better purchase prices and reduce the costs related to the maintenance of the rolling stock.	6/6
	Technical dialog	6/6 manufacturers confirm that there is no technical dialogue in the Polish purchasing procedures	6/6
	Evaluation criteria	4/6 manufacturers believe that most of the non-price criteria, such as technical, operational and functional requirements, are imprecisely defined	4/6
	Tendering time	The majority of producers stated that the time specified by the awarding entities in tendering procedures is in many cases too short - this results in the fact that producers do not submit a tender.	4/6
Delivery models	Vehicle Life Cycle Costs (LCC)	3/6 producers confirm that they use LCC calculations in their bids submitted under tender procedures	3/6
	Contract and Maintain	5/6 manufacturers confirmed that the model of delivery of vehicles with maintenance agreements is financially profitable for the contracting authority	5/6

Table 2.
Rolling stock purchase directions

Source(s): Own elaboration

procedures are open tender and restricted tender. To use the negotiated public procurement procedure, the local government must examine whether there are conditions for its application in their circumstances. The authors analyzed purchasing documentation according to prespecified metrics, focusing on awarding criteria.

The tender evaluation criteria used by awarding entities are also changing. Although certain tenders continue to use price as the sole criterion (2017/S 143–295536), they are an exception rather than the norm. European contracting authorities employ additional metrics such as quality criteria, technical criteria and economic criteria, including LCC. The introduction of qualitative criteria does not always influence bid selection. One example of a procedure comprising qualitative criteria despite their irrelevance is a French procedure

Delivery model	Description	Literature base	Quotes from workshops
Construct Only	Construction project delivery methods help determine the way that stakeholders work together during the planning, design and building phases. While construction projects usually involve an owner, a design team and a builder	White (2019)	"Despite newer technological solutions, the offer submitted by such a manufacturer is rejected because the technical specifications of the tender do not take into account many technological aspects."
Construct and Maintain	This delivery model is an integrated procurement model that combines the design and construction responsibilities of design-build procurements with operations and maintenance	El-Haram, Marenjak, and Horner (2002)	"This solution allows you to plan work during technical inspections, which translates into saving downtime of a given vehicle, reduces storage space because unnecessary replacement parts are not stored, and this translates into financial savings." "In order to reduce the costs associated with maintaining rail vehicles, an innovative solution is to equip the rolling stock with a system enabling continuous monitoring of the technical condition, including the consumption of consumables." "This solution creates possibility to build economy of scale for the buyers and receive better offering."
Alliance Contracting	Under an alliance contract, the Owner and the Non Owner Participants (NOPs) work together to collaboratively determine the best offer and deliver the project	Sanderson, Allen, Gill, and Garnett (2018) Gransberg and Scheepbouwer (2015)	

Source(s): Authors' own elaboration

Table 3.
Delivery models mentioned during workshops

(2015/S 068–122520). The bidding process started in April 2015 and concluded with the award of a contract in January 2017. The contract was awarded to Alstom Transport SA and exceeded EUR 168 million. The bidding process was a negotiated public procurement procedure; the contracting authority considered it justified to review its assumptions with contractors and to allow them to comment on the documentation of the procedure, ask questions and negotiate the manner of contract performance. As a result, the contracting authority drafted a framework agreement with options in the procurement process, allowing the purchaser to select the best bid.

Looking at the criteria weights, the life cycle cost criterion is superficial, with a weight of only 5% points. Therefore, the criterion is essentially irrelevant to the evaluation and selection of bids placed in the tender process. An example of a more realistic weighting of the bid evaluation criteria is a German procedure (2017/S 047–086799) on design, production and delivery, in addition to all related ancillary and auxiliary services of new low-floor technology rail vehicles that are approved and ready for use by RNV (Rhein-Neckar-Venrkehr) network passengers. This approval includes the communication and IT equipment necessary for operation on the RNV network, as well as spare parts and necessary special tools. This procedure used three bid evaluation criteria; however, the distribution of weights between

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Tender no	Evaluation criteria	Country	Year	Specificity
2015/S 132– 243424	Price is not the only award criterion; all criteria are mentioned only in the procurement documents "	Germany	2015	contracting authority requested that the contractor should constantly maintain readiness to use the basic rolling stock, but also a maintenance reserve
2015/S 068– 122520	1. Quality criterion 1: technical quality: 50% 2. Qualitative criterion 2: life cycle cost: 5% 3. Price: 45%	France	2015	a procedure for the rolling stock supply
2016/S 179– 320954	Price is not the only award criterion; all criteria are mentioned only in the procurement documents "	Germany	2016	the system of qualifying suppliers for the purchase of new railway vehicles for use in local public transport, the supply of spare parts and, if necessary, additional maintenance by the manufacturer
2016/S 190– 340512	1. Quality criterion 1: technical quality: 50% 2. Price: 50%"	France	2016	a procedure for the supply
2017/S 073– 140212	1. Quality criterion 1: technical quality: 70% 2. Price: 50%"	Italy	2017	supplier qualification system <ul style="list-style-type: none">• delivery of new rolling stock, including certificates, approvals, commissioning and technical acceptance, for various types of rolling stock and• full service, first and second level, for newly delivered rolling stock, for various categories of rolling stock
2017/S 093– 182702	1. Quality criterion 1: technical quality: 70% 2. Price: 30%	Italy	2017	a procedure for the supply, including full technical service
2017/S 052– 096648	Price is not the only award criterion; all criteria are mentioned only in the procurement documents "	Germany	2017	a procedure for the supply
2017/S 143– 295536	Price 100%	Poland	2017	a procedure for the supply
2017/S 047– 086799	1. Quality criterion 1: technical quality: 40% 2. Qualitative criterion 2: life cycle cost: 30% 3. Price: 30%	Germany	2017	a procedure for the supply
2018/S 120– 274586	Price is not the only award criterion; all criteria are mentioned only in the procurement documents "	France	2018	a procedure for the supply

Table 4.
Rolling stock purchase directions

(continued)

Tender no	Evaluation criteria	Country	Year	Specificity
2018/S 247–571258	1. delivery terms - 28% 2. maintenance conditions - 4% 3. maintenance conditions: documentation, resources and training plan - 8%. The remaining 60% was the price evaluation	Spain	2018	a procedure for the rolling stock supply
2019/S 031–070567	1. delivery terms - 28% 2. maintenance conditions - 4% 3. maintenance conditions: documentation, resources and training plan - 8%. The remaining 60% was the price evaluation	Spain	2019	procedure for the supply of trains along with maintenance services

Source(s): Authors' own elaboration based on Innorail Project

Table 4.

them shows that each criterion is almost equally important to bid selection. Such a distribution of the criteria weights forces bidders to focus not only on price but also on quality. The more reliable the solution the supplier offers, the cheaper that solution's operation and maintenance will be for the customer over the vehicle's service life.

In a Spanish public procurement request (2018/S 247–571258) by ADIF-Alta Velocidad for the supply and maintenance of twenty-two locomotives, the bid evaluation criteria continued to develop during bidding. As part of the evaluation criteria, the contracting authority examined as many as three quality criteria, representing 40% of the evaluation value. Awarding entities may not only use traditional procedures in awarding public contracts. One solution is the supplier qualification system that involves keeping a list of entities appropriate for performing a given type of repetitive sectoral contract, such as passenger rolling stock. Poland has used a contractor qualification system since 2012. The goal is to create a list of potential bidders who meet the subjective conditions specified by the contracting authority operating the system. Accepting the application for admission to the system means that the contracting authority has recognized a given rolling stock operator as capable of performing deliveries in a certain category of contracts. This creates a database of potential bidders for future tender procedures. An example of the above is the system of qualifying suppliers for the purchase of new public transport railway vehicles, the supply of spare parts and additional maintenance by the manufacturer (2016/S 179–320954), announced by BeNEX GmbH. The vehicles must have a commissioning permit compliant with TEIV (Trans-European Railway Interoperability Regulation) and EBO (German Railway Construction and Operation Regulations) for unrestricted use in the area of public rail infrastructure with regular tracks in Germany; they should be designed according to a modular concept and, if possible, offered in different configurations (such as 3, 4 or 5-piece vehicles).

National regulations do not explicitly provide for the possibility of applying a qualification system that already exists at another contracting authority; however, the sectoral directive [3] (Article 77 (3)) mentioned such a solution. Thus, when applying the provisions of the directive, the contracting authority has the option of invoking such a "foreign" qualification system if that system meets its own requirements. In that case, it is enough for the contracting authority to specify the institution running such a system. Contracting authorities should consider using systems already established by other Member States and attempt to learn from each other. Given that the rail market is a European market, it seems natural to benefit from both domestic experiences and those of other Member States.

All the proceedings mentioned above were negotiated procedures. The estimated life cycle of rolling stock is approximately 35 years. Therefore, when purchasing rolling stock, key factors include not only the delivery price but also service and maintenance conditions. One solution that might address service concerns is a lease agreement and determining only the selection criteria of the expected service. Another solution is developing contracts that are not long-term leases but ones that ensure maintenance throughout the rolling stock's life cycle. Such multi-year contracts are a simple way to get a higher quality product and the contractor offering the rolling stock is obliged to service the product for several years.

While rare in Poland, framework contracts continue to gain popularity in other EU states. A framework contract is a stage in awarding a larger purchase contract. Such a contract legally renders the parties ready to conclude executive contracts during the framework contract's validity period. The framework contract defines its subject matter and its implementation method. However, neither the contracting authority nor the economic operator is obliged to award or submit a contract under it. Framework contracts primarily provide flexibility in operation. The contracting authority may or may not implement them and may, therefore, make decisions depending on its financial situation. If the contracting authority decides that it wants to award the contract and has a framework contract in place, the framework contract may lead to the award of the purchase contract much faster because the customer need not go through a complete purchasing procedure. The customer only needs to observe the implementation procedure of the framework contract. The framework contract's nature precludes its implementation. Alternatively, despite the ordering party's willingness to execute it, contractors may not submit tenders in executive proceedings. No one "loses" in such a situation.

Rolling stock purchasing strategy

To create an optimal purchase strategy for rolling stock in a given passenger transport category, we argue that it is worth supporting a methodology based on the following five steps. We developed these steps based on an analysis of the workshop interviews conducted for this study and the available literature. [Table 5](#) includes a summary.

Purchasing units with various positions within the company structure develop and execute the purchasing strategy. Furthermore, these units are responsible for analyzing and categorizing purchases. Depending on the results, the units define and implement strategies for the individual purchasing categories.

The examination of the current strategy/category situation should coincide with the review of archival data. The archival data review should focus primarily on the current rolling stock purchasing strategy for the passenger transport category. Unfortunately, companies responsible for vehicle purchases rarely resort to this strategy. The main reason for lacking such a strategy is financing from EU funds (in 2007–2013, the total value of subsidies for the purchase of rolling stock for agglomeration and regional transport amounted to PLN 4.8 billion). The companies must account for the transferred funds in accordance with the funding calendar; otherwise, they are required to return unused funds within a specific timeframe. Such a requirement often leads to ad-hoc purchases of passenger rolling stock and allows purchasers

Step no.	Step description
1	Evaluation of current strategy/category situation
2	Needs evaluation/product specification
3	Supplier market research
4	Analysis of strategies available
5	Plan, measurable goals, milestones

Source(s): Authors' own elaboration based on [Hesping and Schiele \(2015\)](#)

Table 5.
Rolling stock
purchasing
strategy steps

to make full use of the funding entrusted to them. As a result, many businesses are obliged to evaluate the data they already have in their records. These data include historical rolling stock purchases (unit price, quantities ordered, delivery date), specifications, as well as data related to ongoing tenders for the purchase of passenger rolling stock: time spent preparing the documents, technical specifications, model contract and other tender documents, the duration of the procedure based on the start and end dates of the tender, the tendering procedure to be applied, delivery dates and the composition of the tender committee.

Furthermore, enterprises must analyze the agreement types concluded with existing suppliers in a given category to determine the terms of delivery and payment. Based on the collected data, these business entities can assess the following: unit purchase prices of rail vehicles by type of propulsion according to the category of passenger transport; preparation time of the tender procedure (complete tender documentation); the specifications and guidelines of the procurement entity; the duration of the tender procedure; evaluation criteria; and the type of agreements concluded. The average duration of proceedings with a value above the EU thresholds was 96 days, with the duration of average tender proceedings sectioned by the type presented in [Table 6](#).

To prepare the necessary specifications, a contracting company requires knowledge of current technological solutions that can be applied to the contract as an added value to the tender. The team working on the tender documentation must be qualified and have purchasing experience in that category. Therefore, the buying team is a crucial element in building a strategy. The team should evaluate previous tenders to assess the competence of their participants. A competent team plays a vital role in the success of a procurement process.

Before launching a procurement procedure, the contracting authority may conduct preliminary market consultations to prepare the procedure and inform contractors about its plans and requirements for the contract. Such consultation is optional and may be used regardless of the value of the contract ([Bayer, Schäuble, & Ferrari, 2018](#)).

The contracting authority may also issue a request for information (RFI) when conducting a market analysis. This way, the authority may prepare a list of potential service providers that it can invite to participate in a tender procedure in which the selection of the contractor is determined by the price offered in the bid. The purpose of sending an RFI to potential suppliers is to obtain information regarding the current range of products offered, available technologies, order execution/production, capacity and production constraints, the cost structure of suppliers, required licenses, permits, patents developed and elements of the total cost of ownership (TCO). TCO considerations include service requirements, consumables, maintenance costs and supplier experience ([Sirina & Yushkova, 2020](#)).

The purchasing strategy is not limited to conducting analyses, although thorough analyses allow companies to select appropriate purchasing levers and conduct tenders in the most effective manner. Many managers struggle with evaluating employee effectiveness and encouraging employees to implement the company's strategy – in this case – the fleet strategy. The final step of the methodology for building a procurement strategy is identifying key performance indicators (KPIs). [Table 7](#) illustrates relevant procurement measures and

Type of the tender proceedings	Average duration of the proceeding
Open tender	95 days
Restricted tender	134 days
Negotiations with publication	220 days
Competitive dialog	202 days
Innovation partnership	194 days
Source(s): Authors' own elaboration	

Table 6.
The average duration
of the proceedings

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Name of the measure	Description	Counting directions	Relevant factors
Reducing the cost of purchases	Use of the LCC index as an evaluation criterion in the tendering process	Main factors influencing the whole-life cost (LCC) of rolling stock: the cost of purchasing rolling stock; the cost of maintaining the rolling stock over a 15-year cycle; cost of energy consumption	Verification and enforcing LCC factors upon receipt of vehicle; maintenance costs - subcontracting technical maintenance to a manufacturer; energy consumption cost - vehicle mass index per passenger; mass of the vehicle by weighing
Increase in passenger transport market share	Increase in financial receipts as a result of increased interest in travel on purchased trains	% increase in passenger transport after last tender	Optimal specification and orientation to customer/ passenger needs
Savings	Unit price reduction	% of the highest bid	Reduction of the result of negotiations in relation to the first offer
Increasing passenger satisfaction	% reduction in the number of complaints after the implementation of the last tender	Number of complaints lodged in period t/Number of complaints in period t-1	Drawing up product specifications taking into account passengers' needs, including relying on surveys
Increase in passenger numbers	% increase in the number of passengers after the implementation of the last tender	Number of passengers in year t/Number of passengers in year t - 1 *t - 12 months after delivery and operation of the new rolling stock	Drawing up product specifications taking into account passengers' needs, including relying on surveys
Process improvement	The average tender duration of the last 5 years will indicate the efficiency of the process. The shorter the time the more efficient the process was	Average duration of the tender from the appointment of the Tender Committee to the signing of the minutes of the supplier selection	Identification of factors in historical tendering procedures that affect the length of proceedings and their elimination or reduction to a minimum
Process improvement	Canceled proceedings are equivalent to the non-implementation of the purchase plan. The more cancellations, the less efficient the bidding process	Ratio of tender procedures cancelled/ resumed vs. the number of tenders conducted in a given category in a given time period	Streamlining of processes at the level of appropriate choice of tender procedure
Increasing the transparency of expenditure	Transparency of expenditures	Ratio of % of procedures conducted under a tender procedure other than open tender procedure	In the course of strategy building, assessment of the possibility of using a tender procedure other than the open tender procedure
Availability of vehicles	Readiness of rolling stock	Rolling Stock Availability at a minimum of 95% per annum except in the year of P4 service where a Rolling Stock Availability of at least 91% per annum is required	Preparation of specifications clearly defining quality requirements

Table 7.
Rolling stock procurement measures

(continued)

Name of the measure	Description	Counting directions	Relevant factors
Availability of vehicles	The reliability factor of the rolling stock	A rolling stock reliability factor of at least 98 %	Preparation of specifications clearly defining quality requirements
Improving employee engagement and skills	Degree of implementation of training plans	Min, one training per year, per employee	In order to increase the qualifications of employees, professional training is necessary, as well as participation of merchants in conferences/meetings/congresses/workshops related strictly to the rolling stock topic

Source(s): Authors' own elaboration based on Innorail Project

Table 7.

presents the correlations between the strategy for the entire company, the strategy for the purchasing department and the resulting rules of operation for managing categories, suppliers and the purchasing process. We assessed the KPIs resulting from this activity during the second round of workshops and summarized them in [Table 7](#).

These measures can show how the company supports individual overarching goals regarding the strategic objective. Some objectives in the purchasing area, such as reducing purchasing costs, streamlining the purchasing process and increasing the transparency of expenditure, are universal and pursuing them is usually a good management decision.

Discussion and recommendations

Like a well-designed procurement strategy, a well-designed and effectively implemented rolling stock strategy promotes the development of a company and contributes to building its competitive advantage. Effective implementation is of crucial importance in seeing the strategy's benefits.

Successful implementation requires the strategy to be known, understood, controlled and communicated to the entire organization. The company's plans, tasks and operational activities must reflect its strategic plan and objectives, while the achievement of strategic objectives should be monitored through the aggregation of results from the operational level.

Two important elements of the purchasing strategy include the decision about the intensity of cooperation with the supplier in developing the purchased assets and the automation investments relating to the order-handling process. The purchasing goal should be to maximize functional requirements while minimizing LCC. The primary conclusion from several years of co-financing from EU funds in Poland is that the method of spending funds significantly hinders achieving long-term economic development goals in Poland – such as improving productivity or innovation. The Polish economy needs to stop focusing on the lowest price and start investing in innovative solutions. In other words, in the long run, replace the criterion of "cheap" with "good."

Purchasing groups – associations of entities that aggregate and jointly execute purchases – are rare in the public procurement system in some European regions, such as Poland and contracting authorities are reluctant to set them up. Contracting authorities may jointly conduct a procedure and award a contract within a purchasing group. By the same token, any entity may decide to jointly conduct a procedure and award a contract without having to

fulfill any prerequisites or conditions. The benefits of using this form of purchasing include a reduction of transaction costs and economies of scale. This allows contracting authorities to ensure price competition among suppliers. The risks involved in setting up a purchasing group are the principles of fair competition and equality of economic operators. A lack of standardization generates costs that result from, among others, the need to maintain higher inventory levels. Therefore, it is necessary to effectively select the level of aggregation of needs among equal organizational units.

As European and national regulations strictly control technical standards and safety requirements and with the standard of expected passenger comfort already defined, descriptions of the contract's subject matter should lean toward standard solutions. These solutions, or features, can include modular, reliable and easily serviceable units with available spare parts and the possibility of using substitute parts from other manufacturers.

The relevant enterprises should take steps to increase the use of negotiated procedures. This mode of contract ensures comprehensive competitiveness of the tender procedure. As a result of a contract notice, any interested entity may join the negotiation procedure, and its participation in subsequent stages is determined solely by whether it meets the conditions for participation. The fact that negotiations with an announcement are a basic procedure for sector procurers also supports this practice, and their execution does not require meeting any conditions.

Furthermore, entities should increase the use of technical dialog and market analysis. Before launching a procurement procedure, contracting authorities should obtain up-to-date knowledge from the market to make an effective purchase. This allows for verifying technical and legal bid assumptions, evaluating contract design, learning how suppliers calculate contractual risk and gaining up-to-date knowledge from manufacturers. Such preparations will also minimize the risk of cancellation of the procedure due to a lack of bids or budget overruns.

The smooth implementation of the procurement process depends, to an extent, on the relevant provisions listed in the contract with the supplier. Several essential principles must be considered for a contract to ensure the necessary circumstances of its performance. There are two practices concerning the inclusion of model contracts in the tendering process. The ordering party either includes the model contract as an element of the tender specification or only the material provisions of the contract feature in the tender specification, and the contract takes its final shape during direct discussions with the contractor. The provisions of a public procurement contract must consider the principle of fair competition, equal treatment of suppliers and social co-existence. These principles would be violated if the contracting authority stipulated that only the contractor would pay liquidated damages if it failed to perform its obligations, for example, through a delay in the performance of its duties, while the contracting authority would not incur such damages. The contracting authority should avoid rigid provisions in the formulation of contract terms because their application will make it impossible to adapt the contract to changing realities during its performance. Furthermore, the contracting authority should pay particular attention to determining the supplier's remuneration in a flexible manner.

Limitations and future research

While this study presents a thorough evaluation of rolling stock procurement practices, its limitations result from geographic isolation. Future studies should compare the procurement practices discussed here to procedures used in the EU, North America, South America and Asia. Moreover, this study focuses on the passenger rail segment. Passenger transport is a vital function of the rail network in the EU; however, future research should expand the assessment of rolling stock procurement strategies to include freight rail.

This study demonstrates standard rolling stock procurement practices in complex EU railway markets. This work expands the literature through a review of these practices and through enabling research into best practices and evaluating a commonly accepted procurement model.

Conclusions

A systematic literature review showed a lack of publications focused on rolling stock procurement. Nevertheless, the authors performed a literature review on rolling stock and strategic procurement extended by market analysis and a comprehensive examination of tender procedures, which gave the authors a more complete picture of the existing research about rolling stock procurement.

The second step of the research provided data needed to analyze rolling stock procurement strategies. The authors divided this stage into two parts. The first consisted of workshops with rolling stock stakeholders. These included rolling stock manufacturers, rail authorities, local representatives and end rail users. Second, the authors evaluated the rolling stock procurement strategy during another round of workshops with rolling stock purchasing authorities. Rolling stock stakeholders indicated their requirements in regard to rail transportation.

The requirements are likely to reflect the necessary balance between the economic efficiency of procurement and the progressive instrumentalization of rolling stock procurement law. This research also makes it possible to eliminate other critical problems in public procurement. One such problem is ineffective management of the procurement process, including planning the award of the contract, the preparation of the procedure and the conclusion of its implementation. Another challenge includes the focus on the cheapest solutions in the short term over the most effective solutions in the long term. The focus of contracting authorities on meeting formal requirements instead of obtaining the best quality product or service is something that purchasing entities should also consider. Finally, purchasing entities conducting procedures in modes other than the public procurement procedure do not need to worry about having to explain why the cheapest bid won the tender.

The study identified variations in rolling stock vehicle types. This phenomenon occurs due to ordering a limited series of rolling stock thanks to “financial injections” obtained, for example, from EU funding. A wide variety of vehicle types generates more significant costs in terms of driver training, maintenance and spare parts availability. A well-constructed procurement strategy should aim to standardize vehicles for the sake of parts, technicians and driver interoperability. We should emphasize that when building a purchasing strategy for a given assortment, we do not necessarily have to resort to the category of specific transport. Depending on demand, the strategy should be adapted to the type of propulsion – electric, diesel, or bimodal trains. The update of each strategy should align with the rolling stock strategy, and the optimum time for the update is when we are preparing to launch the tender process. Employees of purchasing units do not always have the capacity, in terms of time and expertise alike, to keep up to date with changes in the supplier market. In the era of continuous dynamic development of technology and the concentration of supply markets, strategic purchasing management becomes crucial to maintaining a competitive position. An effective and increasingly popular practice of building a procurement strategy is employing an experienced team of procurement consultants with vast and practical experience in the field.

The article fills the gap in the literature on rolling stock procurement in the area of procurement strategy. The authors deliver tools useful in the managerial sphere. Finally, the article emphasizes the importance of the study, and the authors suggest that the research can be extended to include the remaining European countries and freight transportation.

Notes

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3. Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014 on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC.

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Further reading

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