3.1 Problem Identification

This research is conducted in beverages producer in Indonesia, namely AQUA-Danone. It takes place at PT. Tirta Investama in Klaten, Central Java. AQUA Group is the pioneer of Bottled Drinking Water (AMDK) in Indonesia. Through the mission and dual commitment for business and social growth, Danone aims at building a healthier future through healthy lifestyle, healthy Earth, and healthy ecosystem. As a manifestation of its vision and commitments to responsible management of its operation, AQUA developed an efficient production process by considering the sustainability of the supply chain and manufacture. In fact, AQUA evaluate and often found that they have not meet the proper sustainability movement in the way they produce the water bottle. As a result, AQUA is often failed in performing energy saving since the entire production activities are related to natural resource exploitation. Therefore, an action plant should be taken to improve the performance in a broader perspective to create greater business value by considering the environmental (impact) performance of a company over time. Hence, this research aimed at evaluating the environmental impact of product –PET Bottled Drinking Water – produced within its entire life cycle. Life cycle assessment (LCA) was adopted as the method in examining the environmental impact associated with product’s life cycle. The
result of this research is the solution or proposed alternative regarding to the environmental impact result by considering the economical principles as means to attain the sustainability manufacture.

### 3.2 Problem Formulation

The main concern and focus of this research is the solution or alternative that corresponding to the sustainability manufacturing and economical principles. The problem formulation is set as a basis to limit the research area and clearly define the issues that the researcher tries to address.

### 3.3 Literature Review

Inductive and deductive study are combined as literature review. In inductive study, performed the previous studies that have been done before with any correlation with current research. While it has difference method and subject, object, thus, the purpose is to have dissimilitude of research to avoid plagiarism and basic theory are mainly to be comprehensive of the method and formula used in the research. Moreover, the inductive reasoning is added to clearly define the reason behind using that method. While for deductive study, gained from many literatures, journals, books with the keyword of LCA, sustainable manufacturing and eco-efficiency.

### 3.4 Data Collection

Data that being used in this research are primary and secondary data. Primary data are stated the Table 3.1.

<table>
<thead>
<tr>
<th>Table 3.1 Primary and Secondary Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Type</td>
</tr>
<tr>
<td>Primary data</td>
</tr>
<tr>
<td>Secondary Data</td>
</tr>
</tbody>
</table>
3.5 Data Processing

The data processing flow is depicted on the Figure 3.1. The research flow designed as the guidance to researcher to conduct the entire process from beginning until end of research.

3.6 Discussion

After the data is completely proceed, the discussion contains the analysis of LCA assessment as well as the environmental impact result from producing the PET water bottle and the alternative being proposed using the Eco-efficiency assessment. The solution is being proposed by considering and comprehending the economical aspect as the improvement. The limitation of the solution proposed also explained a bit detail here.

3.7 Conclusion and Recommendation

In conclusion and suggestion, the problem formulation has answered. Some suggestions are provided for the company and future research. The Figure 3.1 depicts the flowchart of the whole research project.
Figure 3. 1 Research Flowchart

- **Start**
  - Problem Formulation
  - Literature Review
  - Data Collection

**Data Processing**
- **Life Cycle Assessment**:
  1. Goal and scope
  2. Life cycle inventory (LCI)
  3. Life cycle impact assessment (LCIA)
  4. Interpretation

- **Eco-efficiency assessment**:
  1. Life cycle costing
  2. Eco-efficiency ratio (EER)

- Result and discussion
- Conclusion and suggestion
- Finish