

## Feasibility Analysis of Injection Molding Machine Replacement at CV Gradient

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**Abstract.** The motorcycle industry in Indonesia continues to show strong market potential. Based on data from the Asosiasi Industri Sepeda Motor Indonesia (AISI), motorcycle production between 2013 and 2017 remained high despite a temporary decline in 2015. The increasing demand for motorcycles has directly impacted the demand for spare parts, including Spring Guide components produced by CV Gradient. CV Gradient, a Bandung-based spare parts manufacturer established in 1993, supplies products to major industrial clients. However, the company faces significant production gaps due to limited machine capacity and frequent breakdowns of its Injection Molding machine. Although annual demand for Spring Guide HKWB ranges from 1.12 to 1.30 million units, actual production remains fixed at 806,400 units per year, resulting in an average production gap of 33%. Machine downtime averages 12 days per month (144 days per year), reducing machine utilization to only 50%. As a result, unmet demand must be subcontracted, leading to lower profit margins, higher costs, and potential quality and delivery risks. Financial comparison shows that full in-house production would generate approximately IDR 40–50 million higher annual profit compared to partial subcontracting. This indicates a significant opportunity loss due to current production inefficiencies. Based on operational and financial considerations, replacing the existing Injection Molding machine is economically feasible. The investment would reduce downtime, increase production capacity, improve quality control, minimize subcontracting dependence, and enhance profitability. Given that the company currently serves only 12% of national demand, machine replacement also supports long-term growth and competitiveness.

**Keywords:** Machine replacement, feasibility analysis, production capacity, injection molding, manufacturing efficiency

### I. Introduction

The motorcycle industry in Indonesia plays a vital role in supporting national transportation needs due to affordable prices and low maintenance costs compared to four-wheeled vehicles. According to data from the Indonesian Motorcycle Industry Association (AISI), motorcycle production showed a generally positive trend from 2013 to 2017, despite a temporary decline in 2015. This growth directly increases demand for motorcycle spare parts. CV Gradient is a manufacturing company established in 1993 in Bandung, Indonesia, specializing in molds, press tools, jigs and fixtures, and motorcycle spare parts. One of its main products, Spring Guide HKWB, accounts for approximately 60% of total production demand. However, the company is only able to fulfill around 806,400 units annually, far below customer demand ranging from 1.12 to 1.3 million units. The main cause of this production gap is frequent breakdowns of the injection molding machine, which operates with only 50% utilization and experiences an average of 12 downtime days per month. As a result, the company relies heavily on subcontracting, leading to higher costs, quality risks, and reduced profit margins (Irawan, Nasiatin et al., 2020; Nurhikmat & Azizi, 2016; Yulifa et al., 2021). Therefore, an

investment feasibility analysis for replacing the injection molding machine is necessary. The motorcycle industry in Indonesia has experienced significant growth and remains one of the largest markets in Southeast Asia. According to data from the Asosiasi Industri Sepeda Motor Indonesia (AISI), national motorcycle production between 2013 and 2017 consistently reached more than five million units annually. This strong production volume directly increases demand for motorcycle spare parts. CV Gradient, a manufacturing company located in Bandung and established in 1993, specializes in producing molds, press tools, jigs and fixtures, and motorcycle spare parts, including Spring Guide components (Fu et al., 2020; Tsai, 2022). The company serves several major industrial clients. However, despite increasing market demand, CV Gradient faces production capacity constraints. Annual demand for Spring Guide HKWB ranges from 1.12 to 1.30 million units, while actual production capacity remains limited to 806,400 units per year, resulting in an average production gap of approximately 33%. The primary cause of this gap is the low utilization of the Injection Molding machine, which operates at only 50% efficiency due to frequent breakdowns. Machine failures occur on average 12 times per month, causing significant downtime and forcing the company to subcontract part of its production. This practice reduces profit margins and increases operational risks related to quality and delivery performance. Considering the substantial production gap, financial losses, and growing market potential, it is necessary to evaluate the feasibility of replacing the existing machine. A comprehensive investment analysis is required to determine whether machine replacement can improve operational efficiency, increase profitability, and strengthen the company's competitiveness in the spare parts industry (Ford Motor Company, 2011).

## II. Literature Review

### 2.1 Market Feasibility Aspect

Market feasibility analysis evaluates whether sufficient demand exists to justify investment decisions. It includes market size, market share, demand growth, segmentation, targeting, and positioning (Kotler, 2003). Market share reflects a company's competitive position and is often used as a performance indicator in marketing strategy (Ufuophu-Biri & Ayewumi, 2022). The market and marketing aspect evaluates the existence of market opportunities, demand conditions, competitive dynamics, and potential market share. This analysis applies the STP framework (Segmentation, Targeting, and Positioning) to identify suitable market segments and determine the most profitable targets. Pricing strategy, consumer behavior, and external market factors are also examined to ensure alignment between company objectives and market needs (Apfiyanti et al., 2010).

### 2.2 Technical Feasibility Aspect

The technical aspect focuses on production processes, capacity planning, machine reliability, layout, and technology selection. According to Suliyanto (2008), technical feasibility determines whether a company can operate efficiently with available facilities and resources. The technical and operational aspect assesses the company's readiness to conduct production activities effectively. Key considerations include location selection, facility layout, production capacity planning, technology selection, machinery requirements, and workforce needs. Proper operational planning ensures efficiency, optimal resource utilization, and sustainable production performance.

### 2.3 Financial Feasibility Aspect

Financial feasibility assesses whether an investment is economically viable using indicators such as profit analysis, Return on Investment (ROI), and Payback Period (Riyanto, 2004).

Engineering economics plays a crucial role in capital budgeting decisions involving machinery replacement (Gitman, 2000). The financial aspect analyzes the feasibility of the investment from a financial perspective. It includes capital structure evaluation, estimation of fixed and variable costs, revenue projections, and cash flow analysis. Financial indicators such as Profit Margin, Return on Investment (ROI), and Payback Period are used to measure profitability and financial sustainability.

#### **2.4 Legal Aspect**

The legal aspect ensures that the proposed business complies with applicable laws and regulations. This includes determining the appropriate legal entity, securing required licenses and permits, verifying land ownership status, and assessing the legal background of business operators (Adha et al., 2020; Agroindustrial et al., 2023; Baum et al., 2025; Omoregie, 2020; Science, 2025; Shan et al., 2022; Tsai, 2022). Legal compliance is essential to prevent operational disruptions and ensure long-term business continuity.

### **III. Methodology Penelitian**

This study uses a **descriptive quantitative approach**. Data were collected through:

- Production and demand records (2013–2017)
- Machine utilization and downtime data
- Cost and profit reports
- Company financial statements

The feasibility analysis covers three main aspects:

1. Market aspect
2. Technical aspect
3. Economic/financial aspect

Investment evaluation methods include capacity analysis, cost comparison, profit analysis, ROI, and Payback Period.

#### **3.1 Research Framework**

This study applies a systematic research framework to analyze the feasibility of purchasing a new injection molding machine at CV Gradient. The research stages include preliminary study, problem formulation, theoretical foundation, method selection, data collection, data processing, and financial feasibility analysis. The framework is designed to ensure that all stages of improvement and decision-making are aligned with the identified problem.

#### **3.2 Preliminary Study**

The preliminary study was conducted through interviews and direct observation of production activities at CV Gradient. Industry data indicate strong motorcycle production levels in Indonesia, suggesting continued market potential for motorcycle spare parts such as spring guides. Despite having established production facilities, the company needs to evaluate whether investment in a new injection molding machine is financially and operationally feasible.

### 3.3 Problem Formulation and Research Objective

The main problem addressed in this study is determining the feasibility of purchasing a new machine to support production capacity. The objective of this research is to analyze the investment feasibility based on market, technical, and financial aspects to support managerial decision-making.

### 3.4 Theoretical Foundation

The theoretical foundation includes feasibility study concepts, demand forecasting methods, capacity planning, time study, cost analysis, and financial evaluation techniques. These theories guide data collection, processing, analysis, and conclusion drawing.

### 3.5 Research Method

This study employs a feasibility analysis approach. Demand forecasting is conducted using several quantitative methods, including:

- Single Moving Average
- Moving Average
- Single Exponential Smoothing
- Double Exponential Smoothing
- Linear Regression

The best forecasting method is selected based on the lowest Mean Square Error (MSE) value. Linear regression was identified as the most accurate method for projecting future demand.

### 3.6 Data Collection

Data collected include:

- Machine specifications and current production capacity
- Raw material data (polypropylene)
- Production process details (injection molding process)
- Labor requirements
- Operational and investment costs

Primary data were obtained from company records and direct observation.

### 3.7 Data Processing and Capacity Planning

Demand forecasting results are used to determine production capacity requirements. Capacity planning considers working days, working hours, and shift systems. Time study analysis is conducted to determine cycle time, normal time, and standard time.

Machine requirements are calculated based on production capacity and effective working hours. Investment costs (fixed capital), operational costs, and depreciation are then estimated.

### 3.8 Financial Feasibility Analysis

Financial evaluation includes:

- Investment cost calculation
- Operational cost estimation
- Profit and loss projection (5-year period)
- Cash flow analysis
- Net Present Value (NPV)
- Return on Investment (ROI)
- Profit Margin
- Payback Period

These financial indicators are used to determine whether the proposed investment is economically feasible and capable of generating sustainable returns.

#### IV. Research Results

CV Gradient is a manufacturing company operating in the automotive sector, specifically producing spring guide grip components for Honda motorcycles. The company is legally established as a Limited Partnership (CV) and is located in Buah Batu, West Java, Indonesia. CV Gradient specializes in producing spring guide grip components for automatic (scooter-type) Honda motorcycles using a make-to-order production strategy. This approach ensures that products are manufactured based on customer demand specifications. The primary raw materials used in production are polypropylene plastic pellets and chemical coloring agents (intra black). The polypropylene material is supplied according to required specifications and processed directly through injection molding machines without additional assembly stages, as the company focuses solely on producing specific plastic components for motorcycle applications.

##### 4.1 Market Analysis

The demand for Spring Guide HKWB increased steadily from 2013 to 2017, with total demand reaching 6,026,000 units. However, CV Gradient's production capacity only covered approximately 67% of demand, indicating a large untapped market opportunity.

##### 4.2 Technical Analysis

The existing injection molding machine operates at only 50% utilization due to frequent breakdowns, causing an average of 12 days of downtime per month. Machine replacement is expected to:

- Increase effective production capacity
- Reduce downtime
- Improve delivery reliability
- Eliminate dependency on subcontractors

##### 4.3 Financial Analysis

Profit comparison shows that self-production using a reliable machine yields higher profits than subcontracting. From 2013 to 2017, profits with full internal production consistently exceeded profits with partial subcontracting.

Investment evaluation results indicate:

- Higher annual net profit
- Faster payback period
- Improved ROI

These findings confirm that machine replacement is financially feasible and beneficial.

##### 4.4 Production System

Based on the research findings, CV Gradient operates in the automotive spare parts industry, specializing in molds, press tools, jig & fixtures, spare parts manufacturing, and repair services. Established in 1993 in Bandung, the company serves several major clients, including PT Showa Indonesia, PT Astra Group, PT Pindad (Persero), and PT Yamaha Motor Parts Manufacturing Indonesia. The company applies a make-to-order production strategy, manufacturing products based on customer demand. This study focuses on one specific product: Spring Guide, which consists of several variants (HKWB, HKVY, HKEV, and HK159). Demand fluctuations during the 2013–2017 period resulted in production shortages, leading to unmet customer demand. To mitigate this issue, the company subcontracted part of its production to external parties to minimize shortages and control operational costs.

##### 4.5 Demand Forecasting

Demand forecasting aims to estimate future monthly product requirements to prevent overproduction or shortages. The forecasting process uses a time series approach based on

five years of historical demand data. The demand pattern indicates a trend, characterized by fluctuations influenced by market demand and machine-related factors. Therefore, forecasting methods applied include:

- Moving Average
- Linear Regression
- Double Exponential Smoothing

Model selection is determined by comparing Mean Square Error (MSE) values. The method with the smallest MSE is considered the most accurate in representing future demand. Forecast verification is conducted using control charts to ensure that forecasting results adequately represent historical data. The results show that no Moving Range (MR) values exceed the Upper Control Limit (UCL) or Lower Control Limit (LCL), indicating that the selected forecasting model is statistically acceptable.

#### **4.6 Capacity Planning**

Capacity planning is conducted to determine the optimal production volume based on total market size and competitive conditions. Considering the presence of multiple competitors in Bandung producing similar products, CV Gradient positions itself to capture approximately 7% of the total spring guide market share in the region, based on internal marketing assessment. The projected demand derived from forecasting results becomes the basis for determining required production capacity, machine utilization, and workforce allocation.

#### **4.7 Process Design**

Process design is established using an Operation Process Chart to identify production stages, including operation, inspection, and storage activities. The Spring Guide production process involves raw material preparation, injection molding, product inspection, and packaging. This structured process mapping facilitates identification of cycle time, production bottlenecks, and required production facilities.

### **V. Conclusions**

1. Based on the production system analysis, the company needs to add one additional machine unit to increase production capacity. This addition will enable the company to meet market demand independently without relying on subcontracting (subcon) services.
2. The financial evaluation using the Net Present Value (NPV) method shows a positive present value of IDR 9,149,712,004. Since the NPV is greater than zero, the investment in an additional machine is financially feasible and profitable.
3. The Payback Period analysis indicates that the investment will be recovered within 2 years. This relatively short payback period strengthens the feasibility of the proposed investment.

### **VI. Recommendations**

1. CV Gradient should proceed with the investment in a new injection molding machine.
2. Preventive maintenance management should be improved to maximize machine utilization.
3. Future studies may include risk analysis and sensitivity analysis for investment uncertainty.

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