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Make-or-buy Decisions in Transport Logistics: A Case Study Analysis as a Basis for Decision-Making for Beverage Producers

Sebastian Fiehl (55714)

Work project carried out under the supervision of:

Ana Sofia Costa

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Abstract

The work investigated the problem of a make-or-buy decision in the field of transport logistics from the perspective of a German beverage producer. Based on the findings of a literature review, the author developed a decision framework applied incrementally in a case study of Company A. In particular, the specificities of the German beverage industry, such as the transport network and special features of the deposit system, were considered. The findings of the literature review paired with the case study allowed the development of a framework that can be used by German beverage producers across companies in make-or-buy decisions.

Keywords

Make-or buy, Supply Chain Management, Transport logistics, Cost optimization, Beverage Industry, Framework development

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1. Introduction

In the last years, manufacturing companies have been faced with complex transport logistics decisions, intensified by a rising share of logistics costs in total product costs, driven by supply bottlenecks during the Covid pandemic and inflation due to the Russia-Ukraine war (United Nations 2022). This affects companies in the beverage industry, as their share of logistics costs in total costs is high due to the low value density of goods (Parker 2023). The beverage industry is faced with the decision of whether it is more economically to manage their logistics operations inhouse, utilizing their own vehicles, or to entrust these tasks to a dedicated logistics service provider (Gudehus and Kotzab 2009). Hence, having a structured framework that offers clear guidance for making such decisions is beneficial.

Schwarting and Weissbarth (2011) use a process model to examine make-or-buy decisions across industries. However, by exploring a make-or-buy decision framework in the beverage industry in the Netherlands, Hsiao (2010) neglects country-specific criteria of the German beverage industry.

This work addresses the absence of an applicable decision framework for the German beverage industry using a case study methodology to answer the following research question: *"What are the key factors that influence the make-or-buy decisions of German beverage producers concerning logistics services in transport logistics, and how can these insights be leveraged to craft a comprehensive decision framework for the entire industry?"*. The structure of the framework should be valid across companies in this sector, considering the special features of the industry and ultimately helping companies to attain competitive cost advantages.

This work proceeds as follows: In chapter two, the author conducts a literature review in which relevant concepts for make-or-buy decisions are discussed. In the third chapter, a meta framework for the entire decision-making process with reference to transport logistics is

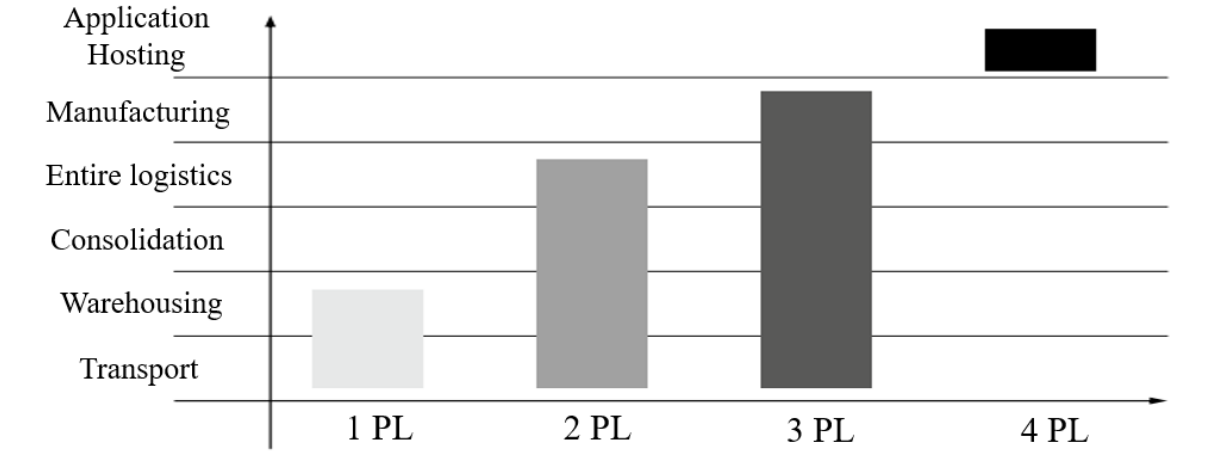
developed based on this literature before being applied to the case of a German beverage producer in chapter four. Conclusions with managerial implications take place in chapter five.

2. Literature review

2.1 Types of logistics service providers

"Logistics is an application-oriented scientific discipline. It analyses and models division-of-labour economic systems as time-based and location-based flows of objects in networks." (Delfmann et al. 2010, 58). Within these systems, logistics service providers (LSP) take on a variety of tasks along the supply chain to support companies in transport, handling, and warehousing activities. Services can range from individual logistics activities to the entire logistics of a company (Gudehus and Kotzab 2009). According to Figure 1, LSP are categorized based on their service range: 2PL (Second Party Logistics) focuses on transportation and storage, 3PL expand to include inventory management, and 4PL integrate services across multiple providers, emphasizing supply chain optimization and IT (Leitner 2015).

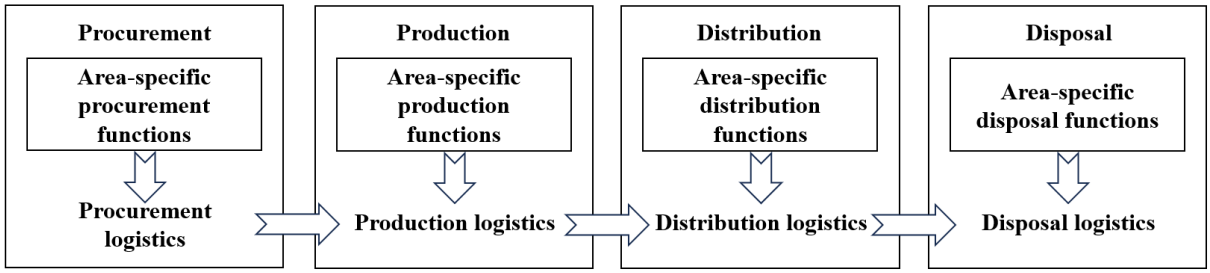
Figure 1: Categorization of LSP based on their service



Source: *(Leitner 2015).*

Inside the framework of this categorisation, logistics services can be organized based on the chronological sequence of goods flow within the logistics subsystems. According to Figure 2 this leads to a phase-oriented division into the logistics subsystems: procurement, production, distribution, and disposal logistics.

Figure 2: Phase oriented division into logistics subsystems



Source: *(Huber and Laverentz 2012).*

This work focuses only on the area of distribution in terms of transport logistics defined as "all logistical structures and processes that serve to move goods from production sites to customers." (Bahrami 2003, 12).

Specialised LSP in the field of transport logistics, to which this work refers exclusively, are characterised as transportation carriers. Hence, LSP in this work are classified as 2PL or as 3PL (only transport activities) (Leitner 2015). They are active in the areas of route planning, shipment tracking and, as a core activity, the execution of transports (Liu 2011). The primary objective is to optimize transportation efficiency, reduce transit times and minimize costs (Karimi, Ghadirifaraz, and Rafiei 2022). Since the German beverage industry relies exclusively on trucks and the road freight logistics between production and beverage retailing, only these are considered in more detail here (Rousseau 2012). The business model of LSP in the transport sector focuses on offering freight space to bridge certain routes. The decisive advantages are the transport network and the location of various warehouses, which means that transports can be planned more efficiently, improving truck downtime and vehicle utilisation (Rousseau 2012). The KPIs of downtimes and utilisation are therefore often significantly better for LSP than for manufacturers with their own fleets (Sweeney and Waters 2021).

Service providers in the transport sector are selected based on the criteria of their competencies and resources. Competencies are defined as the ability to organize and carry out transports within a certain geographical area for distinct goods (Gudehus and Kotzab 2009). Competence

levels in different regions vary based on location and operations. Larger transport networks, with more customers, warehouses, and trucks indicate higher competence in carrying out transports in an area (Hans-Christian Pfohl 2022). In addition, personnel and assets, usually warehouses, transport vehicles and IT form the core of LSP resources, which must be provided in sufficient quantity and quality to be able to carry out transports. Accordingly, competences and resources are mutually dependent and influenced by the decision of the service provider as to which geographical areas, products and customer segments it operates (Bensel 2009).

Specialization based on competencies and resources can consequently limit the choice of service providers for industrial companies, but at the same time increase the level of service. From the point of view of an industrial company, such a specialization of LSP, especially on a geographical level, often requires cooperation with several LSP if the company has its own geographically widespread customer structure (Rodrigue 2020).

2.2 Definition of make-or-buy decisions in management

The definition of a make-or-buy decision is divided into the occasion, the object and the extent: Examining the occasion of a decision, the first step is to determine whether the decision is an initial decision based on a new need or a follow-up decision in which a previous decision is reconsidered due to a new occasion (Hsiao et al. 2010). In this work, the author examines the follow-up decision. Questioning a previously made decision may be driven by circumstances such as the focus on competencies, the expiry of supply contracts, changes in costs or quality requirements (Kummer, Grün, and Jammernegg 2019). According to a survey from Baumgarten (2018), the key objectives of companies in make-or-buy decisions are a focus on cost reduction (28%) and on company's core business (21%).

In addition to the occasion, the object of the decision must be determined: this can be either goods or services, whereby services have a particularly high outsourcing potential. The following section deals exclusively with the outsourcing of services, which have two special

features in procurement that need to be considered: The first feature is the specification of the service, where the service must be described precisely in advance to avoid misunderstandings with the LSP. The second special feature is the service level agreement (SLA), which defines the performance standards of the service in connection with possible bonuses or penalties in the event of contractual violations. For example, if a logistics service provider does not meet the defined delivery performance, it pays penalties to the client (Jahani et al. 2021).

Third, a make-or-buy decision can also be classified according to the extent to which it is made. A distinction is taken between pure outsourcing, pure inhouse implementation and a mix of inhouse and outsourcing (Kummer, Grün, and Jammernegg 2019). This extent of the decision is to be assessed based on an economic evaluation, explained in the following chapters.

2.3 Strategy and cost differences as key criteria in make-or-buy decisions

The decision in the make-or-buy context is influenced by criteria, which have different effects depending on the situation. First, the core competence of the company should be considered within the framework of the corporate strategy (Hsiao et al. 2010). If the area of transport logistics is not part of the core competence, further thought can be given to outsourcing (Kummer, Grün, and Jammernegg 2019). Furthermore, it is important to consider how necessary autonomy is in corporate action. External procurement often involves the transfer of know-how to LSP. Additionally, there is a risk of dependency in connection with the ability to deliver and the quality of delivery, which can rebound on the own company if the service provider performs unsatisfactorily (Buia, Heyning, and Lander 2018).

By combining logistic services that are identical in terms of the creation processes, economies of scale occur. The creation of a transport service is similar, regardless of when and between which (un)loading points the transport takes place. In this way, the unit costs can be reduced when the output volume increases. As outlined by Schäfer-Kunz and Tewald (1998), the reasons

for this can be either fixed cost degression or operating size effects, which represent an advantage for LSP, as these effects are pronounced due to specialisation (Appendix 1).

On the other hand, economies of scope occur when parts of transport logistics are integrated. This integration involves the route optimization, since a LSP can strategically optimize routes, ensuring the vehicles are utilized to their maximum potential (Rauf and Zakuan 2023). Similarly, this concept extends to information management, where the joint utilization of systems leads to more streamlined order processing, inventory management, and supply chain operations. This synergy results in enhanced transparency, quicker response times, and reduced administrative costs (Sayer 2018).

In contrast to the mentioned cost advantages of inhouse, the transaction costs for outsourcing are higher than for inhouse implementation and "[…] defined as the process of agreeing on an exchange of services, which precedes the transfer of goods or services." (Hildebrandt 1990, 153). These costs consist of initiation, agreement, settlement and control costs. Additional adjustment and termination costs may be incurred (Schäfer-Kunz and Tewald 1998). Beyond that, factors such as the form of coordination, the behavioural assumptions of the participants, the transaction properties and the framework conditions have an influence on the level of transaction costs and must therefore also be considered (Rao 2002).

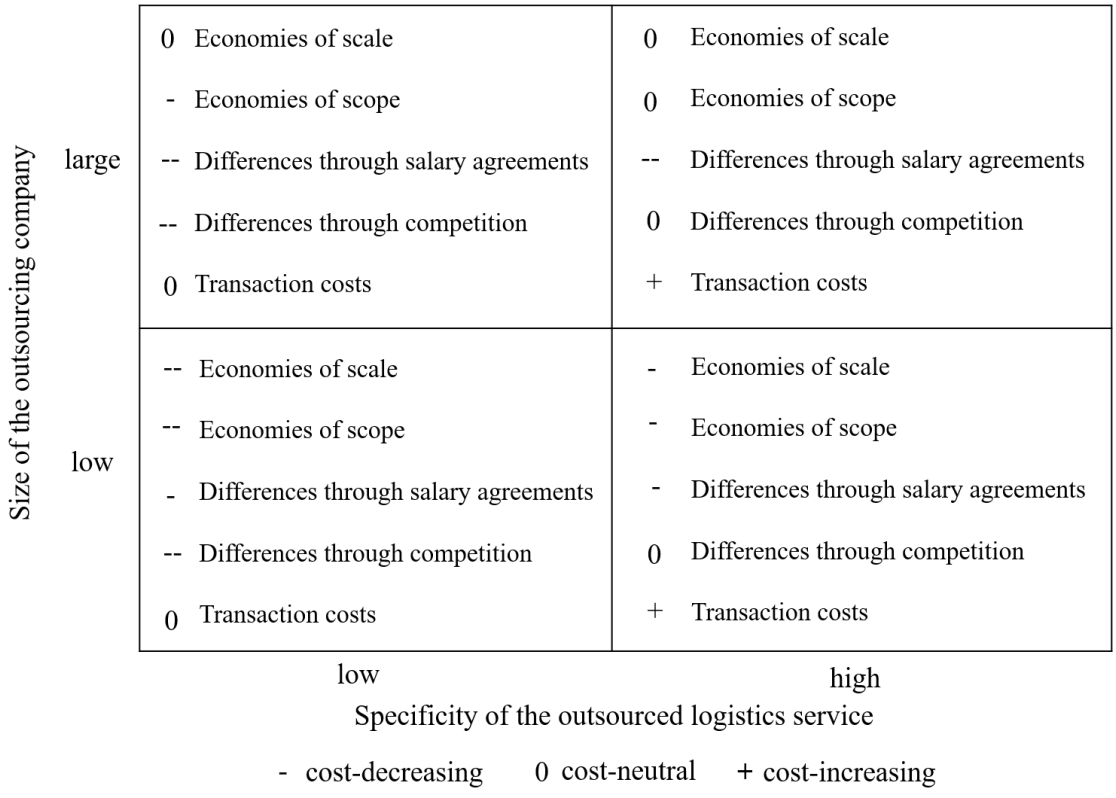
In addition to the mentioned cost types above, it is important to consider the competitive pressure that results in low margins for service providers. The competitive pressure is increasing because of deregulation within the framework of the realisation of the European internal market. The fact that LSP - in contrast to the corresponding parts of the outsourcing company - are exposed to considerable competition, outsourcing of logistics services can also result in cost advantages (Vander Schueren, Mizulin, and Geraets 2022).

The cost benefits that have been elaborated so far are valid across countries. In contrast to other countries, LSP in Germany gain cost advantages by lower salary agreements than the

manufacturing sector, enabling cheaper services. Outsourcing transport logistics allows German manufacturing companies exploit these sectoral cost differences. However, these differences are seen as negative from a moral and social perspective and external costs such as reputational damage that an employer should take into account (Bretzke 2004).

The explanations show that outsourcing may have positive as well as negative effects on the cost structure. These can be classified according to the size of the outsourced company and the specificity of the purchased LSP. Figure 3 shows whether these factors have a cost reducing, neutral or increasing effect on the cost structure (Schäfer-Kunz and Tewald 1998).

Figure 3: Logistics outsourcing effects on the cost structure



Source: (Schäfer-Kunz and Tewald 1998).

Beyond that, depending on the financial situation, cash-flow requirements can vary enormously. In business-critical situations (e.g., capital shortage and high interest burden) it is an important criterion. An expansion of outsourcing reduces the capital requirement, whereas it can increase in the case of inhouse implementation, for example through high investments in a company

fleet. This situation must be evaluated with the help of a planning calculation and considered as a key criterion in the make-or-buy decision (Schwarting and Weissbarth 2011).

2.4 Strategic theoretical foundations and models in context of make-or-buy

This section examines strategic models that support the decision-making process to check whether make or buy fits into the respective corporate strategy. Subsequently, the operational procedure of data processing and implementation is investigated.

In the strategic context, core competencies refer to the skills and knowledge that a company collectively acquires over the years through continuous development of its products and processes. These competencies are built upon types of resources, as well as organizational skills. Competencies serve as a competitive advantage and are crucial for strategic decisions (Van den Berg and Pietersma 2015). The VRIO model (valuable, rare, inimitable, and organised) in Appendix 2 can be used to assess these core competencies. The model helps finding key strengths for a strategy, assuring it relies on competencies that give a lasting competitive advantage (Mackay and Arevuo 2020). In context of transport logistics, it outlines starting points as to which competencies and internal resources should be protected, especially in terms of a make-or-buy decision (Mackay and Arevuo 2020).

One of the best-known instruments is the make-or-buy portfolio, from which norm strategies for decisions can be derived (Probert 1997). In this portfolio, the strategic options are classified according to nine fields of action based on the criteria of strategic importance and availability on the market. These nine fields of action are condensed into the three options of inhouse implementation, outsourcing and selective decision-making as outlined in Appendix 3. In this context, selective decision-making means an individual assessment based on further cost comparison calculations, which are presented in the following (Baumann 2014).

3. Development process of a framework in make-or-buy decisions

3.1 Determination of the logistics services available for disposition

Gathering data becomes challenging and more complex when it involves new delivering services. Furthermore, these situations demand significant investments, making it necessary to collect relevant investment data for decision-making purposes (Watson et al. 2012).

The first step in determining the given data is to define and analyse the service to establish a baseline for comparing inhouse and outsourcing costs. In particular, the organisational unit concerned, the type of service and the definition of the products should be determined. This work deals with the transport activity, which includes the characteristics of transport means, loading locations, number of pallets transported, weights and special transport conditions (Watson et al. 2012). Once the logistics services themselves have been defined, the next step is the measurement of the transport quantities, as these must be included in a transport tender. These service quantities are referred to as the quantity structure and are listed in the detailed overview as in Appendix 4 (Schäfer-Kunz and Tewald 1998).

3.2 Determination of inhouse cost data using different accounting systems

The next step is to determine the current inhouse costs of the logistics service. In this context, a distinction is made between four different accounting systems that enable a comprehensible allocation and representation of the inhouse costs (Schäfer-Kunz and Tewald 1998).

As a first approach, full cost accounting for logistics services encompasses the calculation of all direct and indirect expenses related to the logistics process. This approach considers variable and fixed costs, offering a view of the total expenses involved in logistics (Horngren, Datar, and Rajan 2015). Second, using marginal cost accounting, fixed and variable costs are separated, which is considered as a decision-oriented cost accounting system. In contrast to full cost accounting, only the decision-relevant costs can be considered (Mowen, Hansen, and Heitger 2022). The third option is process costing, which aims to provide transparency in

indirect processes with high fixed costs. It is based on an actual state analysis (follow-up decision), which determines the needed processes to create a service (Horngren, Datar, and Rajan 2015). Finally, direct- and contribution margin accounting is also a decision-oriented cost accounting system, allocating only the direct costs to the corresponding reference variables. In this case, there is no absolute, but a relative breakdown of direct and overhead costs. This leads to a precise cost allocation but increases the complexity of the cost analysis. The explained applicability of the systems is illustrated in the following Figure 4.

Figure 4: Applicability of accounting systems for transportation costs

Criteria	Full cost accounting	Marginal cost accounting	Process accounting	Direct- and contribution margin accounting
Effort and time required to determine in-house costs	+	+	0	−
Accuracy in determination of in-house costs	−	−	0	+
Representation of processes across cost units	−	−	+	+
Consideration of impacts in areas indirectly affected	−	−	0	+
Consideration of transaction costs	−	−	+	+

\+ Well applicable − Medium applicable 0 Not applicable

Source: (Schäfer-Kunz and Tewald 1998).

In summary, the choice of the cost accounting system depends on the extent to which the system is already developed and whether the decision is a first or follow-up decision (Schäfer-Kunz and Tewald 1998). Regarding the research question, the selection of the accounting system is an important part of the framework to be developed, as cost evaluation in logistics in the German beverage industry targets unique cost types and processes. The choice of the right system thus has a strong impact on how precisely the inhouse costs can be determined to be able to compare them with the outsourcing costs later. The costs considered so far were aimed at the costs of inhouse logistics, but there are costs that need to be considered in the overall

context. According to the situation, such costs include opportunity, transaction, and conversion costs. Opportunity costs indicate the benefit that is missed by selecting one option instead of another; transaction costs encapsulate the expenses tied to buying or selling assets while conversion costs involve the expenditures associated with transforming inputs into finished goods or services (Cleary, Heinemann, and Schuster 2021).

3.3 Tender execution and comparison of options for decision-making

A tender assesses external transport costs and supports comparing inhouse and outsourcing options. This process evaluates market prices to identify the best outsourcing offers alongside inhouse expenses. The process starts with the selection of suppliers on a longlist, which can be reduced to a shortlist using filters, that include fleet size, company size, delivery area and transport focus (Schönbohm and von Horsten 2022).

In the tender process, ensuring comparability of bids and alignment with predetermined in-house costs is crucial. This is achieved through the defined baseline in section 3.1 and the use of a standardized tender tool, such as an IT system or Excel file, streamlining the evaluation of bids in terms of prices, quantities, and payment terms. (Chappetta et al. 2021). Following the tendering process, the best LSP for the geographical areas can be selected and used as a basis for comparison with inhouse costs. As soon as the inhouse and outsourcing costs are available, the options can be compared according to the baseline (Rushton, Croucher, and Baker 2022).

In transport logistics, a distinction must be made depending on to the country and zip code of the transports carried out. In this consideration, projecting the costs over the next 5 years facilitates the evaluation, as the development of the transported volumes is considered in addition to the short-term costs. Finally, the current cost comparison and the cost projection can be included in the overall decision-making process (Canci, Mekler, and Mu 2022).

The last step in the decision-making is an assessment of the available data (Rushton, Croucher, and Baker 2022). Costs, but also the strategic and operational considerations presented must be

considered. In this context, a utility value analysis in Appendix 5, can help to evaluate the factors and support decision-making based on a ranking scale. All decision factors are listed and weighted according to their importance as a percentage. Points are then awarded for each of the decision options, resulting in a total score for each decision option (Hofmann 2021).

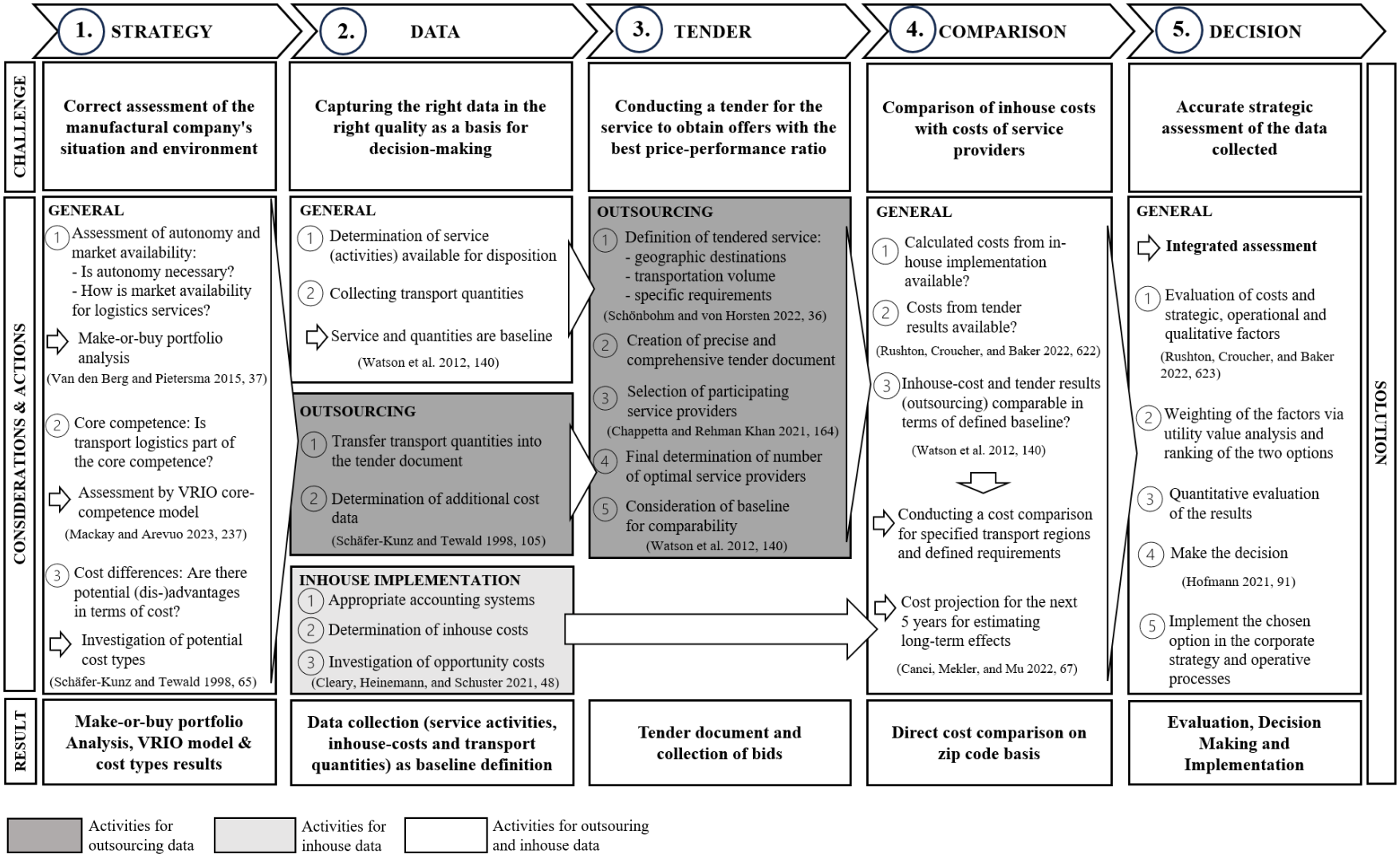
3.4 Development of a framework for a make-or-buy decision in transport logistics

The developed insights into a make-or-buy decision in transport logistics for industrial companies can be summarised into a generalised process. This framework in Figure 5 comprises five steps to first build a basis for decision-making and reach a well-founded decision.

First, the strategy of the company is checked based on the mentioned analyses (Van den Berg and Pietersma 2015). In step two, the data is collected and analysed. Here, general data such as transport volumes and activities are established as a baseline before individual data for outsourcing and inhouse are elaborated. This distinction is necessary as the cost data already recorded from the company's own transports in the past must be listed separately for later comparison implementation (Watson et al. 2012). With outsourcing, the costs must first be determined through a tender. The baseline consists of activities and quantities and serves as a fundament to establish comparability between inhouse and outsourcing.

In step three, a tender focused on the area of outsourcing is prepared, conducted, and evaluated in order to determine the costs of an outsourcing on a defined baseline (Schönbohm and von Horsten 2022). In step four, the current costs of the inhouse implementation can be compared with the outsourcing costs and conditions from the tender (Canci, Mekler, and Mu 2022). The fifth and final step is an evaluation of the results based on a cost-benefit analysis. The option with the better results is chosen and implemented (Hofmann 2021). The following Figure 5 was developed by the author based on previous research and serves as an overview of the steps of the make-or-buy decision for the area of transport logistics in a structured approach.

Figure 5: Developed make-or-buy decision framework



Source: Own depiction.

4. Case study

4.1 Introduction of the German beverage industry and its challenges in transportation

Special features of the German beverage industry and the associated transport logistics, which have not yet been considered in the presented framework, are explained below so that the presented case study develops the framework.

The German beverage industry is one of the leading beverage industries in the world comprising about 560 companies and a total turnover of € 22.5 billion per year. Depending on the products, the industry can be divided into different subcategories (Hubert 2023). Based on the analysed company, this case study focuses on the German juice and soft drink industry. Due to the availability of raw materials, high share of transport costs and freshness criteria, these companies mainly produce for the domestic market and supply beverages within regional structures (Euromonitor International 2023). Resulting from this, regional delivery networks are particularly important regarding the following investigations on transport logistics (Alrawi and Mohammed 2021).

The beverage industry faces product-specific challenges in the area of transport logistics. Temperature sensitivity of products must be considered in special transport equipment. In addition, fragile packaging such as glass places special demands on the care of transport materials and personnel (BITO 2021). Next to the product specific challenges, beverage logistics is also subject to an increased complexity of the transport network, as the products are either delivered to the domestic market in the local area or are destined for export. These types of transport can rarely be combined due to the geographical distance and consequently increase the planning problem of the shipments (Alrawi and A. Mohammed 2021). The difficulty of transport planning due to seasonal fluctuations and irregular customer orders poses a further challenge, which has an impact on the utilisation and planning of available vehicles (Forslund and Mattsson 2021).

Another challenge facing the German beverage industry is the established deposit system for glass and plastic bottles. For recycling and sustainability reasons, beverage bottles and special boxes in different sizes are used several times, which leads to additional transport complexity within the supply chain. In the context of the circular economy, products must be delivered together with the packaging, but also collected again after consumption and returned to the producer (Cwienk and Banos Ruiz 2021).

The aforementioned product and country specificities in the beverage industry lead to the planning question in transport logistics. The primary question is how to organise and utilise the companies own vehicle fleet on economic efficiency. Here, optimising the utilisation of the vehicles as well as reducing downtimes is the main objective (Sweeney and Waters 2021). This question is examined in more detail in the following case study and enhanced by the make-or-buy decision.

4.2 Introduction to the case study of Company A and its challenges in transport logistics

Company A is a leading beverage producer of juices and soft drinks with three production sites located in different regions of Germany. The producer buys raw materials such as concentrates and fruits from international suppliers, but also grows fruit on its own facilities near the plants for its own processing. For this purpose, the company produces beverages for its own brands, but also private labels for leading beverage retailers in Germany.

The customer structure consists of four key accounts, for which both own brands and private labels are produced, and eight medium- to-small customers, supplied with own brands. All these clients are supplied by Company A, which carries out 55% of the transports with its own trucks and subcontracts 45% of the transports to LSP. The company's fleet of 154 vehicles is now outdated and characterised by an investment backlog and high repair costs. Currently, the company’s financial situation is critical, which leads to the question of whether it makes sense to invest in the vehicle fleet or whether it is the right decision to continue outsourcing transport

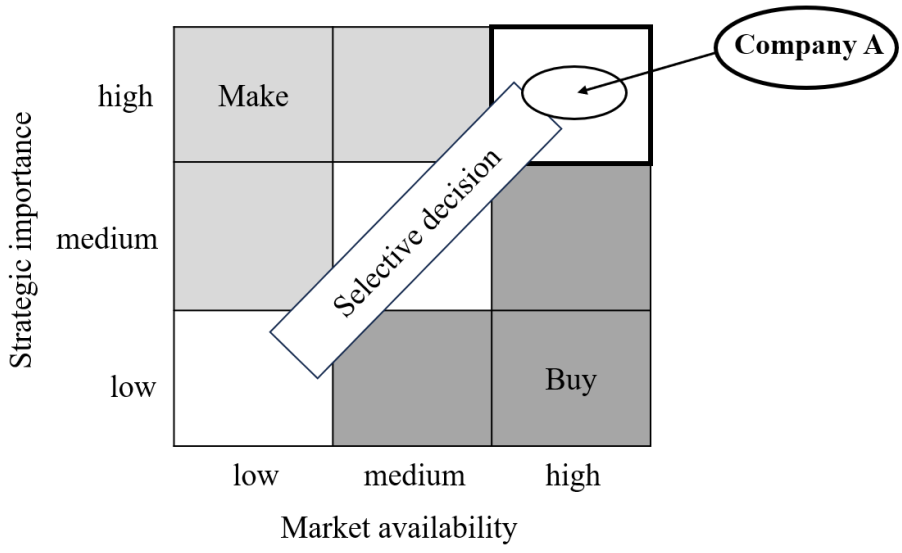
logistics to LSP. This case study examines the extent to which the transport from the production sites to the beverage retail trade should be carried out by the company's own trucks or outsourced to other service providers, building on the make-or-buy decision framework already presented in Figure 5.

4.3.1 Strategy analysis for Company A decision-making

The framework developed in chapter 3 was applied by the author to Company A. The five phases strategy, data, tender, comparison, and decision were covered in sequential order. The application of the framework was supported by data sharing from Company A and interviews with Company A executives (Appendix 11 and Appendix 12).

The assessment of the environment combined with the strategic orientation of a beverage manufacturing company could be supported by the make-or-buy portfolio (Kummer, Grün, and Jammernegg 2019). The strategic importance of the make-or-buy decision was rated as high by the management of Company A due to the annual transport costs of over € 20 million (Company A data and Interview 1). In addition, a high number of transport services in beverage logistics offered by LSP indicated a high market availability of the service to be contracted out as shown in Figure 6 (Weber 2019).

Figure 6: Application of the make-or-buy portfolio to Company A

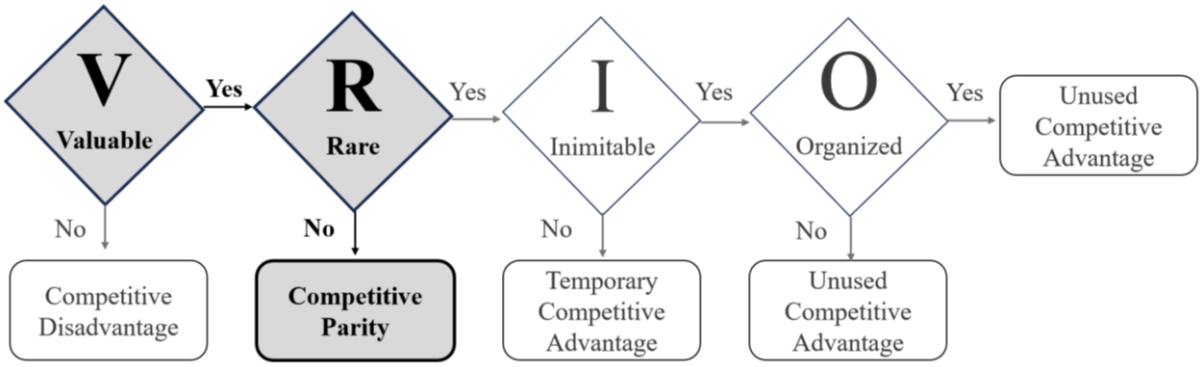


Source: (Kummer, Grün, and Jammernegg 2019).

According to the make-or-buy portfolio, a high strategic importance paired with a high market availability led to a selective decision, resulting in further investigation (Probert 1997).

In this context, the VRIO analysis, which examined whether transport logistics was part of the company's core competence, represented a further investigation (Van den Berg and Pietersma 2015). As shown in Figure 7 the transport services were described as valuable, but not as a rare competence due to the high availability in Germany, i.e., there was a competitive parity, but no competitive advantage (Weber 2019).

Figure 7: Application of the VRIO model to Company A



Source: (Van den Berg and Pietersma 2015).

Since for Company A neither a competitive advantage nor a competitive disadvantage was achieved by using resource of transport logistics, it could not be described as a core competence of the company and a selective decision had still to be made according to the VRIO analysis.

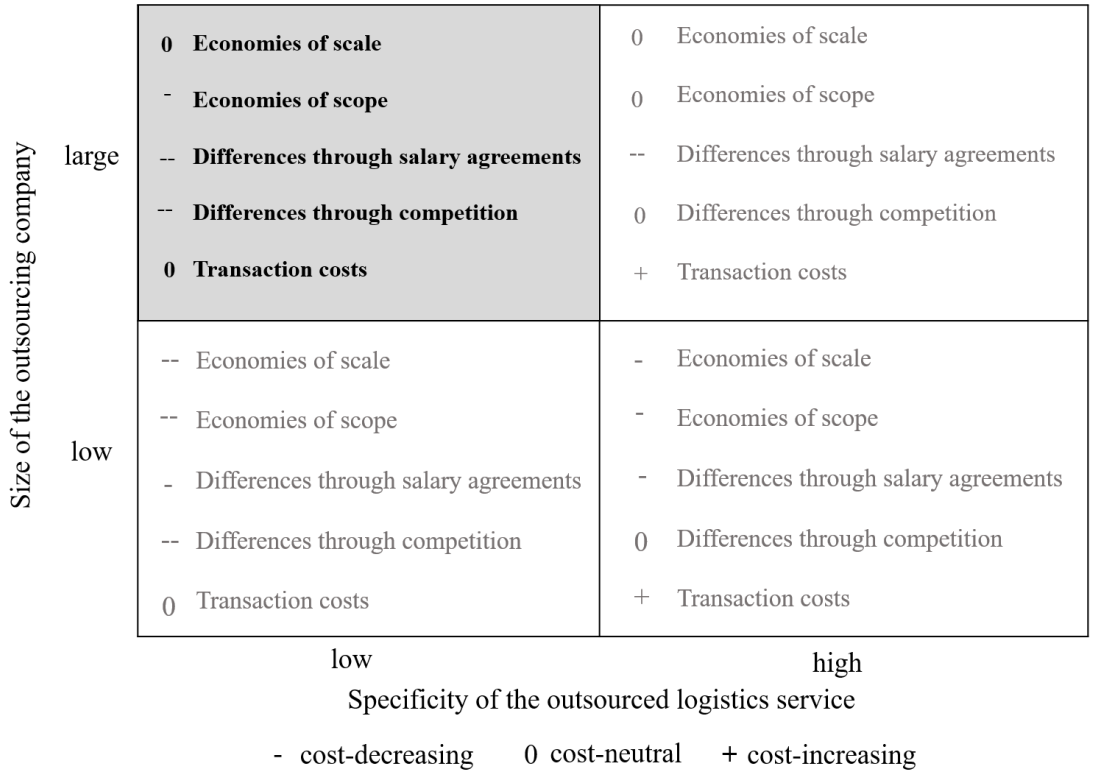
A selective decision could also be made by analysing the cost structure of Company A. The cost structure impact on Company A was analysed by noting that it is a large company with an annual turnover of more than € 500 million and a comparatively low level of specificity in its logistics service (Interview 1). This low level of specificity was characterised on the one hand by standardised transport on euro pallets with standard truck trailers and on the other hand an easy-to-obtain certificate for beverage transport (Walter 2021).

According to the cost structure model, in this environment, transaction costs and economies of scale were cost-neutral. The impact of transaction costs was low because the service is not very

specific and allowed an easy change of service providers. The costs of search and negotiation were consequently negligible. The size of the outsourcing company enabled better bundling of orders and utilisation of vehicles due to larger transport volumes, which led to lower costs per transport unit for a potential inhouse option and represented no cost advantage for outsourcing in terms of economies of scale in this case.

On the other hand, outsourcing can lead to cost advantages through salary agreements and competition. The salarys of German LSP are lower than those of the manufacturing industry. Simultaneously, the low specificity of the service led to high competition with a large number of providers, which resulted in low prices and cost advantages for the outsourcing company (Schäfer-Kunz and Tewald 1998). The effects caused by the size of the company and the specificity of the service to be outsourced by Company A are shown in Figure 8.

Figure 8: Company´s A logistics outsourcing effects on the cost structure



Source: (Schäfer-Kunz and Tewald 1998).

In line with this analysis, potential savings in outsourcing resulted from cost differences in salary agreements and low prices due to strong competition with unaffected economies of scale

and transaction costs. This provided the impression that outsourcing the transports could have a cost-reducing effect for Company A, which has been analysed and is explained below through a specific data analysis.

4.3.2 Data analysis for Company A decision-making

Following the strategy analysis, specific analyses of make-or-buy could only be performed based on comprehensive data. The first step by the author in analysing the data was to establish a baseline for the service and the quantity structure to enable comparability between inhouse and outsourcing.

The services provided by Company A involved the transport of goods from the three production sites to the customers. The quantities were broken down so that transports were differentiated according to location. It was important to list the transports including zip code, number of pallets and weight, the time period, and packaging type as illustrated in Appendix 6. Once the quantities (number of transports, pallets, and weight) of Company A have been processed, allowing them to be grouped by production, zip code, country code and packaging type, the general baseline was available as a basis for comparison (Watson et al. 2012).

The outsourcing cost data had to be determined by transferring this service specification and the quantity structure into a tender document so that potential LSP had an object on which they were able to prepare offers (Tender in 4.3.3). Beyond this, additional cost data had to be determined, which included (estimated) implementation costs arising from the contract negotiations and process implementation (Schönbohm and von Horsten 2022). Company A did not quantify these costs but estimated them to be similar to the further implementation of the make (inhouse) decision, so that they were not taken into further consideration.

The accounting system was determined according to the baseline to calculate the current inhouse costs. Company A had so far used full cost accounting, but this led to an imprecise breakdown of costs for the individual processes. In Appendix 7, the calculation for the

individual processes was implemented as part of process accounting, which enabled a precise representation of the costs per km. Direct and indirect costs were examined by the author, resulting in costs per km of between €1.52 and €1.70 (Company A Data).

The precise breakdown of transportation facilitated the determination of inhouse costs and provided a data basis for the make-or-buy decision. In this process breakdown, the costs had to be determined based on the route km per delivery (Horngren, Datar, and Rajan 2015). This involved calculating inhouse costs per transport from each production site to a zip code area. These cost amounts were calculated, but the total costs had to be added by opportunity costs, which were not quantified for any of the make-or-buy options for Company A (Interview 1).

The inhouse costs have now been determined for the “make” option (Appendix 7). To finalise the outsourcing costs for the “buy” option, the next step was to carry out a tender to obtain the best offers from the LSP for each transport from the production site to the customer zip codes.

4.3.3 Tender process for Company A decision-making

The objective of a tender was to obtain the best offers for the tendered service and an overview of the market. For Company A's tender, the author drafted a longlist, which was then narrowed down to a shortlist through a request for information, considering exclusion criteria such as transportation volume and delivery area (Schönbohm and von Horsten 2022). As Company A did not use tendering software and the implementation costs would have exceed the savings of the project, an Excel file was built by the author to be used as the tendering document and sent to all participants. This file contained a description of the tendered service, a binding schedule and the previously collected transport quantity data. Additionally, a standardised price sheet was used in which the prices for the corresponding zip codes were entered by location.

The standardisation of this price sheet had to correspond to the previously defined baseline to enable comparability between the service provider offers and a comparison of inhouse costs (Watson et al. 2012). The tender file was sent to all participating logistics service providers,

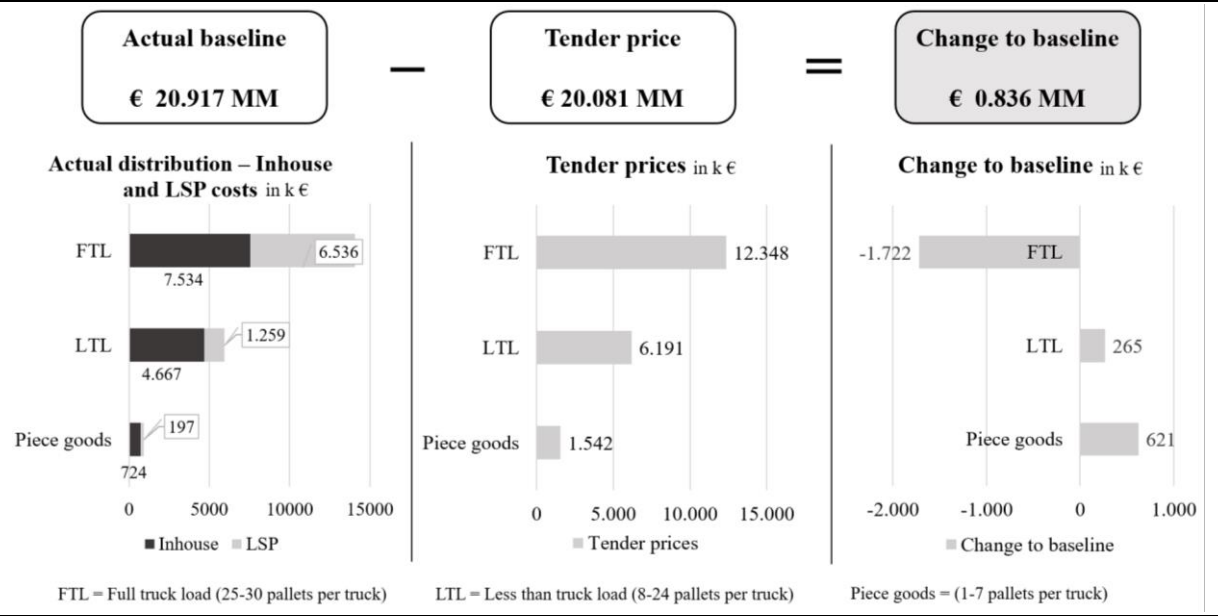
who were given three weeks to prepare an offer. The bids subsequently received were collected in an overview file and could then be compared with each other and with the inhouse costs.

4.3.4 Comparison of Company A outsourcing and inhouse costs for decision-making

Based on both outsourcing and inhouse costs, a cost comparison was performed by the author on the defined baseline. This involved directly comparing the prices of the service providers offers on a zip code basis with the inhouse costs incurred per transport per zip code.

Depending on the zip code area, a decision of whether inhouse transport or outsourcing was more economical for a delivery is made. To obtain an overview of the cost differences achieved by restructuring the network, the actual costs of the last 12 months were compared with the best option per zip code and extrapolated using the quantities of the last 12 months. This difference represented the savings made by choosing the best option in Figure 9, inhouse or outsourcing.

Figure 9: Change to baseline in € by choosing the best option per zip code



Source: (Company A Data).

The 12-month cost baseline of €20.917 MM was reduced to €20.081 MM through the tender, resulting in €0.836 MM savings, primarily due to improved full truckload offers, yielding €1.72 MM in savings. Costs for piece goods (+ €0.265 MM) and less than truckloads (+ €0.621 MM) by LSP were higher and had to be excluded (Company A Data). LSP benefited from optimized

utilization and economies of scale in heavily frequented zip code areas, as demonstrated in Appendices 8 and 9, emphasizing the cost advantage of full truckloads on both a pallet and individual transport basis. Notably, a significant proportion of transports as full truckloads enhanced overall cost benefited by LSP.

4.3.5 Decision making process by Company A

The decision-making process was based on a comparative cost calculation and qualitative criteria. As part of a utility value analysis, operational and strategic considerations, including strategy fit within core competence and autonomy, as well as the impact on operational complexity and costs, were evaluated (Hofmann 2021).

Figure 10 illustrates the options evaluated: make, buy or a mix of make-and-buy. In consultation with Company´s A head of logistics criteria for decision making were assessed and weighted (Interview 2). He categorised costs as the most important criterion due to the difficult financial situation. Strategy fit and process complexity were seen as important, but negligible on the cost side. While option "make" had an advantage in terms of autonomy, internal processes become significantly more complex. The reverse was true for option "buy" (Interview 2).

Figure 50: Application of a utility value analysis to Company A´s make-or-buy decision

	Rating scale 0-5		Option 1		Option 2		Option 3	
		Weighting factors [%]	Inhouse (Make)		Outsourcing (Buy)		Mix of option 1 and 2 (Make and Buy)	
			Rating (0-5)	Part of utility value	Rating (0-5)	Part of utility value	Rating (0-5)	Part of utility value
Rating criteria	**Strategy-fit**	**15%**						
	Core competence	5%	1	0.05	5	0.25	2	0.1
	Autonomy	10%	5	0.5	0	0	2	0.2
	Cost advantage	**70%**						
	Short-term	35%	2	0.7	3	1.05	3	1.05
	Long-term	35%	2	0.7	2	0.7	4	1.4
	Reduction of complexity in operative realisation	**15%**						
	Data preparation	5%	1	0.05	2	0.1	0	0
	Accounting system	5%	0	0	4	0.2	0	0
	Personal and resources planning	5%	0	0	5	0.25	0	0
	Total utility value			**2**		**2.55**		**2.75**
	Ranking			**3.**		**2.**		**1.**

Source: (Own depiction and Interview 2).

The result indicated that a make-and-buy mix with a score of 2.75 was the optimal choice, given the 70% weight in cost advantages. This arised from evaluating transports by zip codes and breaking down make-or-buy costs. Based on the criteria in chapter 2, LSP were able to achieve better economies of scale on specific routes, enabling more cost-efficient operations. This confirmed the analysis in 4.3.4, where option" make and buy" achieved savings of €0.836 MM by considering both inhouse and outsourcing costs and separating transport costs by zip code.

The next step after the make-and-buy decision would be to implement it in Company A's transport system (not part of this work). According to the results so far, the fleet of Company A could be reduced from 154 to 80 vehicles due to increasing outsourcing (Appendix 10). The contracts with the LSP should be concluded and processes implemented for the transports replaced by LSP. This approach would achieve the calculated savings and secure the success of Company A, while preserving the partial autonomy of the transport logistics competence.

5. Conclusion

5.1 Managerial implications

In relation to the research question, the author applied a meta framework to Company A by integrating industry-specific and general decision-making factors, alongside incorporating frameworks for strategy, data, and decision analysis.

Companies facing a make-or-buy decision in transport logistics should consider the framework steps, enhancing overall cost efficiency by breaking down the transport network and considering the individual delivery areas. First, companies should examine the strategic orientation of the company to ensure that transport logistics is not outsourced if it is part of the company's core competence. In addition, the extent to which autonomy in this area is necessary and desirable must be examined. If these strategy analyses do not lead to a result, the company concerned must determine its own transport costs on a defined baseline. The introduction of a cost accounting system is exemplified in Company A's case study, favouring process accounting

for its high precision. Additionally, potential outsourcing costs must be determined through a comprehensive tender, requiring a document aligned with the defined baseline for later cost calculation comparisons. After obtaining all costs, they should be compared by zip code to choose the most favourable option for transporting goods from the production site to the customer. Beyond costs, a utility value analysis involving company management is crucial for considering additional factors and determining the best course of action.

The framework is advantageous as it integrates strategic considerations as well as operational processes, incorporating company-specific data and involving stakeholders in a generalized decision-making process. It enables specific identification of transports where cost efficiency can be improved through inhouse or outsourcing transports. The application of the framework to the case of Company A led to savings in financial and non-financial resources, demonstrating that other companies facing such a decision can also benefit from the use of the framework.

5.2 Limitations

The work was limited within the research question to the Company A´s data within the transport logistics and beverage industry. There is a lack of use cases from other companies to be able to make more generalised conclusions. Beyond that, as discussed in chapter 1, a make-or-buy decision can occur in any logistics subsystem. Limited data availability, especially on precise inhouse costs and transport volume recording in the analysed company, hampers the robustness of findings. In addition, the performance of such a make-or-buy analysis is limited by a lack of personnel resources in the company which complicates the preparation of such a decision.

5.3 Suggestions to further research

These limitations can be narrowed down through a stronger focus on data within new case studies in this field. Companies that use advanced and more interconnected IT systems can be examined. Based on these new findings, the framework can then be applied and further developed in terms of content and extended to other industries and business areas.

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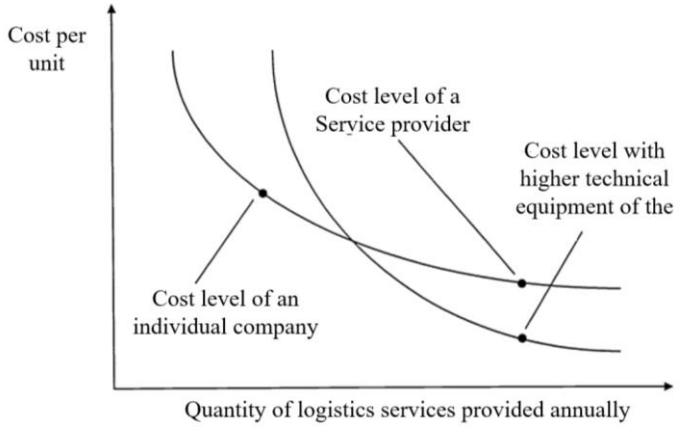
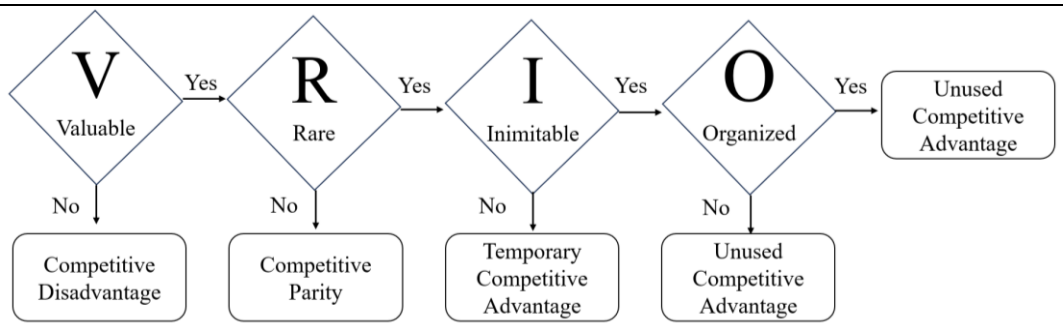
7. Appendices

Appendix 1: Economies of scale in logistics



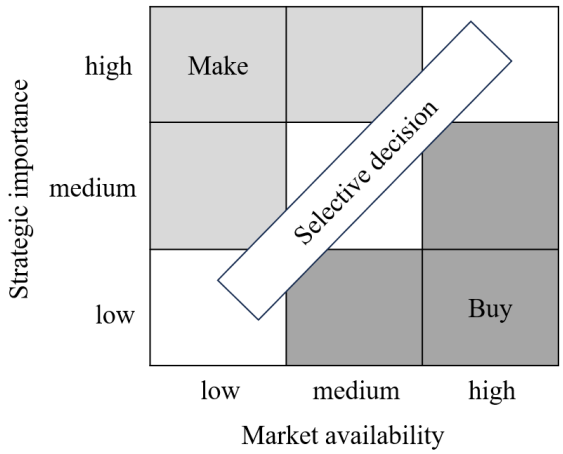
Source: (Schäfer-Kunz and Tewald 1998).

Appendix 2: Structure of the VRIO-model as a strategy analysis



Source: (Van den Berg and Pietersma 2015).

Appendix 3: Make-or-buy portfolio analysis



Source: (Kummer, Grün, and Jammernegg 2019).

Appendix 4: Type of activities measured as a baseline in transport logistics

Activity	Characteristics for measuring performance
Transport	number of transports, number of transported parts, number of transported pallets, transported weight, transported volume, transport time

Source: (Schäfer-Kunz and Tewald 1998).

Appendix 6: Example of a utility value analysis

	Rating scale 0-5		Option 1		Option 2		Option 3	
		Weighting factors [%]	Inhouse (Make)		Outsourcing (Buy)		Mix of option 1 and 2 (Make and Buy)	
			Rating (0-5)	Part of utility value	Rating (0-5)	Part of utility value	Rating (0-5)	Part of utility value
Rating criteria	**Strategy-fit**	**X%**						
	Core competence	X%	…	…	…	…	…	…
	Autonomy	X%	…	…	…	…	…	…
	Cost advantage	**X%**						
	Short-term	X%	...	…	...	…	…	…
	Long-term	X%	…	…	…	…	…	…
	Reduction of complexity in operative realisation	**X%**						
	Data preparation	X%	…	…	…	…	…	…
	Accounting system	X%	…	…	…	…	…	…
	Personal and resources planning	X%	…	…	…	…	…	…
	Total utility value			**X,X**		**X,X**		**X,X**
	Ranking		**X.**		**X.**			**X.**

Source: Own depiction based on Hofman (2021).

Appendix 6: Illustration of the structure of a transportation dataset of Company A

Place of departure	Date	Destination | ZIP-Code	Destination | Country	Number of Paletts	Weight in KG	Packaging
Company A – Plant XX	02/02/2022	59256	DE	28	24.420	Glass
Company A – Plant XY	03/02/2022	25674	DE	24	21.780	Plastic
Company A – Plant XZ	05/03/2022	14564	DE	27	23.590	Plastic
…	14/04/2022	29864	DE	26	23.150	Glass

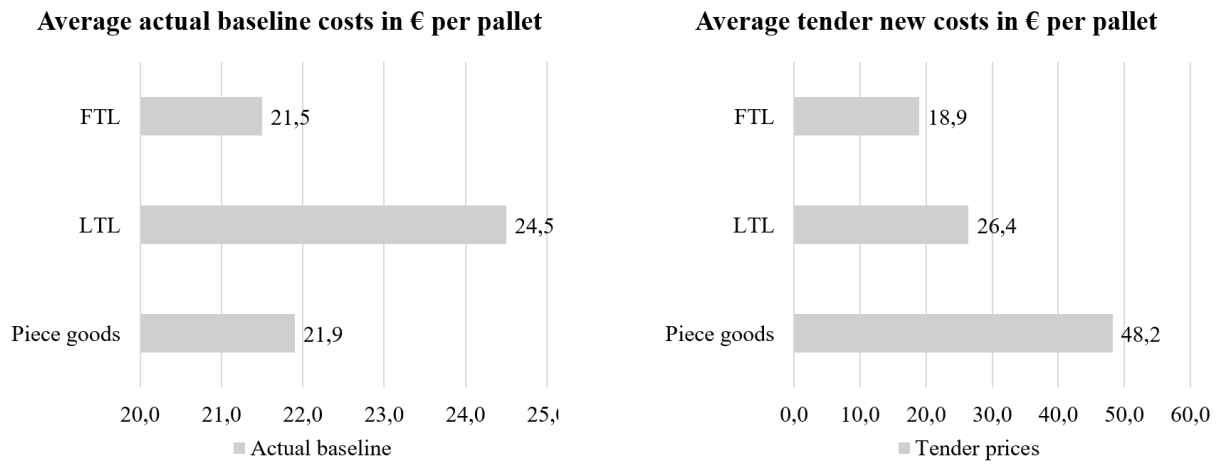
Source: (Company A Data).

Appendix 7: Transport process calculation per km (inhouse data from 2022)

in €			
Direct costs	**Site 1**	**Site 2**	**Site 3**
Spare parts	307.949,00	65.522,00	72.439,00
Labour costs repair shop	307.355,40	116.967,60	0,00
External repair	157.449,00	162.898,00	99.013,00
Diesel	1.981.019,00	834.873,00	566.733,00
Motorway tolls	1.037.554,00	391.729,00	266.904,00
Tyres	124.757,00	33.895,00	40.344,00
Car insurance	108.461,00	46.088,00	23.745,00
Vehicle tax	89.045,00	26.714,00	13.115,00
Leasing	884.583,00	228.856,00	106.850,00
Depreciation	183.382,00	63.333,00	28.836,00
Personnel costs driver	4.586.738,00	1.830.707,00	1.010.661,00
Employee travelling expenses	239.519,00	89.789,00	65.648,00
Leasing work clothes	14.137,00	430,17	0,00
Postage/telephone/fax	51,00	3.610,91	335,00
Total direct costs	**10.021.999,40**	**3.895.412,68**	**2.294.623,00**
Indirect costs			
Cleaning fluids	9.933,00	712,00	0,00
Oils/ Lubricants	10.002,00	3.479,00	1.462,00
Other auxiliary and operating materials	5.877,00	1.006,00	0,00
Total indirect costs	25.812,00	5.197,00	1.462,00
Total costs	**10.047.811,40**	**3.900.609,68**	**2.296.085,00**
Kilometre performance	6.257.606	2.288.480	1.510.914
Costs per km	**1,61**	**1,70**	**1,52**

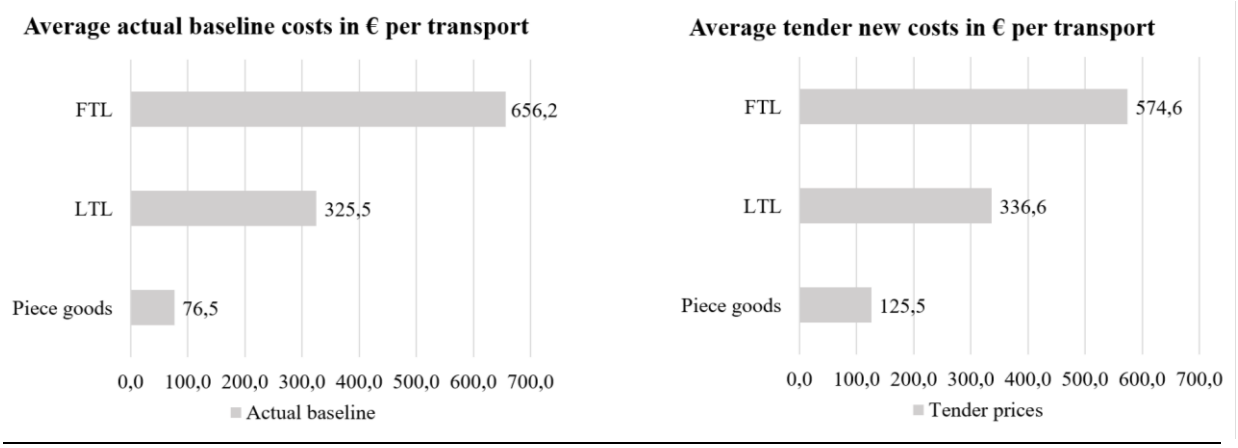
Source: (Company A Data).

Appendix 8: Average pallet costs in € per actual baseline and tender results



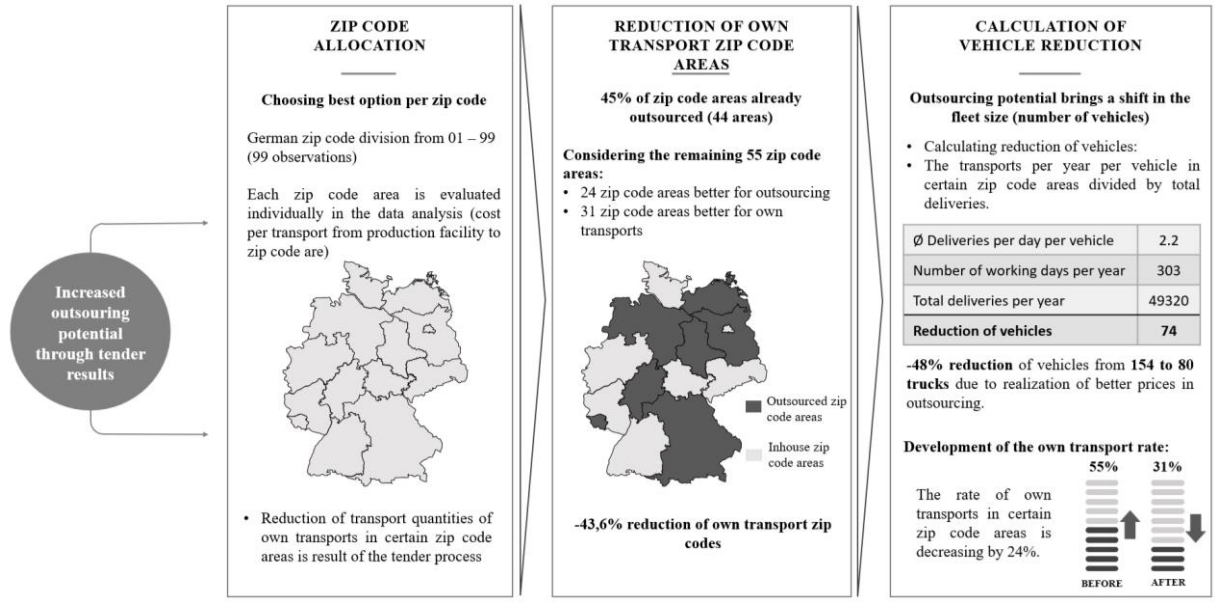
Source: (Company A Data).

Appendix 9: Average transport costs in € per actual baseline and tender results



Source: (Company A Data).

Appendix 10: Approach and calculation of the vehicle reduction for Company A



Source: (Company A Data & Own depiction)

Appendix 11: Interview 1

06.11.2023 - In-depth discussion with the Chief Operating Officer Company A about the logistics strategy and supply chain challenges

Main Insights:

- Discussion of the general logistics and supply-chain strategy of Company A
    - Current fleet of 154 trucks, many of them are obsolete. These are used for 55% of transport, the rest is outsourced to logistics service providers
    - Transportation costs of € 20 MM within a turnover of € 500 MM
    - Transport mainly to the surrounding zip codes of the production sites - there are always exceptions
    - The focus has already shifted more strongly towards outsourcing in recent years – several own trucks have already been sold
    - No specification as to whether inhouse or outsourcing is better for corporate strategy, the decisive factor is the most cost-effective alternative
    - Warehouse logistics to remain entirely inhouse, only transport to be outsourced
- Discussion of main logistics and supply chain challenges of Company A
    - The challenge lies in optimising the capacity utilisation of our own vehicles, combined with flexibility with regard to short-term customer orders
    - High logistics costs due to short-term customer orders, resulting in poor vehicle capacity utilization, which leads to high logistics costs per product
    - Increasing costs in own fleet - high salaries due to collective labour agreements and high repair costs due to old trucks
    - Investment in the fleet is necessary, but not quantified as well as the opportunity costs of such an investment

Appendix 12: Interview 2

07.11.2023 - Discussion and implementation of the utility value analysis with the Head of logistics of Company A

Main insights:

- Conducting the utility value analysis and defining and weighting the decisive criteria
    - Cost advantage the most important criterion should receive 70% of the weighting, with long-term and short-term (35% each) equally weighted. Logistics services are an exchangeable service (commodity), which is why costs are the most important criterion
    - The strategy fit is divided into autonomy and core competence, but only weighted at 15%, as it is less important than cost advantage. However, autonomy should be weighted more heavily (10%), as independence is extremely important for short-term customer orders in order to guarantee delivery capability
    - In the reduction of complexity, data preparation, the accounting system and personnel planning are named as essential criteria and are all weighted equally with 5% - in total 15%
- Rating option 1: Inhouse (Make)
    - The transport logistics of Company A cant be seen as a core competence, the core competence lies in the production of beverages, especially fruit juices. It can be ranked with 1 out of 5 points
    - Autonomy is very important because customer orders are often received at short notice and cannot be fulfilled by a logistics service provider in the size and time. Part of companies fleet should therefore remain inhouse and ranked 5 out of 5
    - The cost advantage for inhouse is dependent on the zip code are and ranked with 3 for short term and 2 long term cost advantages

- In terms of reduction in complexity there is no advantage for the inhouse option, since it increases the complexity of inhouse operations. The criteria are ranked with 0-1

- Rating option 2: Outsourcing (Buy)
  - The core compentence is ranked very high (5), since it is a core business of a logistics service provider. However, the autonomy decreases with full outsourcing to 0, since Company A is no longer able to conduct own transports.
  - The cost advantages are also dependent on the zip code area and evaluated with 2 out of 5 points for short and long term advantages
  - The outsourcing option brings a reduction of complexity in the the operative business, since there is less effort for Company A in the data preparation (2/5), accounting system (4/5) and personal and resources planning (5/5)
- Rating option 3: Mix of option 1 and 2 (Make and Buy)
  - The core compentence is still available, since own transports can be conducted, but not in the full range (2/5). The same is valid for the autonomy in transport logistics (2/5)
  - Cost advantages are higher for option 3, since Company A is able to choose the best option for each zip code area: short term (3/5) and long term (4/5). Short term cost are ranked lower, since there is a high effort for implementation
  - Since the mentioned effort is high due to the fact that both options have to be implemented, the reduction of complexity is ranked with 0