INDUSTRY

Factors Influencing Heavy Machinery Rental Decisions: A Literature-Based Review and Conceptual Framework for Cranes, Boom Lifts and Truck-Mounted Boom Lifts

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Abstract

Cranes, boom lifts and truck-mounted boom lifts are essential to construction, infrastructure, industrial and maintenance work, but owning them requires heavy capital investment and brings depreciation, storage, transport and maintenance burdens. Many contractors and businesses therefore rent such equipment for the duration of a project. Rental decisions are shaped by a combination of economic, technical, operational and risk-related considerations, yet the academic literature mostly treats them under the broader heading of construction-equipment selection. This paper reviews the published research on equipment and crane selection, synthesises the factors it identifies, and relates them to the rental of cranes, boom lifts and truck-mounted boom lifts. Drawing on the review and on practical exposure gained during an internship at a lift and access-equipment company in Navi Mumbai, the paper proposes a conceptual framework of ten rental decision factors grouped into four dimensions, sets out six propositions for empirical testing, and identifies gaps in the literature, notably the limited attention to operator availability, transportation, rental duration and provider reputation. The paper offers a structured basis for future survey-based research and practical guidance for rental providers.

Keywords: heavy machinery rental; construction equipment selection; cranes; boom lifts; aerial work platforms; decision factors; conceptual framework

1 Introduction

Heavy lifting and access equipment sits at the centre of modern construction and industrial activity. Cranes lift, lower and move heavy loads. Boom lifts carry workers and tools on a platform at the end of an articulated or telescopic boom. Truck-mounted boom lifts place a similar platform on a road-going vehicle so that it can be moved between sites without separate transport. Each machine is expensive to buy, requires skilled operation and regular inspection, and is needed only intermittently by most users.

Renting resolves this mismatch. It converts a capital expense into an operating expense, avoids the cost of holding idle equipment between projects, and lets a customer match machine type and capacity to each job. For rental companies the commercial question is which attributes of equipment and service make a customer choose one machine or one provider over another.

The academic literature has examined equipment selection from several angles, including optimisation models, decision-support systems, sustainability criteria and contractor competitiveness (Naskoudakis & Petroutsatou, 2016). Crane selection in particular has attracted a sizeable body of

work (Wang et al., 2021). However, the rental decision as such, and the aerial work platform segment (boom lifts and truck-mounted boom lifts), are less well covered. The author's internship at Worldwide Machines Impex, a Navi Mumbai firm operating in the lift and access-equipment sector, provided practical exposure to enquiry handling, quotations and client communication on rental requirements, and prompted this review.

The paper has three aims:

1. to review published research on construction-equipment and crane selection and extract the factors it identifies;
2. to relate those factors to the rental of cranes, boom lifts and truck-mounted boom lifts; and
3. to propose a conceptual framework and a set of propositions to guide future empirical research on rental decisions.

2 Approach

This is a narrative literature review and conceptual paper. It does not report primary survey data. Sources were identified through searches of publisher and indexing sites for studies on construction-equipment selection, crane selection and decision-support models, and through the reference lists of those studies. Priority was given to peer-reviewed journal articles with verifiable bibliographic details. Industry practice is described using the website of the internship organisation and the author's observations during the internship. Because the review is selective rather than exhaustive, its conclusions are indicative and are framed as propositions for testing, not as established findings.

3 Background: the equipment and the rental market

3.1 Cranes

Cranes are selected on load capacity, lifting height, working radius, site conditions, duration and accessibility. Mobile, hydraulic, truck-mounted and telescopic cranes serve different applications. Because a crane may be required only for a single lift or phase of work, it is among the equipment most commonly rented rather than owned.

3.2 Boom lifts

Boom lifts are aerial work platforms. Articulating booms give access around obstacles; telescopic booms offer greater horizontal reach. Selection depends on working height, horizontal reach, platform capacity, terrain and indoor or outdoor use. Typical uses include building maintenance, electrical work, painting, installation and inspection.

3.3 Truck-mounted boom lifts

Truck-mounted boom lifts combine an elevated platform with a vehicle. Their mobility suits work spread across several locations, such as utility maintenance, signage and street-lighting work, and infrastructure upkeep. Rental decisions also involve vehicle accessibility, fuel or operating expense and transport arrangements.

3.4 Rental providers

The internship organisation presents itself, on its website, as a team with expertise in lift and access equipment, with a portfolio that includes scissor lifts, telescopic mobile cranes and boom lifts, and it emphasises that machines are checked, tested and serviced by engineers. Its customer base spans construction and infrastructure contractors, industrial and facility-management firms, utility service providers and event or temporary-project operators. This profile illustrates why customers evaluate inspection, servicing and technical support alongside price.

4 Review of the literature

4.1 Crane selection

Early work on crane selection modelled the choice of the optimum crane for a construction site as a technical and economic problem (Furusaka & Gray, 1984). A more recent critical review of crane selection in building construction identified 19 constraints, 70 selection criteria and 8 selection methods, and distinguished tower-crane from mobile-crane selection, concluding that crane selection is a multi-factor decision and not a matter of price (Wang et al., 2021).

The study most directly relevant to rental is El-Tourkey et al. (2022), who built an integrated decision-support system for mobile crane selection that combined the analytic hierarchy process (AHP) with the simple multi-attribute rating technique (SMART). Their analysis found rental cost, crane availability and safety considerations to be the most significant criteria. This is notable because it places rental cost and availability, not only technical suitability, at the top of the mobile-crane decision.

4.2 General equipment selection

Samee and Pongpeng (2016) surveyed contractors and used structural equation modelling to link equipment-selection factors to contractor competitive advantage. They identified six factors: compatibility with site characteristics, services and maintenance, costs, safety and environmental effects, ease of acquisition, and technology and innovation. Two points stand out for rental. First, services and maintenance and ease of acquisition are explicitly treated as selection factors, which maps closely onto rental provider support and availability. Second, the study shows that appropriate equipment selection is connected to contractors' broader competitiveness, so the decision matters beyond the immediate job.

Raja Prasad (2016) used interpretive structural modelling to study the factors influencing equipment selection in Indian construction organisations and found productivity and safety to be the important factors, in a context where equipment selection involves large capital commitments. As the only study here set in India, it is particularly relevant to the Indian rental market.

4.3 Sustainability and soft factors

Waris et al. (2014) noted that equipment selection traditionally rests on matching available equipment to tasks, accounting for productivity, capacity and cost, and proposed criteria drawn from the triple bottom line of sustainability, based on a questionnaire survey of Malaysian contractors. Waris et al. (2019) extended this with an AHP-based sustainable procurement index covering 38 subcriteria. Together these works show that environmental and social considerations, including emissions, health and safety, are entering equipment-selection decisions alongside cost and performance.

4.4 Overview studies

Naskoudakis and Petroutsatou (2016) reviewed a decade of research on construction equipment and identified optimisation, decision-making, maintenance, innovation and environment among the main themes. Their review confirms that research is concentrated on models and optimisation, with comparatively little on how customers behave when choosing between rental offers.

4.5 Synthesis

Table 1 summarises which factors are supported by the reviewed literature.

Table 1. Factors influencing heavy machinery rental and the support for each in the reviewed literature.

Factor	Supporting evidence in reviewed literature
Rental cost	Most significant criterion in mobile crane selection (El-Tourkey et al., 2022); costs as a selection factor (Samee & Pongpeng, 2016)
Machine availability	Among the most significant crane criteria (El-Tourkey et al., 2022); ease of acquisition (Samee & Pongpeng, 2016)
Safety	Significant criterion (El-Tourkey et al., 2022); important factor in Indian organisations (Raja Prasad, 2016); safety and environmental effects (Samee & Pongpeng, 2016)
Capacity, performance and suitability	Compatibility with site characteristics (Samee & Pongpeng, 2016); productivity and capacity in matching equipment to tasks (Raja Prasad, 2016; Waris et al., 2014); project and site constraints (Wang et al., 2021)
Service and maintenance support	Services and maintenance as a selection factor (Samee & Pongpeng, 2016)
Technology and innovation	Selection factor (Samee & Pongpeng, 2016)
Environmental and sustainability considerations	Waris et al. (2014, 2019); Samee & Pongpeng (2016)
Machine condition and age	Indirectly through maintenance and reliability themes; limited direct evidence
Operator availability	Limited direct evidence in reviewed studies
Transportation cost and rental duration	Limited direct evidence in reviewed studies
Provider reputation and service quality	Limited direct evidence in reviewed studies

5 Conceptual framework

Combining the literature with observation of rental practice, ten factors are grouped into four dimensions that jointly shape a customer's rental decision and, through it, satisfaction and repeat business.

Economic dimension

- Rental cost
- Transportation and other additional charges
- Rental duration and flexibility of terms

Technical dimension

- Capacity, performance and suitability for the task and site
- Machine condition, age and reliability

Operational dimension

- Availability and delivery time
- Operator availability
- Maintenance and service support

Risk and relationship dimension

- Safety features and inspection
- Provider reputation and service quality

The framework implies that the effective cost to the customer is a total rental cost, including transport, operator and delay-related costs, and that technical fit, availability and safety act as conditions that a machine must satisfy before price is compared. Provider support and reputation act as risk reducers, particularly for renters who do not own the machine and cannot directly assess its maintenance history.

6 Propositions for future research

The framework generates the following propositions, which could be tested through a customer survey or multi-criteria decision methods such as AHP.

- **P1.** Rental cost, machine availability and safety are weighted most heavily in crane rental decisions, consistent with El-Tourkey et al. (2022).
- **P2.** For boom lifts and truck-mounted boom lifts, working height, reach and platform capacity are the dominant technical criteria, with machine condition and safety close behind.
- **P3.** Customers evaluate total rental cost, including transportation and operator charges, and not the headline rental rate alone.
- **P4.** The importance of operator availability is higher for cranes than for boom lifts, because of the skill and certification requirements of lifting operations.
- **P5.** Provider reputation and service support are stronger decision factors for customers that rent infrequently and lack in-house equipment expertise.
- **P6.** Customers' satisfaction with rental services depends on the combined performance of cost, availability, condition, safety and support, not on any single factor.

7 Implications

For rental providers. The literature and practice both suggest that price competitiveness alone is not sufficient. Providers can strengthen their offer by publishing transparent total-cost quotations that include transport and operator charges; keeping commonly requested machines available and giving realistic delivery commitments; carrying out and documenting pre-delivery inspection and preventive maintenance; advising customers on matching machine specification to the job; and responding quickly to enquiries and breakdowns. Using digital tools for enquiry, quotation and availability information, and collecting feedback after each rental, can support these practices.

For customers. Customers should define job requirements first (load, height, reach, ground and site conditions, duration), request inspection and maintenance records, compare total cost and confirm operator, transport and support terms before committing.

For researchers. The concentration of existing work on selection models suggests value in customer-side empirical studies of the rental market, particularly in India, and in studies of aerial work platforms.

8 Limitations

This is a narrative review. The literature search was selective, and the reviewed studies concern equipment selection by contractors in general, often including purchase and ownership decisions, so the transfer of their findings to the rental setting is partly an inference. Most of the cited work concerns cranes, and evidence on boom lifts and truck-mounted boom lifts is thinner. The paper contains no primary data, and the framework and propositions have not been empirically tested. Observations from the internship are illustrative and not systematic data.

9 Conclusion

Heavy machinery rental decisions are multi-factor judgements. The reviewed research consistently shows that cost, availability, safety, technical suitability and service support matter together, and the evidence on mobile cranes places rental cost, availability and safety at the top. Factors such as operator availability, transportation, rental duration and provider reputation are prominent in practice but under-researched. The framework and propositions presented here offer a structured starting point for survey-based and multi-criteria studies of cranes, boom lifts and truck-mounted boom lifts, and give rental providers a checklist of the dimensions on which customers are likely to judge them.

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