# Research Methodology (Quantitative Approach)

## 1. Introduction

The purpose of this research is to design and implement a Furniture Workshop Management System for a small-scale family-run workshop. The workshop, operated by the researcher’s father, currently relies on a manual bookkeeping system where all sales, orders, and payments are recorded in handwritten ledgers. While this method has sustained the business for years, it suffers from common limitations: difficulty in retrieving past records, lack of real-time data visibility, increased risk of errors, and the absence of analytical insights for decision-making.

To overcome these challenges, a digital system is proposed that incorporates not only core management functions such as customer registration, product cataloging, order tracking, and payment handling, but also AI-driven enhancements including recommendation engines, fraud detection, chatbot assistance, and image recognition for custom furniture uploads.

To ensure that the system is designed on a solid foundation of evidence, the research adopts a quantitative methodology. Unlike qualitative approaches that focus on perceptions and subjective experiences, the quantitative approach collects and analyzes numerical data that represents real-world workshop activities. By translating sales records and operational workflows into measurable values, the system design can be aligned with actual business needs such as order volume, sales trends, performance benchmarks, and AI accuracy requirements.

## 2. Research Design

This study adopts a descriptive and analytical quantitative research design. The descriptive component is used to outline the current operational trends of the workshop, while the analytical component applies statistical techniques to forecast future requirements and benchmark AI system performance.

The choice of a quantitative design is justified for several reasons:

1. Objectivity – Numbers provide unbiased insights into how the workshop operates.

2. Scalability – Quantitative data allows projections about future growth and system expansion.

3. Performance Benchmarking – Measurable AI accuracy levels, transaction speeds, and system loads can only be established through numerical targets.

4. Decision Support – Quantitative outcomes such as average order value, monthly growth rate, and frequency of custom requests directly inform technical decisions in database design, server capacity, and AI model selection.

Thus, the system is data-driven rather than assumption-based, ensuring reliability and scalability.

## 3. Data Collection

3.1 Population and Sampling

The population for this study consists of all workshop transactions, including product sales, customer orders, payments, and custom furniture requests. Since digitization is intended to cover the entire operation, the target sample was drawn from six months of historical records maintained in the manual ledger. This time frame was selected to provide sufficient data while also being recent enough to reflect current business conditions.

3.2 Data Sources

- Primary Data: Extracted directly from the workshop’s physical sales book, including daily order counts, payment entries, and product types sold.

- Secondary Data: Benchmarks and performance metrics were drawn from industry reports and academic studies on e-commerce systems, particularly for AI modules. For example, chatbot accuracy is typically expected at ≥85%, recommendation relevance at ≥80%, and fraud detection accuracy at ≥90%.

3.3 Data Collection Instruments

To standardize the data gathering process, structured extraction sheets and questionnaires were developed. These instruments ensured consistency in capturing numerical information. Examples of quantitative questions included:

- How many customers visit the workshop per day?

- How many orders are placed weekly and monthly?

- What is the average sales value per transaction?

- How many custom furniture requests are made per month?

- What percentage of orders remain unpaid after 30 days?

- How many concurrent transactions should the system support?

By focusing on closed-ended, numerical responses, the collected data could be directly analyzed statistically.

## 4. Data Analysis Techniques

The data collected was analyzed using a combination of descriptive statistics, growth analysis, and benchmarking. The techniques are summarized below:

- Descriptive Statistics (Mean, Median, Mode): Summarize workshop activity such as average daily orders and sales values.

- Frequency & Percentage: Distribution analysis such as % of custom orders vs. standard sales.

- Growth Rate Analysis: Forecast scalability and project sales growth over time.

- Load Estimation: Define technical limits such as concurrent users & transactions.

- Benchmarking: Validate AI performance (Chatbot ≥85%, Recommendation ≥80%, Fraud Detection ≥90%).

- Correlation Analysis: Identify relationships, e.g., seasonal patterns vs. sales volume.

These methods enabled the conversion of raw ledger entries into actionable system requirements.

## 5. Research Questions

The research was guided by specific quantitative questions, including:

1. What is the average number of orders processed daily, weekly, and monthly?

2. What is the average sales value per order in LKR?

3. What proportion of sales are custom furniture requests compared to standard items?

4. What percentage of orders remain pending or unpaid monthly?

5. What is the growth rate of sales over six months?

6. What system load (concurrent users and transactions) must the system support?

7. What measurable accuracy levels are required for AI modules?

## 6. Sample Data Presentation

An illustrative example of the type of data analyzed is shown below:

Month | Orders | Total Sales (LKR) | Avg. Order Value (LKR) | Custom Orders (%)

Jan | 120 | 1,200,000 | 10,000 | 25%

Feb | 150 | 1,350,000 | 9,000 | 30%

Mar | 180 | 1,800,000 | 10,000 | 28%

Apr | 160 | 1,440,000 | 9,000 | 27%

May | 200 | 2,100,000 | 10,500 | 32%

Jun | 220 | 2,310,000 | 10,500 | 30%

From this data:

- Average orders per month = 171.6

- Growth rate = +83% from Jan to Jun

- Custom orders average 28–32% of all sales

Implications:

- Database must handle at least 200+ orders/month initially, scalable to 500+.

- AI recommendation system should prioritize customization, since ~30% of orders are custom.

- Payment and order modules must support ~LKR 2 million monthly transaction volume.

## 7. Ethical Considerations

Since the research is based on family business records, privacy and confidentiality were prioritized. No customer names or personal identifiers were included in the analysis. Only numerical data such as counts, totals, and averages were extracted. AI features will be implemented in compliance with ethical principles, ensuring no misuse of sensitive customer data.

## 8. Limitations

- The study is limited to a single workshop and may not represent larger or more diverse businesses.

- Seasonal variations (e.g., holiday sales, promotional events) were not captured fully in the six-month dataset.

- AI benchmarks are based on industry standards rather than live testing, though these will be refined after deployment.

## 9. Conclusion

The quantitative methodology provided a rigorous foundation for developing the Furniture Workshop Management System. By analyzing six months of operational data, the research established concrete values for order volume, sales trends, and customization rates. These values directly inform the system’s database design, functional requirements, and AI performance benchmarks.

In contrast to subjective assumptions, the numerical evidence ensures that the system is both technically robust and aligned with real-world demands. This methodology not only validates the need for digitization but also ensures that the transition from manual ledgers to an AI-powered digital platform is scalable, measurable, and sustainable.