CHAPTER 1
INTRODUCTION

1.1 Background

In the current era of information, data has greatly changed the world we live in today. The combination of data science and machine learning has earned the ability to predict the future. Nowadays, a lot of big companies are data driven, they are utilizing the data to improve themselves even more, to gain advantage over their competitor, to efficiently manage their resources, to reduce unnecessary cost, etc. With the utilization of the data, there are unlimited potential of how one company can improve.

That being said, a lot of companies, especially middle and small-sized company still have not taken advantage of advanced information technology. A lot of restaurants still have not used the technology in managing their restaurant inventory. What’s the best method we can use to prevent excess food ingredients that will result in ingredients waste while at the same time also avoiding ingredient shortage that will definitely affects customer’s satisfaction? This is the question the researcher asked before that lead to this research. This research aims to answer this question with the help of data and technology mentioned above.

Indonesia ranks third among G20 country with the growing rate of 5.17 percent as said by the President Joko Widodo [1]. It has both large and unique food and beverage markets, as well very active food and beverage market. Food and beverage are one of the sectors that is actually quite interesting. Despite seemingly countless number of restaurants out there, which also mean tight competition, there are a lot of things that can be done in order to win in the fierce competition. One of the examples
is to keep the total expenses low, allowing the restaurant to generate higher revenue. And to do this, what the company can do is to control the restaurant food cost. [2]

One of the methods to control the food cost is by buying the fresh ingredients needed by the restaurant in bulk. As we all might have already known, buying ingredients in bulk can help us to save inventory costs. The main advantage of buying in bulk is cheaper price per unit. The more you buy, the cheaper it is. Another advantage of buying in bulk is less trip to or from the supplier, which mean less delivery cost. [3]

However, despite the advantages of buying in bulk, it also comes with disadvantages. For example, buying in bulk requires in-depth planning especially when it comes to fresh ingredients. Buying in bulk mean you need to consider the inventory carrying cost. Inventory carrying cost, or carrying costs, is an accounting term that identifies all business expenses related to holding and storing unsold goods. Storing, holding, or carrying inventory has its own cost [4]. The cost includes the cost of the space used such as rent and maintenance, the cost of the money occupied by the inventory, the cost of insurance, the cost of inventory deterioration, etc.

Ultimately, the company need to decide the exact amount of the inventory they want to buy. This is also called Economic Order Quantity or EOQ. Economic order quantity (EOQ) is the ideal order quantity a company should purchase to minimize inventory costs such as holding costs, shortage costs, and order costs. The formula assumes that demand, ordering, and holding costs all remain constant [5]. As mentioned above the purpose of the EOQ formula is to know the most optimum number of product unit, or in this case, fresh ingredients to order. When accomplished, a company can lower its inventory cost which include buying, delivery, and storing cost. The reason why EOQ is important is because there are a lot of information that
can is contained. The formula helps the company to manage the inventory better. A lot of company’s profit heavily dependent on the inventory efficiency and this can be achieved with the help of EOQ formula. With EOQ, the company know when they should re-order the inventory, or also called reorder point. Reorder point is the minimum number of things, ingredients usually, should available in the inventory [6]. By knowing the reorder point, the company will be able to avoid the scenario where the company is out of stock and therefore unable to fulfil the customer’s needs. Failing to fulfil an order will obviously affect the company badly.

However, deciding EOQ is not as simple as it seems by all means, especially when it comes to the restaurant business model. When deciding the EOQ, there are a lot of factors that need to be considered by the company. For example, fresh ingredients have deterioration rate which need to be carefully taken into consideration. Another example is demand spike or drop due to various reason such as weekends and holidays, unforeseen event, promotion etc. This mean that the company needs to be able to utilize its past data and numbers to predict the upcoming trends and demands. To do this, the company needs to analyze the previous data, process it into meaningful information and then eventually draw a decision based on it, this process is also called Business Analytics.

Business Analytics refers to the utilization of data with methods such as data mining and predictive analysis to turn data into meaningful information that will help the company to predict the upcoming trends and make decision based on the information. The data-driven business helps the company to be able to solve its problem more accurately compared to traditional predicting method. In the case of the restaurant, there are some ways make use of the data to help the company. For example, it would be able to help the restaurant to predict the number of visitors in the future,
therefore the restaurant could prepare the ingredients needed accordingly. This means the restaurant would be able to prevent itself from buying too much ingredient, which result in food wastage. Or buying too less, which will cause the company to suffer bad reputation from unfulfilled order. This is especially important for restaurant.

It is mentioned above that data science uses machine learning algorithm to turn raw data into meaningful prediction that will help business owner make decision. What exactly is machine learning? Machine learning, as its name suggest is the ability for a machine, or a system to learn a specific pattern by itself. But here comes another problem, how to apply the machine learning itself into the company?

To conclude, data science and EOQ, all of these are problems that needs to be solved by the company in order to be able to control its inventory cost and eventually gain more profit.

1.2 Scope and Limitation

This study will use the data gathered from various sources as a study case. As explained above, this kind of business model rely heavily on its inventory management as a way to gain profit. However, since each business model, or company even has its own unique process, EOQ formula need to be modified based on accordingly. Therefore, this study will be focusing on finding the most optimized EOQ for this study case with the help of machine learning algorithm prediction. This study is limited to sample from Indonesia as well food and beverage business model only. The sample data used in this research is limited in term of quantity.
1.3 Aims and Benefits

1.3.1 Aims

The main goals of this study are to help both existing and upcoming all-you-can-eat restaurant business model in some ways which are:

- To find which machine learning algorithm that can produce the best prediction result.
- To build accurate predictive models using computational intelligence associated with the optimal inventory management in a restaurant, like predicting number of visitors and quantities of ingredients for a certain day.
- To optimize the overall revenue, the ingredients waste and inventory cost.

1.3.2 Benefits

With the help of this study, the company is expected to be able to manage its own inventory better than before and therefore will receive benefits such as:

- Improved order accuracy

  A better management of inventory also mean one thing: improved order accuracy. With higher accuracy, the company would be able predict which menu will be ordered during specific hours or days. This will also assist the company to be able to stock up enough ingredients to make sure there isn’t any ingredients shortage.

- Forecast trends

  By using the method offered by this study, the company would be able to forecast the upcoming trend and revenue. By doing comparison between past data with the current one, the company would be able to foresee where the company would be
in the future. And with this information, the company could develop a strategy to help the business to achieve its target.

- **Reduce food waste**

  When developing a menu, it is crucial for a company owner to know the amount of ingredients needed to prepare the menu. A better inventory management would be able to assist the company to check the past and present inventory levels. This will help the company to minimize the food waste by buying the exact amount required at the right time and therefore reduce the overall food cost.

- **Better planning**

Lastly, better inventory management aid the company to prepare for future shifts by foretelling customer trends and business peak time.

### 1.4 Structure

This thesis report has a good structure comprising of:

- **CHAPTER 1 INTRODUCTION** describes the background of this research. The reason why this research is conducted, how much it covers and the goal of the research,

- **CHAPTER 2 THEORETICAL FOUNDATION** explains most of the term and theory related to the research

- **CHAPTER 3 METHODOLOGY** talks about the methodology of how the research will be conducted,

- **CHAPTER 4 PROPOSED SYSTEM AND DESIGN** shows the new proposed system and design

- **CHAPTER 5 DESIGN IMPLEMENTATION** elaborates the design implementation and brief explanation of the prediction result
CHAPTER 6 EVALUATION AND DISCUSSION Evaluates the results and discusses about the result in details.

CHAPTER 7 CONCLUSION AND RECOMMENDATION Concludes the writing and gives out recommendations for the upcoming related research.