Buy, Rent, or Lease (BRL) Decision-Making of Construction Equipment in the Dutch Construction Industry

A Case Study

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ABSTRACT

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Buy, rent, or lease (BRL) decision-making of construction equipment in the Dutch construction industry: A case study

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The buy, rent, or lease decision of construction equipment impacts construction companies' project timelines, costs, and efficiency. Acquiring construction equipment causes challenges for Dutch construction companies related to, among other matters, regulations, technological advancements and rising costs. This case study uses interviews with respondents from a construction company to analyse the industry's procurement choices. Key elements in the buy, rent, or lease decision are identified, such as financial stability, technological changes, and maintenance strategies. Several construction equipment selection criteria have been established by this research, such as safety, social benefit, performance, and environmental impact. This study's findings indicate that buying equipment offers savings on long-term costs and allows customisation, renting equipment offers flexibility for short-term needs, and leasing equipment reduces the financial risks of technological obsolescence. The framework of this research contributes to the literature by guiding construction companies in procurement decision-making and aligning financial and sustainability goals.

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1. Introduction

Sustainability is becoming an important aspect in the Netherlands, with high-polluting companies needing to pay for their CO2 emission and being required to register these emissions (Koelemijer et al. 2024). Furthermore, technology changes faster than ever, such as the transitions towards electric-driven equipment (Huang, et al., 2024), making equipment sooner obsolete. These environmental and technological events make the acquisition of construction equipment increasingly more complex. This thesis argues that construction companies need a structured framework to guide the decision whether to buy, rent, or lease their equipment. Without this strategy, businesses risk having outdated equipment, or owning equipment that is not being used, which will reduce their flexibility and profitability.

Thus, procurement decisions play an important role in determining the success and efficiency of the overall process, as these decisions influence the cost, quality and time of a project (Bolomope et al., 2022). In its broadest terms, procurement refers to the activities and processes related to acquiring goods and services through placing purchase orders from external sources (Westerski, Kanagasabai, Wong, & Chang, 2015). In short, procurement in most industries involves selecting and acquiring the resources necessary for an organisation's operations. Within the construction industry, procurement focuses more on transactional procurement with a process that creates and manages contracts for each project's requirements and aligns these with the organisational strategic directions (Ruparathna & Hewage, 2015). According to Smallwood and Deacon (2020), this procurement process is influenced by aspects such as standards, legislation, and the general environment.

The main types of decisions taken in construction regarding equipment procurement cover a range of choices. Important decisions that should be made at the initial stage of the procurement process are whether to buy, rent, or lease equipment (Gransberg & Rueda-Benavides, 2020); the criteria for equipment; and the timing for acquiring new equipment (Petroutsatou, Ladopoulos, & Nalmpantis, 2023). The make-or-buy decision is a fundamental dilemma for companies, where the company must decide whether to manufacture a specific part in-house, known as insourcing, or to procure the goods and services externally, known as outsourcing (Cánez, Platts, & Probert, 2000). However, in construction, the decision revolves around whether to buy, rent, or lease equipment, with each option offering specific advantages and disadvantages regarding ownership, cost, and duration of use (Gransberg & Rueda-Benavides, 2020).

Construction equipment refers to the specialised tools and machinery used in construction activities, such as excavation, winching, and compacting. Procuring this equipment presents a complex problem, directly affecting project timelines, costs, and overall success (Rashid et al., 2006). The procurement decision-making process has become more complicated due to several factors in recent years; these include escalating equipment costs, rapid technological advancements, and growing environmental concerns (Petroutsatou et al., 2023). For example, in the European Union, the price of construction machinery increased by 9.9% in 2023 (Statista, 2024). The decisions in the procurement of construction equipment involve different considerations and criteria, such as cost and environmental impact (Petroutsatou et al., 2023). Poor procurement choices can result in several significant risks, such as additional costs and declined operational efficiency, especially if outdated or unsuitable equipment is used (Gransberg, Popescu, & Ryan, 2006).

This study aims to enhance companies' project outcomes and improve resource efficiency in a changing market, which will reduce the risks associated with misaligned procurement strategies. Many companies try to reduce costs and optimise their processes; therefore, they must make carefully deliberated decisions. The problem addressed in this thesis revolves around the decision-making process to buy, rent, or lease for procurement of construction equipment of the main elements. Furthermore, this research considers the selection criteria for acquiring construction equipment, including different types such as tractors, compressors, or vibrating plates. The changes to construction equipment driven by technological advancements and regulations complicate procurement decisions. In particular, the construction industry is transitioning from fossil fuel to electric equipment, with innovations and new regulations accelerating the obsolescence of older machinery. As a result, this research aims to inform companies about the risks associated with each acquiring decision, thereby enabling them to remain competitive.

Furthermore, the elements that influence the make-or-buy decision need to be investigated, as they directly impact the organisation's overall outcomes. A deeper understanding of these decisions is essential for successful equipment management. Currently, companies based in the Netherlands are also making purchase decisions based on experience or emotions. People who rely on personal experience tend to select the most familiar equipment, which may not be the most cost-effective for the task at hand (Chan, Ip, & Lau, 2001). Furthermore, using decision-making on emotional processing, such as “gut feelings” and “gut instincts,” is negatively related to financial performance, while decision-making on rational processing is

positively related to both financial and non-financial performance (Kaufmann, Wagner, & Carter, 2017). This research therefore delves deeper into the criteria for procuring construction equipment and focuses on the buy, rent, or lease decision. It seeks to identify the requirements for construction companies when acquiring equipment and proposes a framework for the elements that should guide procurement decisions regarding buying, renting, or leasing. This framework can provide an efficient decision-making procurement tool for construction companies to make rational decisions.The research question is thus as follows: What elements should guide the buy-rent-or-lease decisions regarding construction equipment in Dutch construction companies?

1.1 Theoretical and Practical Contribution

The main elements influencing construction companies' decisions to buy, rent, or lease, especially related to equipment procurement, remain largely unexplored in previous research. This research is valuable to construction companies because it directly impacts overall client satisfaction and project success (Love, Skitmore, & Earl, 1998). In terms of academic contribution, this thesis expands our understanding of the buy, rent, or lease decision regarding construction equipment by exploring several key elements within the Dutch construction industry. As a result, this study proposes a decision-making framework to support procurement professionals in construction companies in "choosing" the best option, tailored to the Dutch market. In developing this framework, the study draws on the six main criteria defined by Waris et al. (2019). Although the framework has been developed in Malaysia for selection criteria, it is critical to test this model against the Dutch context. Despite using industry experts from Malaysia, each sub-criterion is supported by evidence from the literature, with international sources, making it more relevant for the thesis. In determining these sustainability criteria of Waris et al. (2019), ISO-10987 was considered as a reference point. ISO certification is an accepted standard in the Netherlands, as it is often a prerequisite for providing services or products to Dutch government tenders (RVO, 2024). Furthermore, ISO is an adopted standard by the Royal Netherlands Standardization Institute, an institute that manages the national standards (RVO, 2024), making these criteria suitable and relevant for Dutch companies. The framework focuses on sustainable procurement, which is an increasingly important part of the Dutch national agenda. As one of the sustainability goals of the Dutch government is to achieve climate neutrality by 2050 (Rijksoverheid, 2023), making a focus on sustainable criteria appropriate for this thesis. With a GDP spending power of 20%, the Dutch government is influencing purchasing towards a

more sustainable process, such as awarding the winning tender towards a more sustainable supplier (Rijksoverheid, 2019). However, there are differences between the Dutch and Malaysian, as the Netherlands have a bigger construction equipment market (Arizton, 2025; Arizton, 2024), other safety laws and regulations like the Working Conditions Act (RVO, 2022), and a lower power-distance culture (38 vs 104 PDI) (Hofstede, Hofstede, & Minkov, 2010), suggesting that the original model needs to be adapted to Dutch companies. Therefore, validating the framework and adapting it where necessary, through ten semi-structured interviews with experts from the Dutch construction market, can increase its usability and make a valuable contribution to the international applicability of the model. Thereby, research on procurement decision making for the construction sector is scarce. Within the European construction sector, four studies reference Waris et al. (2019). Nevertheless, none has completely adopted the framework in the European context. For instance, Božanić et al. (2021) did a partial study in Serbia and defined criteria for construction equipment that meet the criteria set by Waris et al. (2019) in areas such as life cycle cost, theoretical work performance, and the machine's structural properties. However, their criteria did not include the sustainable perspective, as Serbia's sustainability performance and development potential are both poor (Huang, 2023), making it less relevant for the Dutch industry and literature review. Waris et al. (2019) has never been validated in the Dutch construction industry. Given the Netherlands' strict sustainability standards, this study will validate the framework in a Dutch Company. Finally, this thesis identifies similarities and differences between the existing literature on decision-making and practice, which informs evidence-based practice. Similarities validate the decisions in the existing research, while differences may indicate the need for updated research.

Research in the Dutch construction industry is essential, because of its impact on the national economy. The industry is known for its inefficiencies and low productivity (Delgado et al., 2019), but better procurement decisions can improve its efficiency and productivity (Kumaraswamy & Dulaimi, 2001). This research contributes to streamlining procurement processes and improving equipment management, which will result in cost reduction, and increased equipment availability. Moreover, insights from the findings can improve supply chain efficiency. Depending on the specific equipment procurement situation, such as the length of usage, this research can help Dutch construction companies determine what, when, and how much to buy, rent, or lease, thereby optimising their equipment procurement and management processes.

2. Literature Review

2.1 Strategic Procurement

Since the 1980s, strategic sourcing has grown in popularity. As globalisation and technological advancements have changed the basis of competition, strategic sourcing has transformed from a peripheral function to a central component of competitive strategy. The focus of strategic procurement is currently on controlling and optimising critical capabilities, whether internal or outsourced. Companies think differently about their organisations, valuing changes and competitive positions because even critical functions in the organisation such as research and development can be outsourced (Gottfredson et al., 2005).

According to Van Weele (2014), the purchasing process is divided into six phases, including both tactical and operational elements, as illustrated in Figure 1. This distinction in procurement between tactical and operational aspects ensures that decisions are made at the appropriate organisational level, increasing efficiency and effectiveness in daily activities. Sourcing is managed by procurement professionals and involves strategic decision-making processes. Sourcing defines the procurement strategy and involves identifying and selecting potential suppliers and negotiating contracts. During this phase, management of the supplier–organisation relationship is crucial. In contrast, operational procurement focuses on implementing the procurement strategy, which includes order placement, goods inspection and evaluation, inventory management, and conducting assessments (Bäckstrand et al., 2019). During expediting and evaluation, the quality of goods and services needs to meet contractual standards.

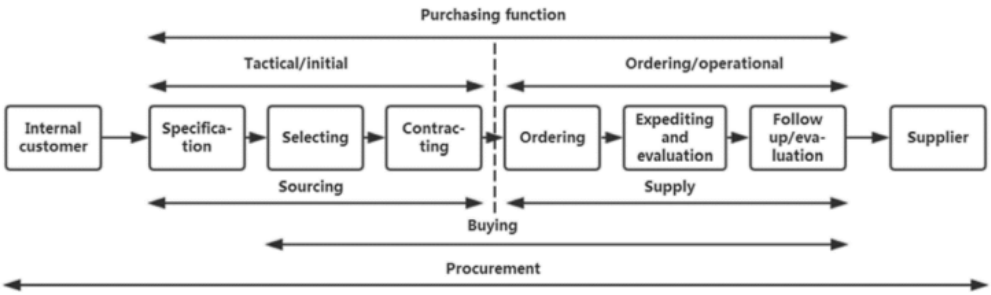

Figure 1. Process model reproduced from Arjan van Weele (Bäckstrand et al., 2019)

Procurement is known as the process of acquiring goods and services, including activities from identifying the needs of the internal customers to engaging with the supplier. Strategic sourcing, as a fundamental part of this process, aims to achieve long-term objectives such as risk management, cost reduction, and quality improvement. Yet the uncertainty and complexity of strategic sourcing have increased in today's market, with poor sourcing

decisions and ineffective supply chain management leading to negative outcomes for companies, including financial losses and quality decline (Nikolarakos & Georgopoulos, 2001). Thus, strategic sourcing is crucial to identify suppliers which offer maximum value. This requires careful strategic planning and supplier management (Talluri & Narasimhan, 2004). In this study, sourcing decisions refer to the "buy, rent, or lease" decision, which is discussed in detail in the literature review. Additionally, this study examines the selection of construction equipment, with the criteria influencing this decision elaborated upon in the literature review.

2.1.1 Procurement Decision-Making

Procurement decision-making is crucial for determining project success. The process is influenced by several factors, including client specifications, project characteristics and procurement options (Bolomope et al., 2022). According to Rados (1970), the purchasing process can be seen as a series of questions, as illustrated in Figure 2. The process starts with either an active or passive search for construction equipment. During this phase, the decision to buy, rent, or lease the equipment must be made. The first phase focuses on assessing the immediate need for the construction equipment. If there is no immediate use, the equipment should either be redesigned or not purchased. If the equipment is necessary, it moves to the next phase. The second phase involves determining whether the equipment should be tested. If testing is required, the equipment should be tested to minimise, for example, the risk of failure; if not, the process can proceed to the next step. If the equipment fails the test, it should not be purchased. A suitable supplier needs to be identified before the equipment can be purchased. If there is no suitable supplier, the company should withhold from purchasing the equipment (Bäckstrand et al., 2019).

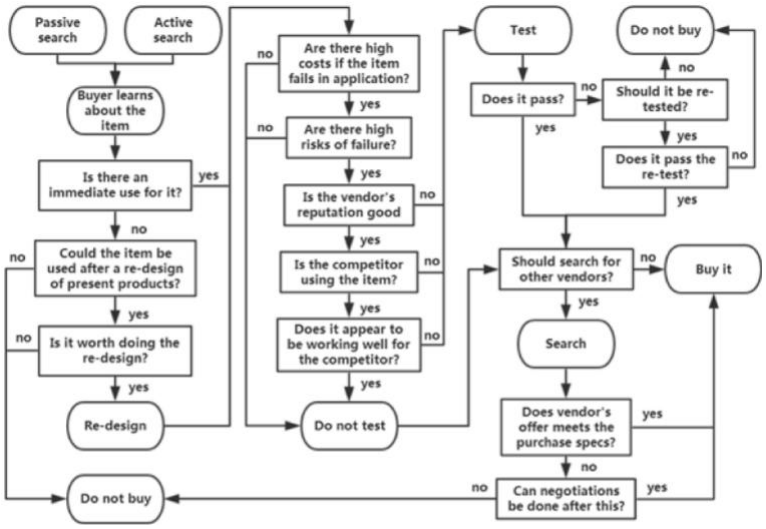

Figure 2. A decision-making process model for purchasing. Reproduced from Rados (Bäckstrand et al., 2019)

2.2 Buy, Rent, or Lease Decision

Procurement traditionally involves a "make-or-buy" decision. The make-or-buy includes strategic and informational considerations, with procurement providing profitability information and strategic positioning (Arya, Mittendorf, & Yoon, 2014). Given that construction companies typically do not manufacture equipment, they must decide whether to purchase equipment outright, rent it for short-term use, or lease it for long-term access. Selecting appropriate construction equipment contributes to operational efficiency and offers competitive advantages, including financial stability, improved corporate image, and better technical capacity (Samee & Pongpeng, 2016).

In today's construction industry, there are multiple options for acquiring heavy equipment, including buying directly from manufacturers, working with brokers, or renting from rental companies. Rent and lease decisions are included in the traditional purchase process and allow companies to bid on a diverse range of equipment, which creates flexibility, reduces the financial risks associated with ownership, and eliminates the commitment of ownership (Gransberg, Popescu, & Ryan, 2006). The equipment market is facilitated by online platforms and provides access to construction equipment with detailed specifications.

The primary consideration in the buy, rent, or lease decision is the level of risk a company is willing to take, which often is related to financial factors (Gransberg, Popescu, & Ryan, 2006). Companies must thoroughly analyse the cost of ownership for each option. The best decision depends heavily on the company's financial situation (Schexnayder & David, 2002). However, the literature also identifies several additional elements beyond financial considerations that influence the buy, rent, or lease decision for construction equipment. These elements include maintenance strategies (Liu, Liu, & Yang, 2024), technological advancements in equipment (Nair & Hopp, 1992; Mao & Zaleski, 2011), flexibility (Dyment, 1996), usage time and frequency (Dyment, 1996), and company policy regarding owning versus renting (Chinchore & Kahre, 2014).

2.2.1 Buying Decision

The first option is to buy construction equipment; this is also known as owning. In the construction equipment industry buying is the most common acquisition method. Purchases can be financed through cash payments or debt financing. According to Clapp et al. (2007), at least 75% of company construction equipment is owned. Cash purchases account for

35.6% of acquisitions, lease-purchase agreements for 30.8%, and loans of more than one year for 25%, with other financing methods covering the remaining purchases.

Buying is also the simplest acquisition method for construction equipment. The equipment can be paid for upfront or through financing options like loans or agreements. If financing is used, the buyer and seller negotiate the terms, including interest rates, repayment schedules, and collateral requirements. The seller delivers the equipment to the buyer after payment or financing is arranged, and the buyer then assumes ownership and responsibility for its maintenance and usage. The transaction involves the necessary paperwork, such as invoices, receipts, and documentation of ownership transfer (Day & Benjamin, 1991).

Buying construction equipment provides several advantages. The owner gains complete control over equipment use and maintenance when buying equipment; this independence allows companies to make decisions without third parties, fostering a sense of ownership and resulting in better care and longer equipment lifespan (Gransberg, Popescu, & Ryan, 2006). Ownership also allows companies to customise the equipment to meet specific operational needs, which can increase productivity. Additionally, preventive maintenance strategies can be implemented to reduce repair and maintenance costs (Liu, Liu, & Yang, 2024).

Buying construction equipment also offers long-term cost benefits compared to leasing and renting. Especially, for frequently used equipment, buying equipment is usually more cost-effective per operation hour. Although the initial investment may be high, buying eliminates ongoing lease payments and interest charges, leading to long-term savings. Furthermore, buying equipment outright allows companies to build equity faster. Equity can help companies to be financial stable (Day & Benjamin, 1991).

However, buying also carries challenges, such as financial risks. The high initial investment can strain the company's financial resources and affect cash flow, which could limit the ability to invest in other necessary equipment or projects. Additionally, uncertainty about the equipment's resale value adds another layer of financial risk, making it difficult to predict long-term returns (Gransberg, Popescu, & Ryan, 2006). Furthermore, the ownership of equipment has additional costs beyond the initial buying price, including maintenance and repair expenses. The company is also responsible for maintaining the equipment, which can be challenging due to the scarcity of spare parts. As the equipment ages, maintenance costs tend to rise, while operational efficiency may decline. Moreover, there are operational risks

associated with owning equipment. For example, the company must take full responsibility for operational issues and potential downtime (Alumbugu, Saudi, Abdulazeez, & Shakirat, 2015). Finally, the company is responsible for transportation of the equipment and storage, when the equipment is not in use, and it is challenging and costly to transport equipment to job sites every day (Vaniraj, Sethuraman, & Sujithra, 2023).

Technological advancements in construction equipment present further challenges for buyers. As newer, more advanced equipment enters the market, older equipment models may become inefficient and outdated. Therefore, buying has often been perceived as inflexible due to the difficulty in exchanging equipment when needed (Dyment, 1996). The stricter emission standards and transition to electric construction equipment are growing concerns as this equipment is more expensive (Un-Noor et al., 2022). Modern equipment further complicates decision-making by integrating digital technologies. New models have advanced digital capabilities to improve efficiency and enable data-driven insights (Alaloul, Liew, Zawawi, & Kennedy, 2020). Outdated equipment will not have the features of the newest models, this makes it challenging to buy over time when there is a new model on the market, as the exact date of new models is not given. The summarised advantages and challenges of buying construction equipment are illustrated in Table 1.

Table 1. Advantages and challenges associated with the buying strategy.

Decision process	Advantages	Challenges
Buy	• Long-term cost benefit • Allows customisation • Builds equity	• High initial investment / Financial risk • Responsible for maintenance and repair • Responsible for storage and transportation • Insecure resale value • Low technological obsolescence • Low flexibility

2.2.2 Renting Decision

The most flexible, risk-free option available is renting equipment through a rent-to-rent agreement. Rental agreements include maintenance and service arrangements, relieving organisations of the burden of upkeep and repair. Renting enables construction companies to scale equipment resources according to project demand, mitigating the risk of underutilisation or overcommitment to specific assets. Designed for users unlikely to need the equipment again, rental agreements allow companies to rent for short periods, usually

less than a year. Equipment is typically rented for a few weeks but can also be rented by the month, day, half-day, or even by the hour. According to Day and Benjamin (1991), a typical weekly rent charge is between 25% and 40% of the monthly rate, with the daily rate typically about 33% of the weekly rate. The shorter the renting period, the higher the hourly rate for the equipment. The rental contract begins when the equipment leaves the depot and ends when it is returned. The rental period can be decided beforehand, and there are typically no penalties for returning equipment early. There are specific scenarios when renting equipment is ideal, for example, to fill in during peak moments, special projects, or for broken machinery. Additionally, companies can try equipment out by renting before committing to buying or leasing, reducing the risk of investing in expensive equipment that may not be needed in the future (Dyment, 1996).

One particularly noteworthy advantage of renting construction equipment is flexibility. Renting specialised equipment for a short-term period is beneficial because the required equipment is available when needed. Equipment can be rented for only one task and returned upon completion. Renting is therefore a cost-effective option because it ensures efficient use without idle equipment. The rental costs are higher in the long-term than leasing or buying equipment (Worthington, 2005). Renting construction equipment also provides upgradability, allowing companies to quickly replace outdated machinery with newer, more efficient models (Pham et al., 2020). Renting does not burden companies with managing and maintaining an equipment fleet, enabling companies to focus on their core competence, streamline workflow, and reduce overhead costs (ERA, 2021)

Renting construction equipment also offers financial advantages. Firstly, a lower initial investment is required compared to buying, making renting accessible to companies with limited capital (Pham et al., 2020). Additionally, renting preserves capital by freeing up cash for other purposes and improving cash flow for operating expenses. The true costs of equipment ownership can be complex to calculate due to the various variables. In contrast, rental costs are straightforward and easily traceable, allowing for better project cost management (Griffin, 2002). Finally, renting proves to be an optimal solution for construction sites by lowering both purchasing and operating costs in comparison to outright ownership of the equipment (Patel, 2019).

Another advantage of renting construction equipment is the reduction in maintenance costs. Rental companies are responsible for general maintenance and repairs unless the renter

mistreats or misuses the equipment. Furthermore, on-site maintenance can be arranged as part of the rental contract, eliminating the need for companies to stock spare parts or allocate resources to service personnel and mechanics (Griffin, 2002). Renting also reduces the likelihood of breakdowns and minimises downtime because rental fleets feature the latest, low-hour, well-maintained equipment models. Additionally, utilising pay-per-use payment models based on actual usage can further reduce maintenance overhead, ensuring that companies only pay for the equipment when it is actively in use (Fitton et al., 2008).

Moreover, renting reduces transportation costs and environmental impact because a rental depot can offer economic and environmental advantages. During the selection of smaller equipment, cost is often the only primary consideration, but larger equipment focuses on the cost and environmental implications of transportation (ERA, 2021). According to the European Rental Association, adopting the rental model can reduce CO2 emissions by 30%–50%. The rental industry currently contributes to emissions reduction by implementing equipment sharing and effective asset management. This minimises equipment production through shared usage and optimises construction equipment management (ERA et al., 2019).

However, there are also challenges to renting equipment. During peak seasons or high-demand periods, the needed equipment may not be available for rental, and this can cause delays in project timelines. Companies' dependence on rental companies for equipment availability and maintenance can introduce uncertainties and potential disruptions to project timelines, leading to increased costs (Rafi & Witjaksana, 2023). Furthermore, when equipment availability is low, rental costs tend to rise. Some rental providers may also have a limited equipment supply, leading to higher rental rates. Additionally, rental companies may charge a premium for specialised equipment during periods of peak demand (Jung et al., 2006).

Higher long-term costs are another challenge for rental equipment. In the short-term, renting seems more cost-effective, but extended or frequent rentals can result in high costs compared to buying equipment outright (Hammad, 2023). In addition, renting does not offer the long-term benefits of ownership, such as equity accumulation or asset appreciation, that come with buying equipment (Day & Benjamin, 1991). The equipment remains The rental company’s property during the rental period, and rental agreements usually do not allow customisation; this bars the company from modifying the equipment to meet specific project needs, thus reducing performance and efficiency. Furthermore, companies cannot customise

the equipment with their logo and colours. Table 2 outlines some of the advantages and challenges of renting construction equipment.

Table 2. Advantages and challenges associated with the renting strategy.

Decision process	Advantages	Challenges
Rent	• High flexibility • Low initial investment • Low ownership and operating costs • Less environmental impact • Technological obsolescence • Focus on core business operations	• High long-term costs • Dependent on rental company • Uncertainty and extra costs during peak season • Not building equity • No customisation

2.2.3 Leasing Decision

A lease is a contract in which the lessor (owner) permits the lessee (user) to use an asset over the lease term in exchange for lease payments. Most corporate financial executives recognise that the earnings are taken from the use of equipment, not its ownership, and leasing is an alternative financing method. Leasing as a form of commercial transaction originated thousands of years ago, with records showing that Catholic priests, who were government officials, leased both land and tools for money (Nevitt & Fabozzi, 2000). Leasing construction equipment provides a middle ground between buying and renting, offering long-term access to equipment while maintaining capital and avoiding the risks associated with ownership. There may be options included in a lease agreement such as equipment upgrades, maintenance services, and buyout options, which provide organisations with flexibility and control over equipment lifecycle management (Merrill, 2020).

A typical leasing transaction works as follows. The lessee determines the required equipment and selects the manufacturer, make, and model. The lessee also specifies any special desired features, delivery terms, warranties, installation, guarantees, and services. The price negotiations are conducted at this stage as well. After selecting the equipment and agreeing on terms, the lessee enters a lease agreement with the lessor (Nevitt & Fabozzi, 2000). During this negotiation phase, details such as the lease duration, rental amount, sales tax, delivery and installation charges, and other optional considerations are discussed. When the lease is signed, the lessee transfers the purchase rights to the lessor, who acquires the equipment as mentioned. After the equipment is delivered, the lessee needs to accept it and ensure it meets the specifications. The lessor then pays for the equipment, and the lease goes into effect. At the end of the lease term, the lessee usually has the option to renew the lease,

purchase the equipment, or terminate the agreement and return the equipment (Nevitt & Fabozzi, 2000).

There are several differences in leasing, with financial and operational leases being the two most common types. In a financial lease, the leasing company recovers all costs incurred plus a rate of return, with the lessee responsible for maintenance, taxes, and insurance. A financial lease could be compared to a mortgage, with the lessee effectively becoming the equipment owner from day one. An operational lease is more comparable to renting and is usually short-term. The lessee acquires the use of equipment for a small portion of its economic or useful life. In an operational lease, there may be an option to purchase the equipment at the end of the lease term. Depending on the contract, either the lessee arranges maintenance or the lessor provides it, with additional services factored into the lease price. Equipment under an operational lease is not shown on the balance sheet (Al Sugheyer et al., 2009).

Leasing construction equipment offers multiple advantages. One of the primary benefits is the flexibility and convenience that leasing affords, with lease payments being customisable to suit the lessee's scheduling needs. For example, payments can be structured to be higher in the later years of the lease and lower in the earlier years (Fabozzi & Peterson, 2003). Leasing is a suitable option when certain pieces of equipment are used frequently, but the company does not have the resources to purchase equipment outright or make a substantial downpayment. Leasing allows equipment acquisition without requiring an initial downpayment, thus freeing up cash and, depending on the type of lease, avoiding debt. Lease terms typically last at least a year (Dyment, 1996). According to Petroutsatou and Giannoulis (2022), leasing is the most popular means of acquisition in the Greek construction industry. There are several reasons for this, such as the low liquidity in Greek companies (Maniatis et al., 2024), the high volatility in the Greek construction market in the last decade (Eurostat, 2024b), and the 3% withholding tax on leasing (PwC, 2025). These insights are relevant for companies in the Netherlands. Whenever the market conditions in the Netherlands are shifting towards the Greek market, companies should emphasise more on leasing as a strategic option. For example, a recent survey suggests that Dutch small and medium-sized enterprises face cash-flow pressure through higher borrowing costs, making companies consider leasing as a more flexible option (CBS, 2024). Another advantage of leasing is that it mitigates the risks associated with ownership by distributing risk between the lessor and lessee. For example, technological changes can quickly make equipment obsolete, but with

leasing, the burden of technological obsolescence often falls on the lessor rather than the lessee. This arrangement allows companies to access up-to-date equipment without the financial risk associated with ownership (Mao & Zaleski, 2011).

However, leasing also presents challenges and disadvantages. One challenge is the complexity of lease agreements. Lessees must understand the terms, limitations, rules, penalties, and regulations outlined in the lease contract. While leasing provides flexibility, it also contains numerous conditions that must be managed effectively to avoid potential penalties such as returning the equipment earlier than agreed (Nevitt & Fabozzi, 2000). Some business managers argue that leasing equipment involves higher interest rates than buying. Indeed, Chambers (2009) suggested that the interest costs associated with leasing can be prohibitively high. In such cases, buying equipment outright may be a more financially sound option to avoid rising interest expenses.

In business operations, leasing and buying construction equipment has implications for asset ownership and operational flexibility. Unlike buying, financial leasing of construction equipment only gives temporary usage rights without resulting in equity over time. This absence of ownership prevents lessees from building long-term financial value. Leased equipment typically lacks the adaptability to be modified for specific operational requirements that need to be used in construction projects with special demands. As a result, the inability to customise leased equipment may delay operational efficiency and effectiveness, potentially causing project delays or suboptimal performance (Fabozzi & Peterson, 2003). Table 3 outlines the advantages and challenges of leasing construction equipment.

Table 3. Advantages and challenges associated with the leasing strategy

Decision process	Advantages	Challenges
Lease	• High level of flexibility • Low initial costs • Mitigate the risk of ownership • Technological obsolescence • Contract can be adjusted to strategy	• Complexity of the lease agreement • Higher long-term costs than buying

2.3 Main Criteria for Selecting Construction Equipment

After making the decision to buy, rent, or lease new equipment, this thesis defines the capacity and requirements of the equipment that will be acquired. In general, procurement managers differentiate between functional specifications and technical specifications (Van Weele, 2014). Determining the specification of construction equipment is a precise process that involves criteria to ensure both the efficiency and safety of construction projects. Over the years, multiple criteria have been established, with sustainability becoming an increasingly important factor. Waris et al. (2019) developed a framework, illustrated in Figure 3, which identifies six main criteria for sustainable procurement of construction equipment: life-cycle cost, performance, system capability, operational convenience, environmental impact, and social benefit. These main criteria are further divided into sub-criteria, which influence the procurement decision and help determine the appropriate strategy.

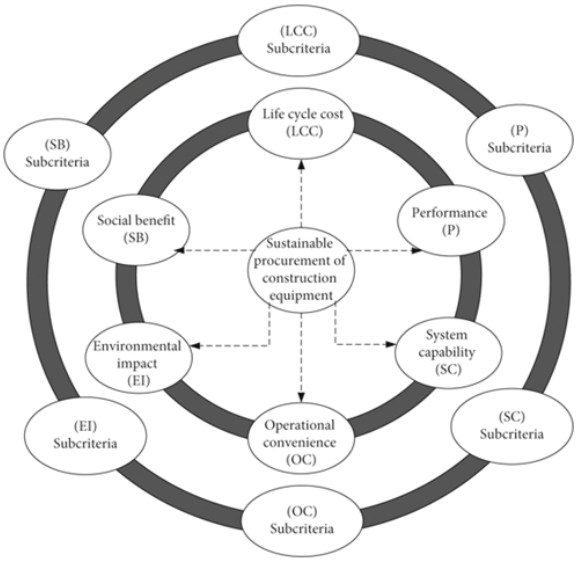

Figure 3. Criteria for selecting construction equipment (Waris et al., 2019).

The first main criterion is life-cycle costing. Life-cycle costing optimises value for money in physical asset ownership by considering all cost factors throughout the equipment's operational life, leading to informed long-term investment decision-making (Woodard, 1997). Costs associated with construction equipment include initial purchase or rental costs, operating expenses, fuel consumption, and depreciation (Patel, 2019).

The second main criterion is performance measures. Performance measures assess the operational capabilities of equipment in terms of productivity, reliability, and work quality. These measures include criteria such as speed, power, capacity, and precision. Equipment

should be selected based on its ability to meet project requirements efficiently and effectively (Chan, Ip, & Lau, 2001).

Another key criterion is system capability. This refers to the design of the equipment and focuses on evaluating its operation, production and performance capabilities. System capability is measured using six sub-criteria: the implementing system, traction system, powertrain system, structure and suspension system, control and information system, and equipment standardisation (Waris et al., 2019). One important sub-criterium is equipment standardisation, which refers to the use of equipment with identical parts and resources that share similar specifications and characteristics. Equipment standardisation reduces repair and maintenance costs, which can lead to higher operational efficiency (Tavakoli, Taye, & Erktin, 1989).

The fourth criterion is operational convenience. This includes six sub-criteria: ease of repair and maintenance, ability to meet job and operational requirements, spare parts availability, compliance with site operating conditions, versatility of equipment, and meeting haul road conditions. All these sub-criteria are crucial to the decision-making process regarding construction equipment (Waris et al., 2014).

Furthermore, environmental impact, or sustainability, is an increasingly important criterion. According to Guggemos and Horvath (2006), the emissions from on-site construction equipment account for a large portion of the environmental impact in construction processes. This criterion is becoming more critical due to growing laws and regulations regarding emissions. For example, the Dutch government has increased efforts to make construction equipment more sustainable by offering subsidies for the purchase of electrical construction equipment by Dutch construction companies. The goal is to reduce nitrogen oxide emissions in the construction industry by 60% in 2030 (The Dutch Ministry of Infrastructure and Water Management, 2021).

The final main criterion is social benefit. This includes seven sub-criteria: operator visibility and comfort, operator proficiency, training needs, operator health, availability of locally skilled operators, relationships with the dealers or suppliers and safety features. Establishing good relationships with dealers or suppliers can simplify procurement procedures and overall efficiency (Waris et al., 2014).

2.4 Dutch Construction Industry

The Dutch construction industry encompasses a wide range of activities, from residential and commercial building construction to civil engineering projects such as roads, bridges, and utility management systems. The industry is known for large water management projects like the Delta Works. However, the industry has a history of challenges related to collusion and cartels, which persisted until the early 2000s (Dorée, 2004). In 2023, the construction industry accounted for 4.9% of the Netherlands' GDP. Between 2010 and 2020, the total revenue of the construction industry grew by 41% (Eurostat, 2024a). On a daily basis, construction companies are involved in activities such as excavation, foundation laying, structural erection, utility installation, and finishing work, such as painting and landscaping. The Statistics Netherlands, or in Dutch centraal bureau voor de statistiek (CBS), categorises the construction industry into three main sectors as illustrated in Figure 4: building construction and development, heavy and civil construction, and specialised construction activities.

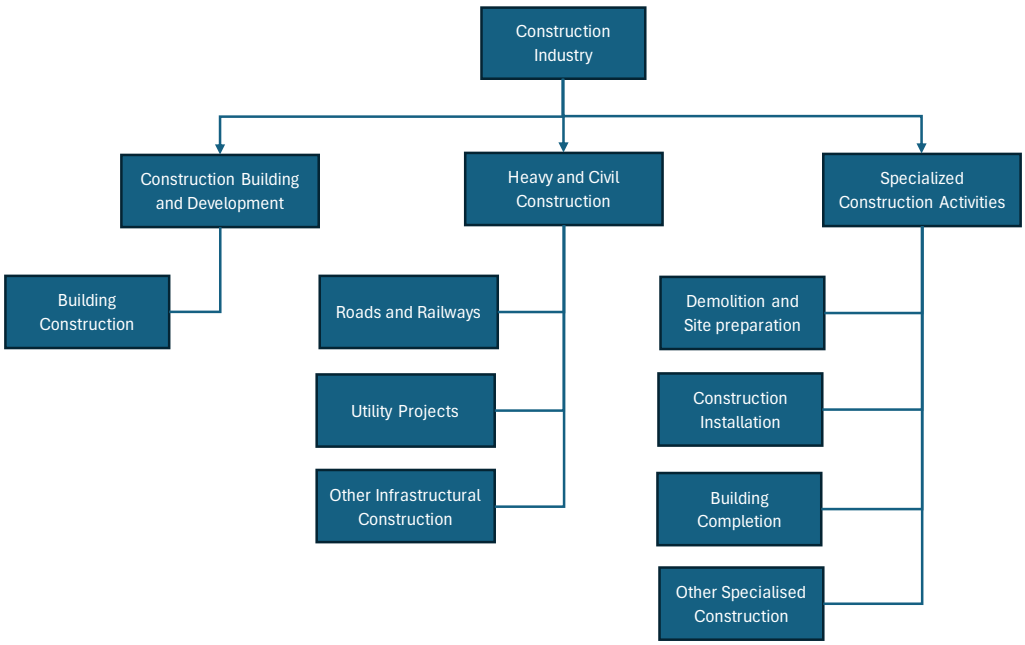

Figure 4. The underlying industries and subdivisions of the construction industry (Hilverda, 2023).

The Dutch construction industry is influenced by companies within the sector as well as various external actors. According to Coenen (2017), the network of the Dutch construction industry consists of six distinct actor groups: the political system, knowledge and education, framework conditions, demand, the industrial system and branch organisations. The overall network, along with its interrelations, is depicted in Figure 5. The actors operate within a single institutional framework, enabling the analysis of policies in relation to other groups

of actors. Framework conditions influence the political system, indirectly affecting the entire industry. The political system strongly impacts the strategic agenda, shaping education and research initiatives. Branch organisations influence the industrial system by responding through governance and policy implementation. The demand side, heavily represented by public organisations, depends on research and education, and industrial system. Some actors straddle both the demand side and the industrial system, as many contractors employ subcontractors and suppliers (Coenen, 2017).

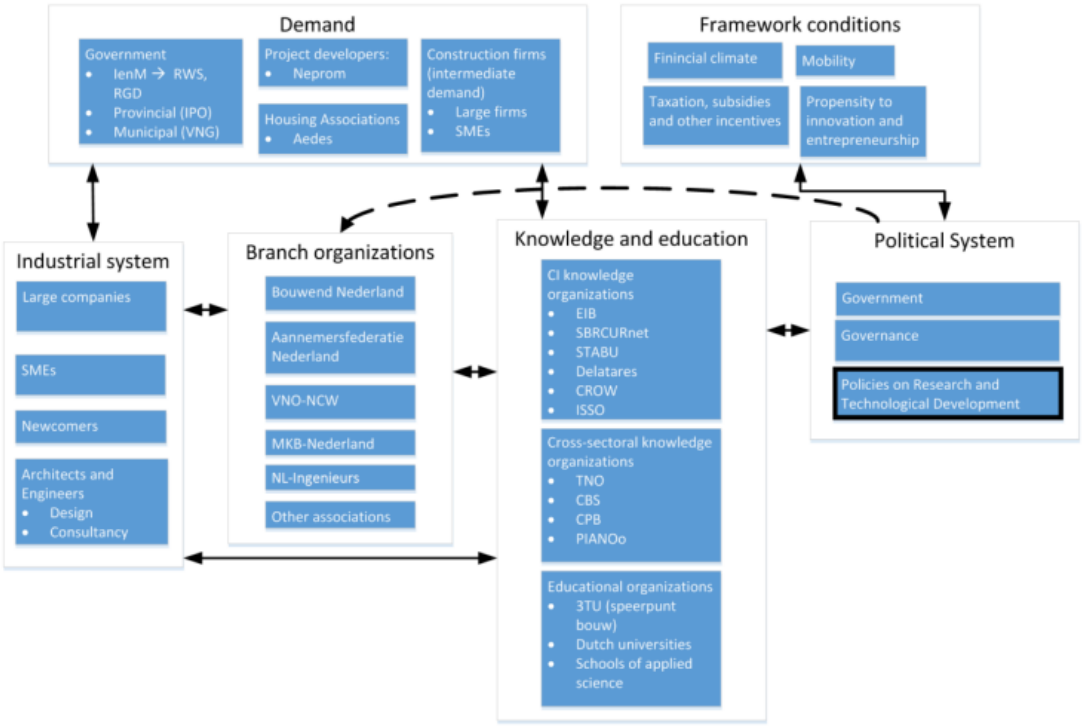

Figure 5. Network of the Dutch construction industry (Coenen, 2017).

The Dutch construction industry also faces several challenges. Firstly, there is a shortage of skilled labour. In 2023, the CBS reported 73 vacancies per 1,000 jobs within the Dutch construction industry. Additionally, the rising cost of building materials presents another challenge, with the prices increasing by 46% between 2015 and 2023 (Hilverda, 2023). Finally, the Dutch government set a goal to achieve carbon neutrality by 2050. To meet this target, environmental regulations within the construction industry are becoming stricter. These regulations cover not only CO2 emissions but also nitrogen emissions, which have impacted numerous construction projects in delay or even cancellation (Rijksoverheid, 2023). Companies must modify their operations to comply with these rules.

2.4.1 Dutch Construction Equipment Industry

The Dutch construction equipment industry plays a vital role in supporting construction activities by supplying machinery and tools for project execution. This industry consists of manufacturers, distributors, rental companies, and service providers. The equipment market is influenced by factors such as construction activity, infrastructure investments, and technological advancements. Its size fluctuates in response to economic conditions and government spending on infrastructure projects (Arizton, 2023). Different types of equipment are used in the Dutch construction industry, including excavators, bulldozers, cranes, loaders, dump trucks, tractors, and compactors. These machines fulfil several functions throughout the construction process, from earthmoving and material handling to concrete pouring and compaction. Major players in the Dutch construction equipment industry include internationally recognised manufacturers such as Caterpillar and Liebherr. Additionally, local distributors and rental companies provide equipment and support services to construction companies nationwide (Arizton, 2023).

Company size within the construction sector varies greatly, with a few large companies and thousands of smaller companies. Some larger construction companies have an internal rental equipment department, where contractors can rent equipment for their own projects. Others prefer to rent their equipment from specialised rental companies. The market for rental equipment in the construction sector has been growing steadily over the last decade. The Dutch construction equipment market is projected to grow at a compound annual growth rate (CAGR) of approximately 4.61% from 2022 to 2029. Market volume is expected to increase from 30,701 units in 2022 to 41,121 units by 2029. Increasing government investment through the National Growth Fund and growing construction of residential buildings and renewable energy projects are expected to drive market growth (Arizton, 2023).

2.5 Research Framework

At the initial stage of the purchasing process, a company identifies its purchasing requirements and faces the make-or-buy decision to determine which products or activities to outsource. The make-or-buy assessment begins when the company formulates its future company strategy, such as to enter new markets or develop new products. In the context of construction equipment procurement, the decision is not whether to make or buy but rather to buy, rent, or lease as the complexity of manufacturing such equipment internally is usually not feasible.

Several factors influence the decision to acquire new equipment (Van Weele, 2014). Given the absence of a specific framework in the literature for the buy, rent, or lease decision concerning construction equipment, this thesis develops a research framework to guide this decision-making process, as illustrated in Figure 6. The framework consists of elements influencing the buy, rent, or lease decision identified through the literature review. Furthermore, there are various selection criteria in the framework. When the company make the buy, rent, or lease decision regarding construction equipment, the purchasing process begins by defining the required capacity and specifications of the equipment to be acquired.

The requirements for construction equipment are divided into functional and technical specifications. A functional specification describes the required functionality of the product for the end user. Describing and using functional specifications has several advantages. Firstly, it allows potential suppliers to fully leverage their expertise. Secondly, it enables the use of new technologies that the buyer may not be aware of, but the supplier is. Finally, it establishes a uniform standard for evaluating all supplier proposals (Van Weele, 2014). Conversely, technical specifications in construction are vital documents that define the work performance expectations for the equipment. These documents are referenced throughout the construction process and must be clearly understood by both contractors and owners to ensure successful outcomes. Clear specifications and a consistent understanding of them by all stakeholders lead to higher project quality. If the purchaser fails to recognise which technical specifications are essential, the equipment might not meet minimum requirements

or could be overpriced (Jackson, 1990). The main criteria identified by Waris et al. (2019) are illustrated in Figure 6.

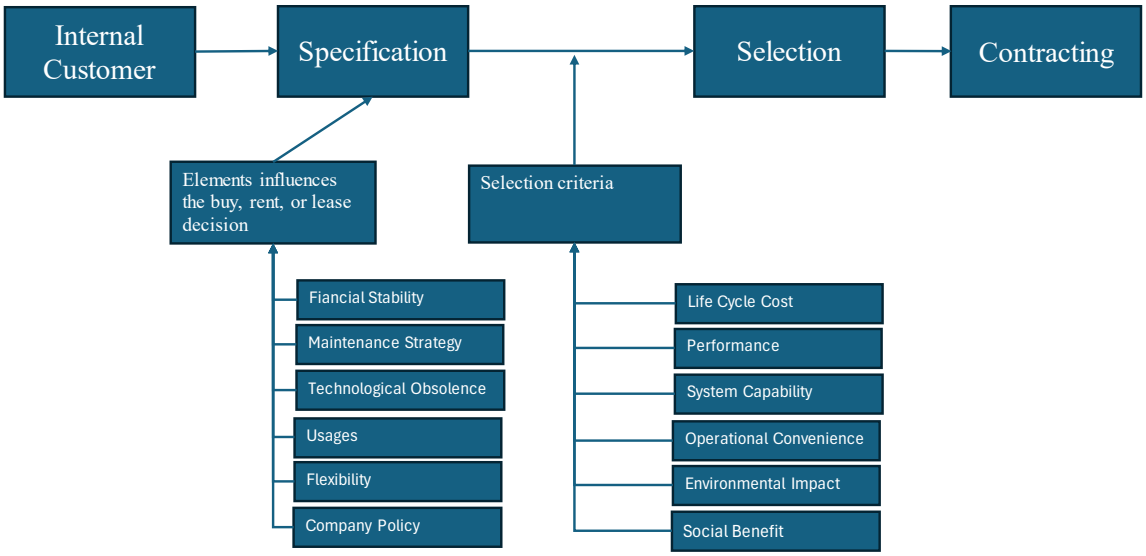

Figure 6. Research framework for the buy, rent, or lease decision and the supplier selection criteria adapted from Waris et al. (2019) for construction equipment.

2.5.1 Buy, Rent, or Lease Framework Elements

Financial aspects are crucial in buy, rent, or lease decision-making. The initial investment required to buy construction equipment is substantial, representing a financial commitment. Companies therefore need to weigh the long-term costs against short-term expenses. Buying construction equipment involves higher upfront costs, but it leads to lower long-term costs. Buying is more likely to happen when the equipment is frequently used over a long-term period (Schexnayder & David, 2002). To make this initial investment, the company must be financially stable. Financial stability refers to the ability to support economic processes, manage risks, and absorb shocks, and it varies over time and across different finance constituent elements (Schinasi, 2004). Total cost of ownership (TCO) is an important concept, encompassing the purchase price and maintenance, insurance, storage, and operational costs. In contrast, renting or leasing typically involves higher ongoing costs but offers lower initial expenses and greater financial flexibility, which can benefit companies with fluctuating project demands or limited capital (Day & Benjamin, 1991).

Another key element is maintenance. When a company buys equipment, it is fully responsible for its maintenance and repairs; this requires an in-house facility or a partnership with a service provider to ensure the equipment remains operational and efficient. The lifespan of equipment can be extended, and downtime is reduced by efficient maintenance,

but it demands resources and expertise. Renting or leasing, on the other hand, transfers much of this responsibility to the equipment provider, simplifying operations and reducing the burden on the company's internal resources (Liu, Liu, & Yang, 2024).

Technological obsolescence is also a significant factor in the buy, rent, or lease decision. The construction industry has long suffered from low productivity, poor project outcomes and disappointing results (Ashcraft, 2022). In recent years, there has been a transition to electric equipment and increased machinery efficiency, but companies must consider the possibility of equipment becoming outdated. Buying equipment may lock a company into using obsolete technology, while renting or leasing offers the flexibility to upgrade to newer, more advanced equipment as it becomes available, ensuring the company always operates with the most efficient tools (Mao & Zaleski, 2011).

Flexibility is another key element. With rental and leased construction equipment, companies are allowed to adjust their fleet to meet project needs, and companies can change the equipment. As such, companies are not tied to specific machinery that may not be suitable for every job (Dyment, 1996). This flexibility is beneficial in projects with varying demands or in industries where the scope of work frequently changes. Ownership provides the flexibility to customise equipment to meet exact specifications, ensuring efficient integration into specific operations and enhancing productivity (Gransberg, Popescu, & Ryan, 2006).

The time and frequency of equipment use are critical considerations. Companies need to forecast project durations and utilisation rates. For long-term, high-utilisation projects, buying equipment may be more cost-effective as frequent use can justify the initial investment (Chinchore & Kahre, 2014). Conversely, renting or leasing may be more practical for short-term or low-utilisation projects by allowing companies to avoid the high upfront costs and only pay for the equipment when needed (Dyment, 1996).

Finally, the decision to buy, rent, or lease construction equipment is influenced by the company’s policy towards ownership. Some companies prioritise building equity through ownership because it is a strategic investment in their asset base. Personal preferences and the company strategy also play a role as some directors prefer the control and potential tax benefits associated with equipment ownership (Chinchore & Kahre, 2014). Other companies may lean towards the flexibility and reduced financial risk associated with renting or leasing (Day & Benjamin, 1991).

2.5.2 Supplier Selection Criteria Framework

The primary objective of procurement in the construction industry is to select the equipment for scheduled tasks, ensuring high efficiency, productivity, and cost-effectiveness. This objective is important given that equipment selection is a strategic decision with economic implications for the project budget (Waris et al., 2019). The increasing technological demands in the construction industry require major use of mechanised equipment, making the equipment acquisition process both complex and competitive (Waris et al., 2019).

In the equipment procurement process, there are several key selection criteria. The user is responsible for specifying the purchasing order criteria, while the buyer's task is to guarantee that the specification is drawn up objectively. A common situation when selecting the required equipment is comparing available options with the intended tasks (Van Weele, 2014). This approach considers both tangible and intangible criteria, such as the six supplier selection criteria of Waris et al. (2019), shown in Figure 7. The buyer can begin supply market research when the purchasing criteria have been defined and translated into functional or technical specifications (Van Weele, 2014). These steps are often intertwined, with practical possibility and cost estimation taking place during the draft of technical specifications. Specific suppliers are often in mind when selecting basic technologies for product design (Van Weele, 2014).

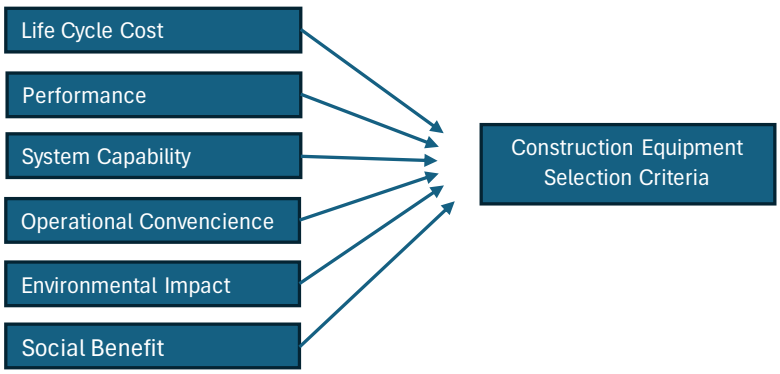

Figure 7. The six supplier selection criteria of Waris et al. (2019).

3. Research Design

This study investigates the key elements that influence the buy, rent, and lease decisions of construction equipment, as well as the critical selection criteria. The output of the investigation is a model that supports construction equipment procurement decision-making. To achieve this, the current state of the construction industry in the Netherlands, specifically within the utility infrastructure, is examined, and criteria relevant to these decisions are explored.

3.1 Case Study

Qualitative research provides descriptive information through the collection of data in non-numerical forms (Gelo, Braakmann, & Benetka, 2008). In the context of identifying elements for the procurement of construction equipment in the Dutch construction industry, qualitative research is the most appropriate data analysis technique. A single case study is used as a research method to address the central research question: "What elements should guide the buy-rent-or-lease decisions regarding construction equipment in Dutch construction companies?".

Case study research is an empirical method that involves a systematic investigation of a specific real-world situation, focusing on "how" and "why" questions. A case study aims to investigate a given phenomenon in a real-life context. According to Yin (2018), there are single and multiple case study designs. Single-case designs are used for extreme or unique cases, allowing in-depth investigation of a given phenomenon. In case studies, close collaboration between the researcher and participants is advantageous for data collection (Baxter & Jack, 2008). This interaction allows participants with different perspectives to share their experiences, helping the researcher understand their actions better.

This method is suitable for generating an in-depth, multi-faceted understanding of a problem in a real-world context (Crowe et al., 2011). Given the limited availability of information on the decision-making elements for construction equipment procurement in the Dutch construction industry, the flexibility of case studies is well-aligned with this research. Moreover, this approach enables a detailed exploration of a specific procurement process within the case company, including its approaches to decision-making. Case studies are also useful for generating insights and new ideas emerging from real-life situations (Siggelkow, 2007).

3.2 Data Collection Method

In case studies, interviews are commonly used, especially when explaining key events and seeking insights that reflect participants' perspectives (Yin, 2018). As such, interviews are the most appropriate data collection method for this research. Interviewers can ask open-ended questions to reveal the interviewee's perceptions. Open-ended questions were used to elicit various responses and possibilities (Pate, 2012), which aided in seeking new insights in this exploratory study. Semi-structured interviews, known for their flexibility, are widely used for data collection. This study conducted semi-structured interviews to identify the main elements influencing the decision to buy, rent, or lease construction equipment.

The unit of analysis in this single-case study is the purchasing department (Flyvbjerg, 2006) of construction company in the Netherlands that primarily focuses on utility infrastructure, with its main activities involving the installation of water and gas pipes, as well as electricity cables. The study explores procurement decision-making regarding the acquisition of construction equipment, involving interviews with employees from the technical service department, directors, contractors, and business managers. The interview covered several topics, including the buy, rent, or lease decision-making process; construction equipment criteria; and construction equipment management, trends, advantages, and challenges. The interview questionnaire was developed based on the literature review presented in Chapter 2. Depending on the function of each participant, the questions varied. There were two primary types of participants in the construction equipment process: those involved in the procurement of construction equipment and those who use the construction equipment. The distinction between the two sets lies in their focus of their role; the first addresses the elements and criteria important to procurement decisions, while the second focuses on the factors that matter most to users.

3.3 Sample Definition

To achieve the best result, the selection of participants is crucial in case study research. In this study, a purposive sampling technique, specifically snowball sampling, was used. Initially, one participant was recruited who met the criteria, and they suggested multiple other suitable participants for interviews. When employing purposive sampling, the quality of the data collected is essential, and therefore the reliability and competence of participants must be established (Tongco, 2007). Maintaining high reliability and validity is critical in research to ensure high-quality results. Reliability refers to the accuracy and precision of the

measurement procedure, while validity concerns the degree to which the research measures what it is intended to measure. Reliability was achieved by interviewing all relevant participants and soliciting their opinions, while validity was ensured by selecting an appropriate sample and interviewing capable individuals (Cooper & Schindler, 2014). Including participants with different functions provided multiple perspectives, a key feature of case studies, and is a form of triangulation (McDonnell, Jones, & Read, 2000).

The sample size, or the number of participants, is an important consideration in answering the research question. In this case study, the sample size reached saturation, meaning that enough information was gathered to replicate the study (O'Reilly & Parker, 2012). Saturation is achieved when further data collection does not generate new insight, and additional coding is no longer practicable (Guest, Bunce, & Johnson, 2006). A sample that is too small may fail to adequately answer the research question, while a sample that is too large may be resource-intensive and unethical (Das, Mitra, & Mandal, 2016). Selecting competent participants is important to aligning the research objectives with participant expertise. For this reason, the procurement department was not included, as it is not directly involved in the acquisition or use of construction equipment.

3.4 Data Analysis

The primary data for this research consisted of 10 individual semi-structured interviews. If saturation were not reached, additional interviews would be conducted. The interviews took place at the company and involved participants with different roles who were either responsible for the procurement of equipment or its usage. The questions in this interview varied depending on the participant's role, as detailed in Appendix 1. The interviews were conducted in Dutch for ease of communication and were held in person or via Microsoft Teams, depending on the participant's availability. All interviews were recorded and transcribed into text documents. The transcripts were coded to identify the main elements in the buy, rent, or lease decision as well as the selection criteria for equipment. Interview length ranged from 39 to 75 minutes, depending on the speaking pace and follow-up questions. The department in which each employee primarily worked was also noted. Table 4 lists the respondents' responsibilities, divided into those responsible for equipment procurement and those involved in equipment usage.

Table 4. Qualitative information about the interviews

Respondent	Function	Branch	Responsibility	Duration	Meeting
1	Technical Service Manager	A	Procurement	75 min	Face-to-Face
2	Equipment Manager 1	A	Procurement	51 min	Face-to-Face
3	Equipment Manager 2	A	Procurement	67 min	Face-to-Face
4	Controller	A	Procurement	67 min	Face-to-Face
5	Fleet Manager	A	Procurement	53 min	Face-to-Face
6	Contractor 1	A	Usage	63 min	Face-to-Face
7	Contractor 2	B	Usage	40 min	Teams
8	Business Manager 1	A, C, D	Usage	39 min	Face-to-Face
9	Business Manager 2	B	Usage	41 min	Teams
10	Team Manager	D	Usage	53 min	Face-to-Face

3.5 Coding Procedure

The two primary approaches were used in the coding process. The first is deductive coding, where empirical data is analysed using a predefined, theory-driven coding scheme. The second is inductive coding, which involves generating codes directly from the data. This inductive method, also known as open coding, involves revisiting the data to examine its relevance to the research question, generating new codes in the process (Williamson, Given, & Scifleet, 2018). Once the interviews were transcribed, they were coded, resulting in eight categories: C1: Financial, C2: Maintenance, C3: Technology, C4: Flexibility, C5: Time of Use. C6: Company Policy, C7: Selection Criteria, C8: Other Information. The transcriptions were carefully reviewed multiple times to identify connections with these categories.

4. Results

This chapter begins with a description of the company, followed by the presentation of results in six parts. Firstly, the current state of construction equipment management is outlined. Secondly, the company's purchasing process is discussed. Thirdly, the elements influencing the buy, rent, or lease decision are examined. Fourthly, the company's future construction equipment management is discussed. Fifthly, the selection criteria for construction equipment that respondents considered important are reviewed. Lastly, a framework is established, summarising the elements relevant to the buy, rent, or lease decision, and the selection criteria.

The company, founded in the 1960s, is based in the Netherlands, with multiple branches throughout the Netherlands. It also operates in Germany. The company is family-owned and undertakes multiple projects across the Netherlands. It provides a comprehensive range of services related to utility infrastructure, including gas, water, electricity, telecom, and heat. Projects of the company vary in size and complexity. For instance, it is responsible for installing gas, water, and electricity systems during house construction. The company is a medium-sized member of the Dutch construction market, striking a balance between in-house expertise and maintaining a flexible and dedicated workforce. It positions itself as a partner to its clients, trying to establish notable partnerships with certain clients.

The company adopts a long-term perspective not just across years but across generations. It acknowledges its responsibility to future generations and is committed to fostering connection and cooperation. Sustainability is seen as a collective effort, and the company defines it through actions that benefit both people and the planet. Its sustainability policy is structured around three core pillars: Environment, Vitality & Health, and Future. These pillars align with the United Nations' Sustainable Development Goals (SDGs), providing a globally recognised framework for sustainable business practices.

4.1 Construction Equipment Management

The first section of the results outlines the company's current approach to construction equipment management. This includes the types of equipment used, planning procedures, and the respondent's responsibilities. The company's approach to equipment management is decentralised, with no comprehensive oversight of all construction equipment. During the interviews, the current situation at the company regarding equipment management was addressed. The Technical Service Manager mentioned that the complete equipment fleet is

divided into small and large equipment. The large and small equipment can be used by everybody in the company. As the thesis focuses on the larger equipment, the Technical Service Manager mentioned the "Gone is gone story". This expression refers to the situation where no equipment remains available once all is in use. The statement is confirmed by Contractor 1, who added: *"Any equipment I need for a project. I just have it standing on the construction site, whenever I need it. I can use it"*. Moreover, the Team Manager added: *"Actually, each foreman or crew has their construction equipment, which they take to each project"*.

The construction equipment mentioned by the respondents differs in some ways, but the primary equipment used remains the same. As the Technical Service Manager mentioned, the equipment is divided into small and large. The Team Manager discussed the various types of construction equipment, noting that the company uses tractors, excavators, vibratory rammers and plates, containers, direction units, cable drum trailers, and many other tools. Other construction equipment such as dumpers, shovels, compressors, and power generators, were also mentioned by different respondents. This construction equipment will be primarily used by all of the projects, but some projects use different equipment for each other. The Team Manager explained the different equipment, stating: *"No, it is not too bad actually. We do not need that much different equipment. Of course, if you are laying water, gas, telecom, or electricity you need specific equipment"*. The Technical Service Manager explains that different construction equipment is used between water, gas, and electricity. There will not be a cable drum trailer for a project laying water pipes. Business Manager 1 further emphasised: *"In location X, we are working on home connections, main pipe/cable lines, and charging stations. For the main pipe and cable lines you need heavier and different equipment"*.

Another notable difference is how vehicles are allocated to employees. According to the Fleet Manager, this allocation is primarily based on the employee's role rather than the specific project they are working on. Employees certified to work with water, gas, and electricity are typically assigned the largest vans, as they require the most equipment. In contrast, those performing specialised tasks, such as gas leak detection, are provided with vehicles tailored to their specific needs. The construction equipment requirements vary depending on the type of infrastructure the project involves, whether it is for gas, water, telecom, or electricity. Another factor is whether the project involves laying home connections or main cables and pipelines. In addition to differences in equipment, the

duration and type of project can also vary. As the Technical Service Manager explains, there are day-long, week-long, and multi-month projects, depending on the scale and complexity. Projects can take place at residential addresses, street level, district level, or city level, and may also occur in rural areas.

With the differences and similarities in the needs for the projects, there is an interest in the planning of the construction equipment. Most respondents did not acknowledge a planning such as Business Manager 1. Moreover, Contractor 1 explained why there is no planning, and stated: *"I do not need equipment planning, I grab the equipment whenever I need it. The equipment of my project is just standing at the construction site"*. However, not every respondent, including the Technical Service Manager, agrees with these statements. The Technical Service Manager explains there is more of a drop-off service with little planning. The planning is in terms of transport or repair. Furthermore, the Technical Service Manager contradicts himself with an example: *"When a contractor requests a tractor in advance, they will not be asked how long it will be needed"*. Equipment Manager 2 explained that there is an internal planning of construction equipment, but this planning is rarely recorded. The statements of the respondents were different, but only one of the respondents stated that there is advanced and recorded equipment planning. The Fleet Manager noted that they typically handle the annual planning in September or October for the following year. This planning specifically refers to the vehicle fleet, including cars and vans. The planning and keeping track of the construction equipment have not always been the same. Contractor 1 stated that back in the day: *"if someone took construction equipment from the warehouse, they would take a tag. Every foreman and contractor had tags with numbers on them. If his tag hung on the board, we knew that tractor belonged to that foreman or person"*. This is mainly wiped out by the big growth of the company, as summarised by the respondent's later statements.

As summarised in the previous paragraph there is no clear planning for the entire company regarding the construction equipment, but how are the contractors obtaining the equipment. In the interviews, several respondents mentioned that there are multiple ways to obtain the needed equipment. As already mentioned by the Team Manager, the foreman or crew has construction equipment, which they take with them to the next project. Sometimes, there are new projects or tasks for which the crew does not have the required equipment. One of the ways to get the equipment is to call or text colleagues. Equipment Manager 1 highlighted the frequent swapping of equipment among crews. Since many teams in nearby locations often work on similar tasks, they tend to share tools and equipment by contacting colleagues

until they find what they need. Business Manager 1 further mentioned that people often ask in the group chat if anyone has specific construction equipment available. With the swapping of construction equipment, there is confusion about the location of the construction equipment. The location of the construction equipment is assigned in the system to a person's name or a warehouse location, but it is not regularly updated. The Technical Service Manager mentioned: *"So contractor A owns it. And he lends it to contractor B. Contractor B is again called by contractor C. And from contractor B it is again lent to contractor C. In the end, we do not know where the construction equipment is located"*. Equipment Manager 2 confirmed that the frequent swapping of equipment between crews complicated the search for the location of construction equipment. Another way to get the needed equipment is to call the equipment manager. Equipment Manager 2 mentioned, with an example: *"When Contractor A needs a pipe trailer, it takes one or two days to obtain it, as I have to pick it up from a different location"*. There are mainly two ways to get the needed construction equipment of the company. Firstly, contractors are calling or texting colleagues for the construction equipment. Secondly, the contractors call the equipment manager, who will look for it.

Before the interviews were conducted, the respondents' different functions were expected to have different perspectives on the topics. One reason is that each function has its task. For example, the Controller stated: *"I am responsible for the entire financial administration of the Company"*, while Equipment Manager 1 noted: *"I am in the process of purchasing or renewing larger pieces of equipment*". Table 5 summarises the various functions and tasks, providing insight into the different perspectives of the respondents on construction equipment management.

Table 5. The function of the respondents with the related task, based on the interviews

Function	Task
Business Manager	Managing multiple team leaders and preserving the quality
Controller	Responsible for the financial administration of the equipment
Technical Service Manager	Responsible for the equipment service
Equipment Manager	Responsible for purchasing or renewing big construction equipment
Fleet Manager	Responsible for the vehicle fleet of the company
Team Manager	Managing multiple contractors
Contractor	Managing multiple crews

4.2 The Procurement Process of the Company

The availability of construction equipment in the company is difficult to measure. As mentioned in the previous sub-section the location of the construction equipment is not always clear. In this sub-section, the procurement process of the company will be discussed. The respondents were asked about the availability of the construction equipment within the company. There were some mixed statements between the respondents. Some respondents, such as Equipment Manager 1 and Contractor 2, explain that the availability of equipment is difficult to describe. For Equipment Manager 1, it seems that all the requests for equipment are not stopping the work activities. However, some respondents describe the availability of equipment as better for some respondents. Contractor 1 mentioned: *"The availability of construction equipment at the company is good, but that's because I know the way"*. Furthermore, Equipment Manager 2 confirms this statement and mentioned: *"It is easy for me to get equipment"*.

However, not every respondent is positive about the availability of construction equipment at the company. As Business Manager 2 emphasised: *"The equipment is not always available at the company. I had the experience with pumps the other day. There were no pumps available at the company for the projects"*. Business Manager 1 validates this statement using an alternative example. The respondent stated: *"No, not everybody can get everything because it is not available. One of the serious problems is the cable drum trailers"*. The Team Manager agreed that cable drum trailers are often unavailable, noting that when requesting construction equipment like containers, direction units, and cable drum trailers, they frequently receive a negative response. About the vehicles, there are two different perspectives. The Fleet Manager noted that while external supply is difficult to obtain, internal supply remains manageable. The Fleet Manager explained that the challenge in obtaining external supplies has increased, stating: *"Of course comes under pressure since corona. Additionally, the energy transition puts more pressure on the external supply"*.

There are several people involved in the decision-making process of acquiring construction equipment. Each of the respondents has different involvement in the buy, rent, or lease decision. About the acquiring process of construction equipment, there is some confusion. Business Manager 1 explained that he does not know what the process is. Business Manager 2 has a similar comment about the acquiring process. When asked about the acquisition process, Business Manager 2 mentioned that they are not directly involved in acquiring

equipment. They simply place orders with the warehouse, and the headquarters handles the acquisition on their behalf. Furthermore, Business Manager 2 stated: *"If there are big amounts, then I am included in the process or given feedback if everything is correct"*. Additionally, Business Manager 2 explained that the smaller equipment would simply be handled by the contractor or the project manager. Equipment Manager 1 confirmed this and added that the request for equipment often comes from the contractor, who may discuss it with the business manager, particularly when it involves special or expensive equipment. Additionally, Equipment Manager 1 mentioned his involvement: *"After a short meeting with the contractor or business manager, we find out that something is needed for a longer period. Then we (equipment managers) are getting involved in acquiring the construction equipment"*. Equipment Manager 2 agreed and stated: *"We usually discuss this with the Technical Service Manager. And later the director is deciding if we purchase it, particularly in large amounts"*. The Technical Service Manager further stated: *"The equipment managers discuss their findings with me. I plan to inform the director about the necessary steps and their associated cost. The director needs to approve the large amounts, then we can purchase the equipment"*. The Controller plays a different role in the acquiring process. The Controller can see at the administration what construction equipment is rented. The Controller stated: *"If necessary, I will close briefly with the Technical Service Manager, when do you proceed from renting equipment to buying"*. The decision-making process involves not only construction equipment but also vehicles. The Fleet Manager mentioned: *"I basically single-handedly run the entire vehicle fleet. Which means I purchase the cars and vans"*. The level of involvement is established through the interviews, which are displayed in Table 6.

Table 6. The involvement of the respondents in the buy, rent, or lease decision, based on the interviews.

Stakeholder's Involvement	Buy	Rent	Lease
Business Manager	Medium	Medium	Low
Controller	Medium	Medium	Medium
Technical Service Manager	High	High	Low
Equipment Manager	High	High	Low
Fleet Manager	High	High	High
Team Manager	Medium	Medium	Low
Contractor / Project leader	Medium	High	Low

The respondents' levels of involvement vary. The Technical Service Manager and the equipment managers play a major role in acquiring construction equipment. The Fleet Manager is only responsible for the acquisition of vehicles. The process of acquiring new equipment starts with polling the general availability of certain equipment. By gathering information from the contractors about which project everybody is currently working on. For example, the projects can be cable work or laying water pipes. Additionally, the Technical Service Manager mentioned: *"We always reach out to every contractor with the certain construction equipment on its name. Sometimes we succeed in acquiring the equipment, but more often we get no for an answer"*. If they are unable to secure the equipment, they seek alternatives. Equipment Manager 2 mentioned with an example: *"If I cannot get a tractor at the company, I will contact the supplier and mention that I need a tractor. This can be either renting or buying"*. Renting usually happens when there is often little time to purchase the construction equipment, for example, if needed within the next week. However, this is not always the process. Equipment Manager 1 mentioned: *"When there is a request for new construction equipment, we evaluate different suppliers and select the most suitable option. We usually involve stakeholders in the decision-making process. Once a choice is made, we consult the Technical Service Managers"*. Additionally, Equipment Manager 1 mentioned: *"When larger sums of money are involved, the Technical Service Manager will escalate the request to the director. Once the director approves, the construction equipment can be purchased"*. Figure 8 displays the process of acquiring new, large construction equipment.

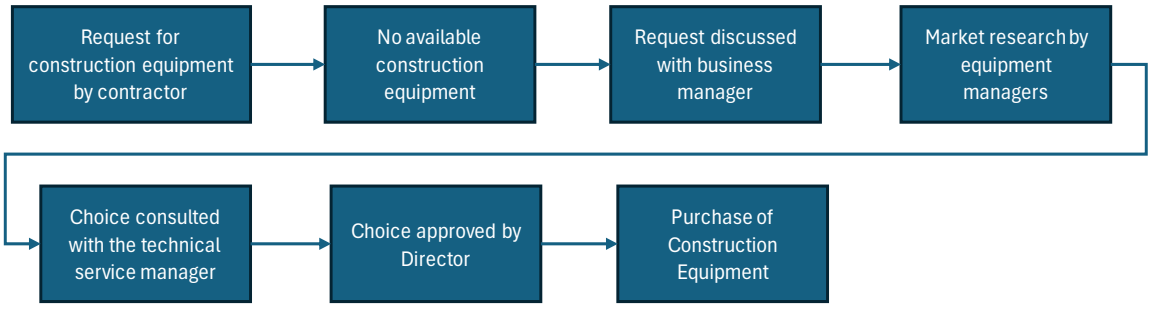

Figure 8. The buying process of new large construction equipment.

4.3 Main Elements that influence the Buy, Rent, or Lease Decision

In the literature review, multiple elements are determined that possibly influence the decision to buy, rent, or lease construction equipment, such as flexibility and maintenance strategy. In the following sub-sections, the elements that influence the decision to buy, rent, or lease construction equipment according to the respondents are discussed.

4.3.1 Financial Considerations in Construction Equipment Procurement

The first element that is being discussed is the financial situation of the company. Before discussing the buy, rent, or lease decision, there will be an introduction to the cost allocation of construction equipment. The Controller explained that cost allocation within the company is based on standardised mark-ups applied across the organisation, with two main percentages in use. For staff, there is an overall cost markup of 47%. This implies that if an employee works externally for one hour, and the cost of that hour is €100, an additional 47% is added, resulting in a total project charge of €147. The 47% covers general overhead costs, including equipment, housing, staff, and sales. Subcontractors, however, have a different mark-up percentage. The Controller mentioned that 10% is applied to subcontracting. For every €100 spent, €10 covers general overheads, with approximately 70% of turnover directed towards subcontracting.

The general policy concerning subcontractors requires them, such as welders, to supply their equipment. However, in certain instances, the company may provide construction equipment to subcontractors if necessary. Not all equipment costs are included in general expenses. According to the business manager, rental equipment costs are allocated to project-specific expenses rather than general overheads. For example, when specific construction equipment, such as pumps, is unavailable, it becomes necessary to rent them. In one instance, €15,000 was spent on rented pumps for a project, which was considered significant since the equipment would usually be covered under general expenses. Had the pumps been available in the company's warehouse, this additional project cost could have been avoided. This was confirmed by the Team Manager, who mentioned: *"If we rent something from our supplier, the cost is allocated to our project, whereas if the company provides the equipment, it falls under general expenses"*.

The financial element influences the decision to buy, rent, or lease equipment, as all respondents highlighted this element. Nine out of the ten respondents believe that buying construction equipment is, in general, cheaper in the long run compared to leasing or renting.

The Fleet Manager explained that leasing involved additional costs, stating: *"You need to understand the business model of a leasing company. You are paying a normal fee, plus for their profit, including an interest component"*. This was confirmed by the Controller, who mentioned: *"You are bringing a lot of money to the lease company"*. Equipment Manager 2 further emphasised: *"A tractor could be leased, but we have never actually explored that option. However, I believe that leasing would cost a fortune"*. This cost concern also applies to renting. The Technical Service Manager mentioned the financial comparison between renting and buying, stating: "*If we are getting close to the purchase price regarding rental cost. People often say we will not throw that money away on renting. Then we will buy the construction equipment"*.

However, buying equipment comes with certain preconditions. Business Manager 2 mentioned: *"Owning construction equipment can be cost-effective, but it requires sufficient liquidity. The company must have sufficient financial resources to purchase the equipment"*. The Technical Service Manager and Controller also confirmed this. The Controller additionally emphasised: *"When liquidity is lower, leasing becomes more likely. At the moment, we are in a favourable liquidity position"*.

There are additional financial advantages to buying construction equipment, such as building equity. The Controller explained that all construction equipment invested by the company is depreciated over five years, regardless of its actual useful life. For instance, the Controller demonstrated a preference for buying construction equipment. The Controller mentioned a project with a shovel, stating: *"We bought the shovel ourselves and most of the purchase price we were able to pass on to the client. That shovel already paid for itself within the project. With renting, you are not able to do that"*.

Although buying equipment has its advantages, multiple respondents also mentioned certain disadvantages. Business Manager 2 emphasised: *"The costs of construction equipment are becoming difficult to control because everything is purchased on a lump sum"*. All purchases are included in general expenses, making it difficult to understand these specific costs. The Team Manager added: *"A lot of the costs are not transparent"*. Another disadvantage of buying is the uncertainty regarding residual value. The Fleet Manager stated: *"You do not know what the residual value of these vans will be. These vans are 15,000 euros more expensive than the current diesel vans, which means a significant financial risk"*. There are also financial advantages to renting within the current system. Business Manager 1

mentioned: *"If you rent construction equipment from Company A, there is a financial stimulus to return the equipment directly when no longer needed, thereby avoiding unnecessary costs"*. The summarised findings of the financial advantages and disadvantages are illustrated in Table 7.

Table 7. The financial advantages and disadvantages of each acquiring method according to the respondents.

	ADVANTAGES	***DISADVANTAGES***
BUY	Long term costs savings	High need for liquidity, through high initial costs, High financial risks and low transparency of costs
RENT	Low financial risks, Includes most costs	Pay a high fee and extra costs on the project
LEASE	Shared financial risk, Includes most costs	Pay a high fee and the possibility of penalties

4.3.2 Maintenance Strategy in the Construction Company

The second element in the decision-making process is the maintenance of construction equipment. During the interviews, every respondent emphasised the importance of maintenance as a critical component. The current state of maintenance practices within the company is discussed, highlighting that the company operates a dedicated technical services team, primarily responsible for conducting most repairs and maintenance in-house. Based in the headquarters, the team entails approximately twenty skilled employees. Some team members focus on inspecting and repairing equipment on-site at various projects, while others manage repairs and maintenance at the headquarters. The Technical Service Manager noted that construction equipment typically undergoes an annual inspection, which includes routine maintenance such as oiling, technical checks, and visual inspections to ensure operational safety. The manager explained that most maintenance tasks are handled internally, except for brand-specific equipment such as tractors and specific tool calibrations.

The condition of the construction equipment varies according to different respondents. Equipment Manager 2 stated: "We have a lot of old construction equipment. Technically, the construction equipment is working, but many items are old and need replacing. We are still somewhat behind on that". Contractor 2 partially confirmed this, stating: "We used to receive rubbish construction equipment, or at least it felt that way. Things are improving now, and we are getting newer equipment". The Team Manager also commented on the inconsistency in equipment condition, stating: "Some equipment looks good, while others are in poor condition. Actually, they are already half dead". Additionally, the Team Manager expressed uncertainty about the company's policy on the renewal of equipment, stating: "I am not sure if there is a policy on when containers or equipment should be renewed".

In-house maintenance offers several advantages. The Technical Service Manager mentioned that managing maintenance internally minimises disruptions to contractors and the work process. Outsourcing maintenance, on the other hand, requires scheduling appointments with third parties, which can reduce flexibility as repairs depend on the availability of external providers. Additionally, the Technical Service Manager mentioned: *"I do not think the cost is significantly different between insourcing and outsourcing maintenance"*.

Despite these advantages, some respondents identified inefficiencies in the company's in-house maintenance approach. Business Manager 2 criticised the current system, comparing it to a "firefighter principle", where the technical service team responds to issues reactively, fixing equipment only when something breaks. Furthermore, inspections are conducted similarly reactively, with inspectors making around 30 visits yearly to check various equipment. Contractor 2, who is in the exact location, supported this view, stating: *"Almost every week someone is coming here to inspect equipment. One week it is person A's equipment, next week person B's, and then person C's"*. Both Contractor 2 and Business Manager 2 stated that these inspections can be more efficient, with Contractor 2 proposing: "*Why not inspect all the construction equipment during the holidays at once"*. However, not every respondent agrees on these inefficiencies. The Team Manager mentioned: *"The inspection is working well. The inspectors plan their appointments and ensure that all equipment is inspected on time"*. Contractor 1 also highlighted the pace of the repairs, stating: *"When something breaks, it is usually fixed by the next day"*. Further emphasised a reason: *"Enschede is close to the technical service centre, so someone is usually available to drive over"*. The projects are distributed across the Netherlands, making location crucial in maintenance strategy, particularly in determining when to rely on external repair services. Equipment Manager 2 stated for projects in Almere: *"We have established a relationship with a dealer of Brand X nearby. Due to the distance, it is impractical for the team in Oldenzaal to travel to Almere for repairs, so we rely on this dealer for quicker service"*.

Maintenance practices also differ for leasing. The Fleet Manager explained that maintenance costs are usually included in an operational lease, whereas the company is responsible for maintenance with a financial lease. The terms of short-term leases can vary, with some contracts including maintenance while others do not, so it is important to pay attention to the specifics of each contract. Equipment Manager 1 added that maintenance responsibility usually does not fall on the renter when renting construction equipment. Contractor 1 supported this, stating: *"When renting construction equipment, it has always worked well*

for me, and I have never had any complaint". The overall findings of the maintenance strategy are summarised in Table 8.

Table 8. Maintenance strategy of each acquiring method according to the respondents.

	RESPONSIBILITY	MAINTENANCE	WHEN TO USE
BUY	Company	In-house	Need for flexibility, Expertise and knowledge in-house, and located close by
		Outsourced	Do not have the knowledge or expertise in-house and located far away
RENT	Rental Company		To focus on core competence and without knowledge or expertise in-house
LEASE	Lease Company		To focus on core competence and without knowledge or expertise in-house

4.3.3 Technology Changes in Construction Equipment

The third element that will be discussed is technology obsolescence. This section will explore current technological advancements, examine future expectations, and discuss how the company responds to these changes through its decisions to buy, rent, or lease equipment.

Technological changes in construction equipment vary significantly depending on the type of equipment. Some types are rapidly evolving, while other equipment will evolve slowly. Equipment Manager 2 mentioned: "*With some machines, you see technology advancing quickly, like rammers. On the other hand, with tractors, the changes are minimal"*. All respondents identified at least one significant technological shift, though some were more commonly mentioned than others. For example, the Technical Service Manager noted that construction equipment is becoming significantly safer, which was also emphasised by Business Manager 1. While safer equipment is an advantage, it also introduces challenges. The Technical Service Manager emphasised: *"Although construction equipment is becoming safer than in the past, not all new safety features are practical to work with"*. Moreover, the increased safety comes with higher costs, both in purchase price and maintenance. The Technical Service Manager added: *"We have to carefully consider whether to invest in safer equipment if it reduces the operational convenience and is not strictly required by clients, especially if we have never experienced accidents with the current equipment"*.

Another technological change was highlighted by Business Manager 2, who pointed to the automation of construction equipment, such as the automation in cable registration systems. Furthermore, the types of cables and coils are getting larger. Business Manager 2 mentioned: *"The coils and cables are getting bigger and bigger. Therefore, requiring different construction equipment than we used in the past"*. The Team Manager also confirmed this

trend emphasising: *"Some of the cable drum trailers are not suitable for the changed conditions"*.

Electrification is another major technological shift that all respondents mentioned. Electrification can be seen as the transition of fossil fuel to electric-powered equipment. Equipment Manager 1 noted: *"We are in the milled of the electrification of construction equipment, the zero-emission trend"*. The Team Manager elaborated further: *"We are already working on projects that are completely electrical, without the use of fossil fuel"*. There are multiple construction equipment that are now electrical instead of fossil fuel. Equipment Manager 1 provided examples, mentioning several electric equipment in use, including shovels, rammers, and vibratory plates. Multiple reasons are mentioned for these technological changes, with the Controller stating: *"The Dutch government is pushing for a rapid transition to zero-emission"*. Equipment Manager 1 added: *"It seems like we want to take the lead in the Netherlands. In some areas, it is already forbidden to release emissions"*. Project contracts also play a role in the shift to electric equipment. Contractor 2 emphasised: *"There are promises made in the new contract. Within a few years, we promised to drive more electric vehicles. This requires us to invest in sustainability. Also, we promised to work with electric construction equipment such as an excavator and a vibratory plate"*. Equipment Manager 2 supports this, stating: *"We already have sometimes demanding requirements to work emission-free, then we do not have a choice"*.

While the demand for sustainable, electric equipment is increasing, there are challenges associated with it. Eight of the ten respondents raised concerns about battery capacity and charging infrastructure. The capacity of the electric construction equipment is one of the downsides. Contractor 1 confirmed this, stating: *"The battery of a vibrating plate lasts for twenty minutes, requiring us to change the battery multiple times a day, which involves much downtime"*. The Controller also noted logistical difficulties, explaining that charging stations are not always available on-site, meaning equipment sometimes needs to be transported for recharging. As the facilities for using electrical equipment are not always there, the Controller stated: *"We want to work with electrical equipment, but the necessary charging infrastructure is not always in place"*. However, several respondents were optimistic about the future improvements in the battery. The Team Manager mentioned: *"The battery packs might get a little bigger and run longer in the future"*. Some other respondents expect more significant improvements. The Controller stated: *"Maybe you can use the vibrating plate for the whole day over 4 years"*, while Business Manager 1 mentioned: *"In five or six years,*

you may have to charge the battery only once a week". Nevertheless, the exact pace of these improvements remains uncertain.

Another disadvantage of electric construction equipment is its higher cost. The Technical Service Manager noted that electric construction equipment is approximately three to three and a half times more expensive than conventional equipment. Renting electrical construction equipment is also more costly, as Contractor 2 mentioned: *"When you want to rent an electrical excavator, it costs around twenty euros an hour more"*. Additionally, there are financial risks associated with electric equipment, particularly its residual value. The Fleet Manager stated: *"The residual value of the electrical vans is unknown, which presents a financial risk"*. Due to the uncertainties and costs, Business Manager 2 advised caution when buying electric equipment, stating: *"You might spend a lot of money on electric equipment that becomes obsolete within a year. Unless it is heavily subsidised, then it could be more attractive"*.

Technological advancements in construction equipment, especially in safety, automation, electrification, and sustainability pressures, influence procurement decisions. High-tech, rapidly evolving equipment often pushes companies toward leasing or renting to avoid obsolescence and reduce financial risks. With low-tech, stable equipment, it is more likely to be purchased outright. Sustainability requirements, including government regulations and client demands, further complicate these decisions. A balanced approach is essential, with subsidies that may shift the preference toward ownership of future technology.

4.3.4 Role of Flexibility in Construction Equipment Procurement

The next element to be reviewed is flexibility. In this chapter, the differences between the respondent's flexibility are explored. Furthermore, the flexibility of the company and its importance is discussed.

Throughout the interview, flexibility remains an important topic. Every interview mentioned a type of flexibility, though the respondents varied in their definitions and interpretations. For instance, Contractor 1 describes flexibility with the ability to use the equipment whenever needed and mentioned: *"I have got a tractor and drum coil trailer at my construction site. I can use the equipment whenever I need it, so I am very flexible"*. Contractor 1 considered flexibility as planning and executing work without delays. Similarly, the Team Manager supported this view, stating: *"I would rather have three too*

many drum coil trailers, so when you need one, you can use it. Otherwise, if one is missing, you are standing still".

On the other side, some respondents have a different interpretation of flexibility. Equipment Manager 1 stated: "*It is like a dream to operate with a safety stock so that we can maintain flexibility by keeping some equipment ourselves at the headquarters warehouse".* The Technical Service Manager confirmed and mentioned: *"You need to be flexible with the equipment, especially with maintaining a minimum safety stock. Larger, special construction equipment is returned to the headquarters warehouse when no longer in use".* In this context, flexibility refers to having equipment on-site and ensuring the company's resources can be deployed efficiently when required. Business Manager 1 emphasised another aspect of flexibility: *"Buying multi-purpose equipment that is not rapidly affected by changing technologies".*

Several reasons for requiring flexibility were raised during the interviews. Contractor 1 mentioned the unpredictability: *"We are dependent on the weather. If it is raining heavily, we cannot work. Sometimes, the work pace varies. If we finish faster but do not have the equipment ready for the next task, the whole schedule stalls, leaving employees idle".* The Team Manager added: *"There are peaks, sometimes we need everything, and other times equipment sits idle".* Flexibility, in this sense, involves responding swiftly to fluctuating demands on-site. The Controller also stressed the internal need for flexibility, mentioning: *"How convenient would it be if, when someone urgently needs a tube trailer, I could ensure one is in stock and ready to deploy".*

The flexibility is also sourced externally. In the case of the company, certain construction equipment can be rented quickly, and these rentals are typically supplied by supplier A. This is confirmed by the Technical Service Manager and emphasised: *"In addition to our safety stock, we rent equipment from supplier A. They are our flexible shell".* However, some specialised equipment, like winches and cable drum trailers, is more difficult to rent and often comes from a different supplier. External rentals are not always preferable, as the Technical Service Manager mentioned: *"If you rely on renting, you cannot always customise the equipment to your exact needs. You are limited to what is available on the market at that time".* Contractor 1 has an example and mentioned: *"I rented a pump from supplier A because all of ours were occupied, but it did not have the power needed. The pump from our company works perfectly".*

Customisation was another critical aspect of flexibility that respondents raised. For Equipment Manager 2, it was essential for equipment to reflect company branding and mentioned: *"I think it is important that the equipment is recognisable as ours, even from a distance"*. There is another example of customisation according to Equipment Manager 1 as mentioned: *"We have a cable drum trailer with a hydraulic lift system that is custom made for us. It is not available on the general market"*. Switching to an alternative is sometimes possible when the ideal construction equipment is unavailable. The Technical Service Manager emphasised: *"If you need a small tractor and it is not available, you can choose a larger one. The downside is higher rental fees and increased operating costs, as bigger tractors consume more fuel"*.

Flexibility is also increasing within the vehicle fleet. The Fleet Manager stated: *"I now have a little more on stock, as the flexibility and speed of the delivery have been under pressure in recent years"*. He further mentioned that short leases are an option when additional flexibility is required and stated: *"I will pay a little bit more for short leases, and it involves more work, but it allows for greater flexibility"*. Short leases or rentals are useful for a couple of reasons. The Fleet Manager emphasised: *"Certain functions are not for the entire year. Some jobs are from March until October, and otherwise, the vehicle will sit idle for the remaining months. Short leases also work well for student mechanics. If they quit after a few weeks, I simply return the vehicle"*. The type of flexibility of each acquiring method is illustrated in Table 9.

Table 9. Type of flexibility of each acquiring method according to the respondents

	TYPE OF FLEXIBILITY
BUY	To customise the construction equipment to the company's needs
RENT	To return the construction equipment at any given time
LEASE	To design the contract to the specific needs of the lease

4.3.5 Influence of Time of Usage on Construction Equipment Procurement

The fifth element that will be discussed is the time of usage. This section addresses how the duration of use affects the decision to buy, rent, or lease construction equipment and how frequently it is used. The usage time of construction equipment varies significantly from project to project. The timeframe of each project fluctuates based on its scale and complexity, ranging from a single day to several months. Projects can be as small as addressing work at a specific location or as large as covering an entire city or rural area.

The length and frequency of equipment usage play a critical role in deciding whether to buy, rent, or lease equipment. In eight of the ten interviews, time of usage was identified as a key element in the procurement process. Most of the respondents agreed on when it is more appropriate to purchase equipment rather than rent it. The Controller mentioned: *"The moment you rent something for a long time, you should consider buying the construction equipment"*. While no precise definition of a 'long time' was provided, the Technical Service Manager stated: *"When approaching the purchase price in terms of rental cost, people often decide not to waste money on renting and proceed to purchase"*. This view is further explained with an example. The Technical Service Manager mentioned: *"There was a need for a site hut for two years. We quickly calculated that renting a small hut from Supplier A for two years would exceed the purchase value, so we decided to buy it. If it is readily available, buying is the better option. Otherwise, we might be stuck with a long-term rental"*.

One challenge with buying is often the delivery times for new equipment. Equipment Manager 2 mentioned that when buying a new tractor, there might be a wait of up to a year for delivery. When immediate needs arise, and the delivery is too long, renting is an option. As Equipment Manager 2 mentioned: *"We are renting construction equipment when we do not have time to buy it. Sometimes we need the construction equipment within a week or two"*. Equipment Manager 1 added that short-term needs are often met through rentals and mentioned: *"For the short-term requirements, such as absorbing a peak moment, we mostly rent the equipment"*.

The construction equipment is not always used at the construction site. Several respondents mentioned that much of the construction equipment often sits idle. Equipment Manager 1 mentioned: *"If you visit construction sites, you will see much equipment standing still, sometimes in the same spot for quite some time"*. Moreover, Equipment Manager 2 emphasised: *"We have much equipment with low operating hours"*. Similarly, the Technical Service Manager stated: *"You find that certain construction equipment is frequently idle. Ultimately, you buy equipment to use it, not to have it sitting idle"*. In some cases, there are justifiable reasons for this. For example, some equipment must be kept on-site as a precaution. The Technical Service Manager stated: *"Some equipment is running ten hours a year because the client's contract required a large pump to be available on-site in case of a leakage"*. There are also solutions to improve the situation. As Contractor 1 mentioned: *"With better control and planning of the construction equipment, utilisation can increase"*.

In the case of vehicles, the time of usage differs. Most of the purchased vehicles will be used for a long time. As mentioned, the company also uses short and operational leases for certain occasions. Regarding short leases, the Fleet Manager mentioned: *"We usually short lease vehicles for a few weeks to up to 8 months, depending on the function of the employees"*. The timespan is longer with an operational lease. As the Fleet Manager mentioned: "For an *operational lease, we usually have a contract from 24 to 36 months, or even longer"*. The Fleet Manager noted there is also a challenge to leasing, stating: *"If you return a vehicle early on an operational lease, there is usually a penalty clause"*. This contrasts with short leases, which allow vehicles to be returned at any time without penalties. The usage time and timeframe for each acquiring method are illustrated in Table 10.

Table 10. The time of usage and timeframe for each acquiring method according to the respondents.

	THE TIME OF USAGE	TIMEFRAME
BUY	For long-term use	> 5 years
RENT	For short-term use	< 1 year
LEASE	For medium-term use	1-3 years

4.3.6 Company Policy Regarding the Construction Equipment Procurement

The final element to be discussed is the company policy regarding buying, renting, or leasing construction equipment. Nine out of the ten respondents referenced specific company policies during the interview. This section will examine various policies influencing the decision to buy, rent, or lease construction equipment.

There is no formal, clearly defined policy regarding whether to buy, rent, or lease equipment nor a written document outlining these decisions. Equipment Manager 2 stated: *"Nothing is mentioned by the top management"*. Despite the absence of explicit policies, indirect company policies influence decision-making. The first company policy that influences the buy, rent, or lease decision involves work activities. The main activities include installing utility infrastructure such as water pipes and electricity cables. As already mentioned by the Controller, 70% of the revenue is directed towards subcontracting. The subcontractors are expected to bring their construction equipment. Certain types of work are routinely outsourced. The Controller emphasised: *"Uncomplicated work, for example digging, is outsourced. Specific and complex work, for example, assembling and welding cable, are done in-house. This was a strategic choice to outsource simpler work"*. This explains why not all equipment on-site belongs to the company. The Team Manager added:

"The subcontractors always bring their excavator". The excavator of the subcontractor needs to be rented, including the subcontractor himself. Another outsourcing activity is the installation of traffic barriers. The Controller emphasised: *"At the moment, we outsource putting traffic barriers. When a project requires them, Supplier B is hired to create a traffic plan and set up the barriers on-site"*. According to the Fleet Manager, the decision to perform the activity in-house depends on various factors, including the availability of resources and expertise. The Fleet Manager mentioned the vehicle fleet: *"The financial component was the deciding factor. If you lack the technical expertise or knowledge in-house, you should question whether you should take it on yourself"*.

In recent years, the company has grown, with more projects coming in, according to the respondents. Equipment Manager 1 stated: *"When you are growing as a company, you also need to invest in construction equipment"*. Similarly, the Controller mentioned: *"The work is increasing, so the moment we score a new contract, we have to invest more in construction equipment"*. However, the company's acquisition policy remains somewhat unclear. Equipment Manager 2 mentioned: *"There is always the motto from management, if we need it, we will buy it"*. Also, Equipment Manager 1 added: *"Basically, we buy everything"*. Nevertheless, the Controller mentioned: *"There is no set policy on it, but if you rent for a long time, we usually consider buying the construction equipment"*. Furthermore, confusion also remains around the budget for equipment investment. The Team Manager emphasised: *"Basically, the management ultimately determines the investment budget"*. While the Controller stated: *"There is no budget for acquiring construction equipment"*. Business Manager 1 confirmed this, stating: *"I have never been asked to submit a budget for construction equipment investment"*.

Technical developments in the construction equipment sector, particularly electrification, are driven mainly by government policies to reduce emissions. Sustainability is also becoming an increasingly important factor in project contracts. Contractor 2 noted that a new contract includes commitments to increase the use of electric equipment in the coming years, emphasising the need to invest in sustainability. Regarding the company policy of electric construction equipment, the Controller emphasised: *"We want to be sustainable, but we must be cautious not to lead the way too much"*. The Controller additionally stated: *"If we increase electrical construction equipment, the project cost will rise. We must be careful that the project remains viable"*. Although the company seeks to enhance sustainability, the facilities are not always there, influencing the project's viability. The Controller mentioned

an example: *"For one project, we could not recharge the equipment at the workplace itself. Therefore, we had to drive very far to recharge it, which reduced the productivity, and the project was unprofitable in the end"*.

Finally, it is important to consider the company's identity as a family-based company. The respondent mentions that the policies and priorities differ from those of a listed company. The Fleet Manager mentioned: *"Employee satisfaction is a key component in this family-based company"*. The Fleet Manager added that unlike publicly listed companies, which are heavily focused on financial performance, family businesses consider factors beyond profits. This is confirmed by Equipment Manager 1, who mentioned: *"In a family business, you are expected to think alongside employees within certain boundaries, but there is still flexibility within those boundaries"*. The Fleet Manager stated an example of employee satisfaction: *"We usually offer employees a small range of choices. For example, you can choose a white or red car, which is not too different in terms of costs"*.

4.4 Future Construction Equipment Management in the Company

During the interviews, respondents raised several aspects that were not covered by the predefined categories. This sub-section summarised the main findings of other mentioned aspects, especially regarding the future of construction equipment management in the case company.

The most frequently mentioned topic by respondents for improvement was the construction equipment management system. Respondents expressed concerns about the current system, particularly its impact on renting practices. The Technical Service Manager stated: *"Everyone tries to avoid renting as much as possible, as it adds extra costs to their operations"*. As a result, many people are holding on to equipment to avoid renting. Contractor 1 mentioned: *"Everybody is hoarding because, for example, we do not have a management on tractors"*. Contractor 1 further explained: *"Everyone holds onto their equipment very tightly, which makes it difficult when I need access to something"*. Several respondents also provided suggestions based on their industry experiences. Business Manager 1, who has extensive experience with various systems, outlined their ideal scenario, stating: *"Inventories are tracked closely, including consumption and utilisation rates. Consultations are held with the implementation team regarding purchases, quality, and brands. A budget is then established, after which purchases are made, and certain items are either written off or depreciated"*.

Two types of preferred material management systems were described by the respondents. The first involves an internal rental company for construction equipment. The Technical Service Manager explained that, in this system, contractors rent the equipment when needed, but the equipment remains within the company. The Technical Service Managers emphasised some advantages of this system, stating: *"There is a financial stimulus to return the construction when it is not being used. This reduces the amount of construction equipment we need to own"*. However, there is also a disadvantage in the internal renting system. Business Manager 1 mentioned: *"You will have more transportation movements. The construction equipment will be more efficiently deployed, but there will be more logistic movements"*. The second option suggested was for each branch to have their construction equipment bundle. Business Manager 2 emphasised that each branch should identify its required construction equipment and contribute a corresponding payment based on a predetermined ratio. Business Manager 2 cited the administrative burden as a key reason for the lack of change in equipment management, stating: *"The process involves much administrative work for each piece of equipment. Every move is carefully documented, including the associated costs. Afterwards, you may shuffle a few empty boxes, but the costs remain unchanged"*.

Another important aspect of equipment management raised by the respondents was the use of data. Business Manager 1 highlighted the potential within the company, stating: *"We have more data than you might think. Data is great, but it is about turning it into actionable information that enables decision-making without the need for interpretation. Data requires analysis, whereas information leads directly to decisions"*. Business Manager 1 further added that the company is not fully leveraging the potential of its data, stressing that more effort is needed to convert data into meaningful insights. Such insights could help identify trends in equipment management of the disappeared, broken, or renewed equipment. The Business Manager 1 noted: *"By investigating where this occurs, what the conditions are, and who is responsible, we can uncover patterns. We might find that whenever certain individuals or factors are involved, there is a recurring issue, a lack of knowledge, or things constantly disappearing"*. This demonstrates the type of information needed to improve equipment management. Contractor 2 further mentioned a way to gather data: "*You might ask yourself if it is feasible to invest in a tracking system that can monitor large equipment, ensuring you always have a clear view of where it is*".

4.5 Main Criteria for Selecting Construction Equipment

This sub-section discusses the different selection criteria for the company's construction equipment. All respondents identified several criteria they consider necessary when selecting construction equipment. However, there is no unified list or formal framework that the company consistently follows. Selecting the right construction equipment is crucial, as equipment that does not meet project requirements often cannot be used. Contractor 1 mentioned an example: *"The subcontractor purchased a batteries-powered cutter for a project. It is a great equipment, but it is wireless. After contact with the client, it was not allowed to cut cables. That piece of construction equipment cost around 30.000 euros"*.

The first and most consistently mentioned criterion is quality. All respondents highlighted its importance, though they described it slightly differently. The Team Manager describes quality as: *"It should be decent construction equipment"*. Equipment Manager 1 added: *"Quality means being able to on it"*. The Technical Service Manager further described quality as ensuring the equipment is robust and 'company proof'. With the term 'company proof' the Technical Service Manager described: *"We work in an aggressive environment, dealing with sand and water. You need equipment of a certain quality to avoid frequent breakdowns, defects, and delays"*. Quality also involves maintenance, as Business Manager 1 emphasised: *"Construction equipment must be durable and robust, requiring minimal maintenance. Additionally, parts should be interchangeable and readily available, ensuring ease of replacement"*. Equipment Manager 2 supported this view. Between a cheaper brand with a 3-week wait for spare parts and a more expensive brand with parts available within a day or two, the equipment manager stated: *"It is better to choose the more expensive option. Shorter waiting times help avoid equipment downtime"*.

Standardisation is another important criterion. Six out of ten respondents noted the value of standardising equipment. Equipment Manager 1 stated: *"For certain brands that function as a 'house brand', we often have more expertise and a greater stock of spare parts. This familiarity and availability can make these brands a preferred choice"*. However, there is a discussion between standardisation and specified construction equipment. Contractor 1 mentioned: *"It is critical that the equipment is specified for the project. but it is also important that it is standardised"*. Similarly, the Fleet Manager mentioned: *"Standardisation is very important, but we prefer standardisation with the company's customisation to it"*.

The company's customisation of construction equipment is important for the respondents. The construction equipment needs to be customised to represent the company's image. Nine out of the ten respondents mentioned company image in the interview as an important criterion. The construction equipment's colour and image must be decent and proper. Equipment Manager 2 emphasised: *"It is important when we buy construction equipment that there is a company recognition on the equipment, especially in terms of colour. You should be able to tell from a distance that the trailer belongs to the company"*. The construction equipment's appearance policy is unclear to all respondents. The Team Manager mentioned: *"I do not know if there is a policy on that. Certainly, I do not know the policy on what a container should look like, and when they should be renewed"*. In some cases, the appearance of the equipment is directly tied to client expectations. Business Manager 1 emphasised: *"We promised the client a fresh white site hut with solar panels on the roof"*.

Another important selection criterion is the safety of the construction equipment. All of the respondents also mention this criterion. Regarding quality and safety, the Controller stated: *"Two of our core values are safety and quality"*. Furthermore, other respondents confirm the importance of safety. The Fleet Manager stated: *"Safety is number 1"*. Safety is integrated into the company's daily operations, especially considering the high-risk environments in which employees work. The Controller further mentioned: *"We are working with gas, water, and electricity. Our specialists deal with these daily, so we must be extremely careful"*. A lot of aspect encompasses safety. The Technical Service Manager mentioned that safety includes injury hazards and hygiene concerns. For the vehicles, there are several safety aspects. The Fleet Manager also noted that vehicle safety features are a top priority, with vans equipped with air conditioning and cruise control. Additionally, the Technical Service Manager compared security standards with those of other companies, stating: *"If we rent a container that is cheaper, but they do not have the required security specifications. Then you face more risks, including potential hidden risks"*.

Moreover, price can be seen as an important selection criterion for acquiring construction equipment. Seven out of the ten respondents mentioned price. Equipment Manager 1 explained that the current cost evaluation includes acquisition and personalisation costs. The personalisation costs can mean adding safety features or theft protection to the construction equipment, which can double the equipment costs. The Technical Service Manager stated: *"For example, a shipping container needs a vent and lockable barricade bar. Plus, there are some costs for the layout of the shipping container"*. However, the maintenance costs are

not taken into account, as Equipment Manager 2 mentioned: *"Because most of our construction equipment has quite a low operating hours"*. However, not all of the respondents agree with this approach. Business Manager 1 says the cheapest is not always the best option. Business Manager 1 stated: *"I would not go for the cheapest. I would carefully consider the most economically advantageous overall, including maintenance, acquiring costs, and other costs"*. The Technical Service Manager and the equipment managers agree that choosing the cheapest option is not ideal but do not factor in maintenance costs. Business Manager 1 mentioned Caterpillar as an example in his previous work, stating: *"Yes, Caterpillar is expensive, but they are durable, strong, and spare parts are always available. They also keep its residual value, making it easier to exchange"*. The acquiring costs are not the only costs for the vehicle fleet. The Fleet Manager highlighted: *"It is often viewed from an economic perspective. We move to a different type of van because it is cheaper in purchase price. But the TCO and serviceability are completely forgotten"*.

Furthermore, the relationship between the company and the supplier can be seen as an important criterion. Five out of the ten respondents mentioned the supplier relationship during the interviews. According to the respondents, the supplier needs to be reliable. Equipment Manager 2 stated: *"The supplier needs to be reliable"*. Equipment Manager 1 further describes a good relationship with a supplier as the following: *"You can just go there in an approachable way, with a question or problem. That he is flexible. That he thinks well with you and can help you with your challenge. Moreover, of course, the supplier has good delivery times"*. The Fleet Manager added: *"The relation should be professional when it needs to be. So tough on substance but soft on the relationship"*. Sometimes, the favour is for a regional entrepreneur rather than a big corporation. The Fleet Manager stated: *"I think relationship management is very important. In doing so, you can support your regional entrepreneur and receive their support in return"*. The Fleet Manager further stated about big corporations: *"I notice that with big corporations like Carglas or Autotaalglas, the corporation does not know the company. You often become just a number in the system"*.

Another selection criterion described by the respondents is operational convenience. Six out of the ten respondents highlighted that construction equipment must have operational convenience, the simplicity with which something can be used. The Technical Service Manager emphasised that operational convenience is high on the list of priorities. The Technical Service Manager mentioned: *"We first consider the operational convenience of the construction equipment, followed by quality"*. The Technical Service Manager illustrates

operational convenience, stating: *"For instance, it includes the working speed and the number of actions required to start or adjust the construction equipment"*. Equipment Manager 2 confirms that operational convenience is important in construction equipment. Moreover, the respondent has an example of adjusting construction equipment for operational convenience. Equipment Manager 2 mentioned: *"For the truck with a lifting crane, we have one fixed driver. The driver was, during the purchase, 50 years old. We chose a model with a lower cabin to accommodate his age, making it accessible for him"*.

The final selection criterion established by the respondents is sustainability or environmental impact. Eight out of ten respondents highlighted the growing importance of environmental considerations, a factor expected to become even more significant in the future. The Technical Service Manager stated: *"At some point, the construction equipment emissions are increasingly important"*. The Fleet Manager confirmed that CO2 emissions are indeed an important aspect of their evaluation. Environmental concerns are gaining prominence in the Netherlands due to regulatory and market developments. Equipment Manager 1 mentioned: *"You should not order diesel-powered construction equipment blindly because you do not know how long you can use it. At the moment, there are a lot of developments in this area"*. According to respondents, the company is actively exploring electric construction equipment. The Controller stated: *"We are testing electric construction equipment, determining if the construction equipment is future-proof as well"*.

Thus, eight selection criteria for construction equipment were mentioned in interviews with the respondents. Quality, safety, price and environmental impact were seen as the most important by the respondents. Table 11 displays these eight criteria, along with the respondents' reasons.

According to the respondents, quality is the most critical criterion. High-quality equipment is needed because the work involves environmentally aggressive conditions, such as water and sand. Without high-quality equipment, the equipment will break down more easily, resulting in downtime. Downtime will cost the company a lot of money, and the respondents want to avoid this in their projects.

Another important criterion is safety, which entails two aspects. Firstly, there are the safety features in construction equipment designed to prevent injuries, accidents or hazardous conditions. Since the construction equipment is used in high-risk environments, accidents can be severe or even fatal. Secondly, there is the security of the construction equipment to

prevent break-ins or theft. Security specifications are necessary; without those specifications, the equipment is vulnerable to potential risks.

However, price is not mentioned as the most important in many cases. The respondents consider that the costs increasingly become more important when renting equipment, due to the direct impact on the respondents' project results. Furthermore, price is regarded as one of the decisive criteria once the other requirements have been met, since higher specifications than necessary can be costly and redundant.

Finally, environmental impact is an important criterion due to unpredictable factors. Firstly, regulations and laws can be revised suddenly, meaning equipment of today may face exclusion due to tomorrow's stricter standards. Secondly, the client's sustainability requirements are increasing in the tender specifications, with some contracts already only demanding zero-emission construction equipment. Moreover, the market developments in the electric construction equipment are rapidly changing, in terms of battery technology and the charging infrastructure. Buying electric construction equipment today can be obsolete as newer, more efficient models emerge. Integrating the environmental impact into the procurement decisions mitigates the risks of regulations, contractual and ongoing technological developments.

Table 11. Summary of the selection criteria of construction equipment according to the respondents

Criteria	**Number of Respondents**	**The respondents' reason**
Quality	10/10	The equipment is used in an aggressive environment
Standardisation	10/10	For in-house expertise and stock of spare parts
Company image	9/10	To fulfil the client's expectation
Safety	10/10	They work in gas, water, and electricity.
Price	7/10	The selection of equipment is often viewed from an economic perspective
Supplier Relationship	5/10	You can support your entrepreneur and receive their support in return
Operational Convenience	6/10	The equipment needs to be comfortable and easy to access for the operators
Environmental Impact	8/10	Due to regulatory and market developments

4.6 Decision-Making Framework

The research identified several critical elements to consider regarding buy, rent, or lease decisions for construction equipment. Key elements include financial stability, maintenance strategy, technological obsolescence, time of usage, flexibility, and company policy.

Buying construction equipment is most suitable for companies expecting to use the equipment over an extended period. When buying equipment, businesses benefit from long-term cost savings. This approach is particularly advantageous for companies with stable project demands and the financial resources to cover the high initial costs. Furthermore, companies with in-house maintenance capabilities can effectively maintain and prioritise repair and maintenance, increasing the value of ownership. However, the buy decision becomes less attractive when technology evolves rapidly of certain equipment, the equipment is required for short-term use, or maintenance costs are unpredictable or high.

Renting construction equipment offers the most flexible option and is ideal for short-term or temporary projects. Renting eliminates the need for a significant upfront investment, making it financially flexible. Moreover, maintenance and repair responsibilities typically fall on the rental company, reducing the burden on the business. Renting is also suitable when the equipment is not part of the core competence, and it further minimises the risk of being left with obsolete technology, as companies can easily upgrade to the latest equipment.

Leasing provides access to equipment over a longer period without the full commitment of buying. Leasing is often chosen when a company needs equipment for medium-term projects but lacks the liquidity to buy it outright. Maintenance and repair responsibilities are typically included in operational leases, reducing the business's burden. Additionally, leasing enables the company to create flexibility in the contract terms, making it an advantageous option for companies facing uncertainty about long-term equipment usage or when technology is advancing rapidly.

In addition to these elements, specific selection criteria play a crucial role in acquiring equipment. These criteria include life-cycle costs, performance, system capabilities, operational convenience, environmental impact, social benefit, company image, and safety. Notably, company image and safety were added by the respondents. Company image must meet client's expectations, ensuring that the equipment is perceived as appropriate and professional. Similarly, safety is a top priority that reflects the company's commitment to protecting workers and minimising risks in hazardous environments.

Moreover, four out of the other six selection criteria mentioned by the respondents differed from those presented by Waris et al. (2019). Most of the respondents' criteria were overlapped, or their focus was too narrow. Therefore, some selection criteria would rather be included in the framework than others. For example, the life-cycle cost is preferred over price, as it captures cost over time. Similarly, social benefit is favoured over supplier benefit, as it represents a complete overview of societal aspects. Moreover, since quality and performance are quite similar, performance will remain in the framework. Finally, system capability will remain in the framework rather than standardisation, as it represents the overall view of the equipment design.

The final decision-making framework, illustrated in Figure 9, integrates these elements and selection criteria. It is based on the research framework, interview findings, and emerging trends in the Dutch construction industry, while also addressing the specific equipment needs of the case company. The three key stakeholders involved in these decision processes are the equipment managers and the technical service manager. Furthermore, the findings are also relevant to directors, business managers, team managers, and contractors.

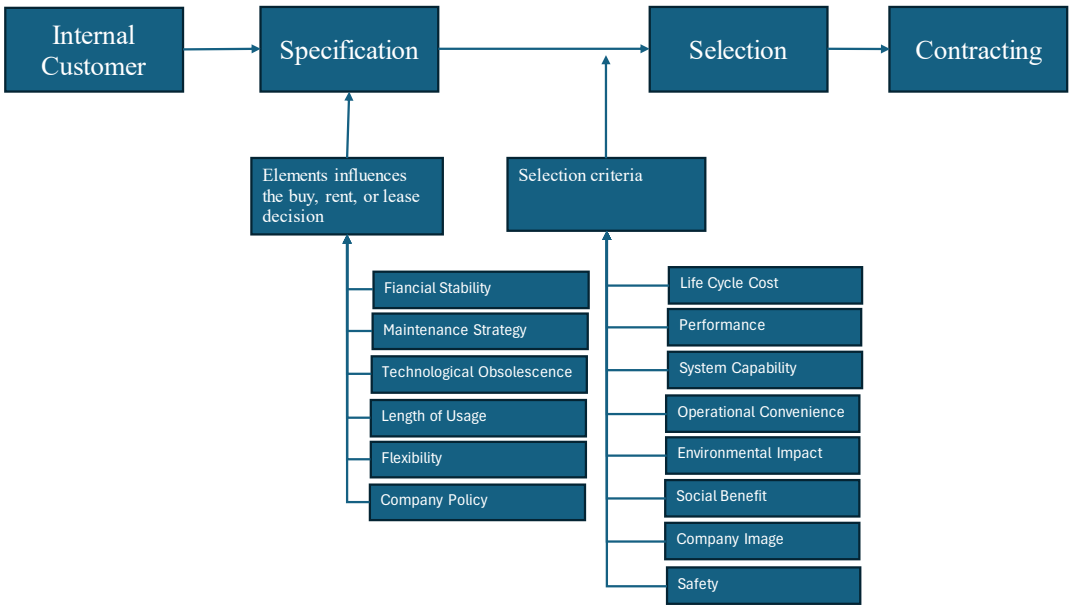

Figure 9. Final framework for the buy, rent, or lease decision and the supplier selection criteria adapted from Waris et al. (2019) for construction equipment in the Dutch construction industry.

5. Discussion

This research aims to understand the decision-making process regarding the Dutch construction industry's buy, rent, or lease options for construction equipment. The findings provide insights into the key elements influencing these decisions. In this chapter, the practical findings of the results for the case company are compared to the literature to identify the key elements that influence equipment acquisition strategies.

The decision to buy construction equipment is often explained by long-term financial planning and stability. This case study suggests that companies must be financially stable to facilitate the high initial investment required for equipment purchases, which is consistent with the literature (Schexnayder & David, 2002). Buying involves higher upfront costs but is generally more cost-effective in the long run. The findings suggest that the case company focuses on acquisition costs, but previous research emphasises the importance of the total cost of ownership, including maintenance and operating costs (Day & Benjamin, 1991).

Another critical factor influencing the decision to buy equipment is a company's capacity to manage maintenance in-house. In-house maintenance strengthens independence from external suppliers, thereby increasing the flexibility of the maintenance planning. This finding is confirmed by the literature, suggesting that in-house maintenance offers greater control over equipment performance and reduces downtime (Mao & Zaleski, 2011). With minimal technological changes, buying is preferable because fewer changes reduce the risk of outdated equipment. Buying could present a financial risk for rapidly changing technologies, such as electric construction equipment. This could lead due to obsoletion.

Another reason for buying is the ability to customise equipment. This flexibility allows companies to adjust their equipment to meet project requirements or for branding purposes. However, the lead time for buying and customising equipment can be long and requires planning. In contrast to the literature, where buying has often been perceived as inflexible due to the difficulty in exchanging equipment when needed (Dyment, 1996), this study demonstrates that buying construction equipment offers flexibility through customisation.

This study's findings suggest that companies are more likely to rent construction equipment when facing lower financial stability or for projects with short-term needs. The elimination of initial capital investment makes renting a suitable option for financially constrained companies. However, the case study and the literature suggest that rental fees are higher than

the long-term costs of ownership. Nevertheless, renting offers the benefit of outsourcing maintenance, which can minimise the operational burden of equipment (Griffin, 2002).

Renting also has the ability to minimise risks in acquiring construction equipment with rapid technological advancements. With renting, the company can use the latest equipment without the financial risk of ownership and obsolete equipment (Mao & Zaleski, 2011). However, this case study suggests that the flexibility of renting may be limited. The availability of rental equipment depends on the market and suppliers, particularly for specific construction equipment. This dependence on suppliers limits the company's ability to adjust quickly to project demands. This contrasts with the literature, which typically describes renting as highly flexible (Dyment, 1996).

Renting is most advantageous for shorter periods, such as during peak seasons or delays in the delivery of purchased equipment. According to this case study, renting is used for projects less than a year. During fluctuations in demand, the flexibility of renting is beneficial, as the construction equipment can be returned to the rental company without any restrictions. This study also suggests that equipment for non-essential activities, such as excavators and traffic barriers in the case company, should be rented. Respondents indicated that this equipment was rented because it was not part of the company's core competencies.

Leasing is not frequently used by the case company due to limited knowledge and experience with this procurement method, but it offers a middle-ground option between buying and renting. Leasing spreads the cost of equipment over time through contracts lasting one or several years. This makes it beneficial for companies with low financial stability. Leasing is similar to renting but offers greater predictability in long-term planning and budgeting (Nevitt & Fabozzi, 2000).

Leasing is, according to the study findings, attractive for construction equipment that undergoes rapid technological changes. The risk of technological obsolescence is transferred to the supplier with leasing. Companies maintain access to up-to-date equipment without the unknown residual value risk. According to the findings, electric construction equipment presents financial risks. Therefore, leasing of electric equipment should be considered, which aligns with literature that identifies leasing as an effective strategy for reducing technological and financial risks (Mao & Zaleski, 2011). The complexity of leasing contracts regarding maintenance can pose challenges. Some companies include maintenance in the contract, while other companies do not. Leasing is an optimal choice for companies

seeking a longer-term commitment without the total financial burden of ownership. Leasing is particularly beneficial when there is uncertainty about the future residual value of equipment.

The buy, rent, or lease decision regarding construction equipment is complex and differs depending on the situation. Financially stable companies prefer the buy decision because of the long-term savings and control over maintenance and customisation, but there is the risk of obsolete equipment. Financially constrained companies prefer the rent decision for flexibility, access to up-to-date equipment, and the ability to focus on the core competence. Companies can focus their resources on their core competence instead of buying equipment. However, renting is costly and does not allow for customisation of construction equipment. Finally, leasing spreads costs over time and reduces financial risk, offering a middle-ground solution for medium-term use, particularly for rapidly evolving technology. Each option presents trade-offs that depend on financial stability, maintenance strategy, flexibility, time of use, technology changes and company policy. The case study provides insights into the challenges and considerations that construction companies in the Netherlands can face, illustrating the importance of modifying equipment acquisition strategies to the specific company context.

Several differences in the selection criteria regarding construction equipment merge when comparing the study's findings with the literature. The framework of Waris et al. (2019) identifies safety as a sub-criterion that is part of social benefit. In this research, safety is not seen as a sub-criterion but as a main criterion. During the interviews, several respondents mentioned safety as one of the most critical factors in selecting construction equipment, therefore making it crucial in the selection criteria.

Life-cycle costs present another difference between the literature and the study findings. According to Waris et al. (2019), life-cycle costs are important in decision-making. This concept is not fully implemented within the case company, which focuses more on acquisition costs. The broader financial implications of ownership, such as maintenance, operational expenses, and disposal, are not included. This gap between theory and the study findings highlights the need for companies to adopt a more comprehensive approach to evaluate costs across the equipment's life-cycle.

Operational convenience is also different in the study findings compared to the literature. In the literature, operational convenience is discussed in terms of efficiency and productivity.

In this study, respondents emphasised operational convenience as a key criterion and related it more to the intuitive ease of use of the equipment rather than broader operational efficiencies. This suggests that the case study participants prioritised user experience and equipment handling in the decision-making process of the research findings, while other considerations are found in the literature.

Environmental impact is one area where this study's findings and the literature align. The literature and this study both identify environmental impact as a crucial criterion in equipment selection. With increasing regulatory pressures and contractual requirements to reduce emissions, the construction industry is becoming more focused on sustainability. Within the construction industry, there is pressure to use sustainable practices and equipment to meet regulation standards. There is also uncertainty about how quickly regulations may change, as the Dutch government can control the pace of these increasing regulations.

This study reveals company image as a crucial selection criterion, which is absent from the literature. Construction equipment should represent the company image, for example, by being painted in the company's colours or with its logo. This underlines the situation-specific decision-making of construction equipment in the construction industry, where practical considerations often differ from theoretical models.

Finally, in this study, social benefits were often mentioned as part of the selection criteria for construction equipment, with safety and operational convenience being the top criteria. There is a slight contrast with the literature, which includes a broader range of sub-criteria under social benefits. The company's focus on safety and operational convenience may reflect its operational priorities and risk management considerations, which differ from the more comprehensive frameworks suggested by scholars like Waris et al. (2019).

5.1 Theoretical Relevance and Practical Implications

In the literature, buy-rent or buy-lease decisions are addressed, but there is little focus on construction equipment or the construction industry. This research expands our understanding of the buy, rent, or lease decision, by exploring the six key elements within the Dutch construction industry. Furthermore, this study refines and extends the selection criteria of Waris et al. (2019) within the Dutch market, by adding safety and company image into the framework of selection criteria. The research provides a practical view of construction equipment acquisition in decision-making by conducting interviews in a single case study.

Construction equipment type plays a crucial role in determining whether to buy, rent, or lease. There is substantial variation between different types of equipment, and each procurement process influences decision-making elements differently. According to the respondents, some types of construction equipment face rapid technological changes, while other equipment types do not. When technology changes rapidly, leasing or renting may be more favourable. Conversely, when the company is financially stable, and the equipment will be used long-term, buying is recommended for lowering costs over time. For short-term needs, renting is advised. Thus, this study indicates that each decision in the acquisition process must be carefully considered, and the recommended option depends on various elements, such as the company's financial position and the type of equipment.

Depending on the country or the industry, acquisition strategies can differ. In this case study, purchasing is the preferred method for the Dutch construction equipment market. In contrast, leasing is the most popular means of acquisition in the Greek construction equipment market. This is mainly due to the financial conditions of the companies, the management of their equipment fleet, and the economic situation of both the country and the funding institutions (Petroutsatou & Giannoulis, 2022). Moreover, the construction face a similar decision regarding whether to buy, rent, or lease. According to Nisbet and Ward (2001), these decisions involve financial and technical considerations. For instance, maintenance and repair influence the financial analysis and practical operation, whether to lease or purchase equipment in these industries.

The findings of this study's framework are illustrated in Figure 9, which outlines the main elements and selection criteria influencing equipment acquisition. This framework is designed for equipment managers, heads of technical services, and other key stakeholders

and serves as a guide for making informed decisions regarding construction equipment acquisition. The framework can be used in decision-making, with each element having its variables. For example, regarding the time of usage, equipment required for longer than five years is preferably bought, equipment required between one and three years is preferably leased, and equipment required for less than one year is preferably rented.

In this research, the meaning of flexibility varies depending on whether equipment is being bought, rented, or leased. With buying, flexibility allows the customisation of equipment, whereas renting offers the flexibility of returning the equipment when needed. In leasing, the contract can be set up flexibly. These differences in flexibility must be considered in the decision-making process.

Moreover, this study recommends that companies should take the total costs of ownership into account, including maintenance and operational expenses, as confirmed by Ferrin and Plank (2002). The case company solely focused on acquisition and customisation costs, but greater awareness of the total cost of ownership is needed to avoid unexpected future expenses, such as maintenance and operation costs. For example, major repairs and overhauls generally cost between 50% and 100% of the original investment in the equipment over its lifetime (Day & Benjamin, 1991). The equipment manager should consider the total cost of ownership in the equipment selection criteria. Additionally, monitoring and predictive maintenance can lead to lower maintenance and repair costs for equipment.

Furthermore, the case company should conduct research in certain areas. Currently, the company only leases electric vans, but leasing is a complex acquisition method that requires specialised knowledge. The transition to electric construction equipment also addresses further research needs as the amount and variation of electric construction equipment in the Dutch market increases. Other markets make similar shifts towards electric construction equipment, like the Chinese construction industry (Tong, Miao, Li, et al., 2021). There have been significant developments in electric equipment in recent years (Huang, et al., 2024), and rapid technological changes introduce risks when acquiring construction equipment. Leasing is a suitable solution for managing these risks, but it requires companies to remain informed about the latest technological advancements and market trends. The case company should continuously monitor and assess new technological developments regarding construction equipment.

Within the case study company, there is no formal equipment acquisition policy. This leads to inconsistent decision-making, which will increase as project demands grow and sustainability goals evolve. The company should be consistent and efficient with buy, rent, or lease decisions and in the development of selection criteria for construction equipment. It is recommended to establish a clear, structured policy to help align financial, operational, and sustainability goals.

The findings identified a problem with the cost allocation of the company's equipment management system for the buy, rent, or lease decision. The current system penalises contractors for renting construction equipment by charging additional fees to their projects, while already purchased equipment is included as a fixed percentage. This financial element negatively influences renting within the company. It is recommended that the company redesign its cost allocation process to reflect a more accurate situation between renting versus buying construction equipment.

This study highlights the gaps between the literature and the findings of the equipment selection processes in the construction industry. For example, Waris et al. (2019) considered safety as a sub-criterion under social benefits, but safety was a critical selection criterion in this research. This research aligns with the statistical data, as the Netherlands had the lowest incidence rate of fatal accidents in the construction industry among European countries in 2022 (Eurostat, 2025), indicating the emphasis on safety in this country. Besides safety, the findings introduced company image as an important criterion. However, no literature finds that company image is an important selection criterion, but the literature indicates that company image affects the success of a construction project (Alzahrani & Emsley, 2013).

The findings suggest the need for construction companies to include safety and company image in the selection criteria for construction equipment. The case companies should work with life-cycle costs in their cost evaluations, including maintenance and operational expenses. The company should research the possibility of leasing construction equipment, especially given the transition to electric construction equipment. Finally, this study recommends that the company should redesign its cost allocation for construction equipment.

5.2 Limitations and Future Research

This single case study was conducted on a family-owned construction company. The findings of the company's decision-making processes regarding the acquisition of construction equipment are relevant. but, the unique characteristics of a family-owned company may limit the applicability of the findings to other types of companies. Additionally, the equipment management system at the company influenced the results. The cost allocation of equipment negatively influences contractors' decisions to rent, and this cost allocation system is company-specific and may not reflect the allocation of costs in other companies, which could affect the broader relevance of the findings.

The roles and knowledge of the respondents are another limitation. A few respondents did not have experience purchasing construction equipment, while several were not highly involved in purchasing decisions. This research was unable to include an interview with the company's director due to internal reasons, which would have provided a greater understanding of company policy and decision-making related to equipment acquisition.

The case company does not frequently lease except for a few electric vans; this means that there is no construction equipment under a lease agreement. Most of the respondents had limited experience and knowledge of leasing, with their insights instead more focused on renting and buying. The lack of the respondents' leasing experience may have affected the study's findings on leasing as an option.

Future research could explore the buy-rent-lease decision across several companies, with different ownership structures and cost allocation systems. One of the options is to conduct a multiple case study with a large number of companies. This could help to provide a more comprehensive framework and test the outcome of this study's findings. Future studies could use a more balanced sample of respondents, including a larger group of individuals with experience in buying, renting, and leasing equipment.

The decision to lease construction equipment requires further investigation, especially as leasing becomes more relevant with the rise of electric and technologically advanced equipment. Companies that lease construction equipment could be researched to provide insights into the cost, flexibility, and access to up-to-date technology of leasing in comparison to buying and renting.

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Appendices

Appendix 1. Interview Questions

*Dutch version:

Elementen die een rol spelen in de koop, huur, of lease beslissing in constructie materieel in de Nederlandse constructie industrie.

1. Instructies voor de ondervraagde.
    a. De anonimiteit van de respondent wordt gewaarborgd. Uitleggen dat het interview zal worden opgenomen. Verder zal er gevraagd worden om toestemming voor opname en dat de gegevens gebruikt zullen worden voor de masterscriptie. De toestemming kan op elk moment worden ingetrokken. Uitleggen hoe de geïnterviewde na het interview zal worden geïnformeerd.

2. Doel van het onderzoek
    a. Het doel van het onderzoek: het bedrijf begeleiden in de beslissing om bouwmaterieel te kopen, huren of leasen en welke elementen daarbij een rol spelen.

3. Persoonlijk gerelateerde vragen.
    a. Kunt u uw functie omschrijven?
    b. Wat is uw ervaring bij het bedrijf?
    c. Wat zijn je verantwoordelijkheden binnen het bedrijf?

4. Wat is de huidige situatie met betrekking tot het materieelbeheer?
    a. Welk materieel gebruikt u? En waarvoor?
    b. Wat zijn de belangrijkste projecten? Waar bevinden deze projecten zich? Hoe gaat het transport naar deze projecten?
    c. Wat zijn externe partners of klanten van het bedrijf?
    d. Wat is de planning met betrekking tot het materieel?
    e. Hoe is de beschikbaarheid van materieel in het bedrijf?
    f. Hoeveel tijd wordt er besteed aan materieelbeheer?
    g. Hoe wordt de bezettingsgraad van de apparatuur berekend? Of hoe zou je dat doen?

5. Hoe verloopt het aanschafproces van materieel?
    a. Wordt het materieel gekocht, gehuurd of geleased?

b. Welke element zijn belangrijk bij de keuze voor kopen, huren of leasen?

c. Wie zijn er betrokken bij de beslissing om materieel te kopen, huren of leasen?

d. Wat zijn de voor- of nadelen van elke aankoopmethode?

*6A. Wat zijn de belangrijkste criteria waarop het materieel wordt geselecteerd?

a. Hoe worden de functionele specificaties gedefinieerd?

b. Hoe worden de technische specificaties gedefinieerd?

c. Hoe worden de leveranciers geselecteerd?

*6B. Wat zijn volgens jou belangrijke aspecten op het gebied van materieel?

a. Waaraan moet het materieel voldoen?

b. Welke aspecten mis je in het bedrijf?

c. Welke aspecten zijn goed geregeld?

7. Heeft u mij iets belangrijks te vertellen over het materieelbeheer of de aankoop van materieel? (Visie/toekomst?)

*6A is questioned with persons who are directly involved in the acquiring process and question 6B is asked to the users of the construction equipment