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TECHNICAL REPORT
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ANALYSIS OF DYNAMIC SYSTEM OF CONVENTIONAL CARS
AND OIL PRODUCTION IN GERMANY USING LOTKA-
VOLTERRA MODEL

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ABSTRACT

The problem of Germany's daily oil shortage draws our attention to determine the factors contributing to the large in oil consumption. In this project, we are interested to investigation whether conventional cars industry are the primary cause to the problem. This project aims to use Logistics and Lotka Volterra models to find the growth rate and to analyze the population dynamic of conventional cars and oil production. To elaborate, the major goal of this research we used a logistics model to find the growth rate of conventional cars and oil production, as well as a lotka volterra model to analyze the dynamic population of conventional cars and oil industry, particularly in Germany. We have the prey, which is oil production, and the predator, which is conventional cars, in the Lotka Volterra model. As a result, we aim to find a solution to the problem of conventional cars being the primary cause of oil production fluctuations in Germany. In this work, we utilised two methods to calculate the growth rate which are the logistic model and Lotka Volterra model for oil production and conventional cars in Germany. We entered the growth rate figures into Microsoft Excel to forecast future production for these two industries. We saw the relationship between them by entering the growth rate acquired in the first objective into Python. As a result, the growth rate of prey and predators plays a substantial impact in the development of an industry, according to our findings. Among these, conventional cars will be unable to function if oil production ceases. In conclusion, this technique is crucial because it allows the oil industry to correctly build long-term operating plans without having to deal with complications when inevitable events occur. As a result, the idea of conducting an oil peak risk analysis to determine the benefits and costs of minimising the likelihood of oil peak events might be very useful, and the option of oil fuel switching transportation should be strongly supported. From the result obtained that the prediction for oil production and conventional cars strayed far from the actual value based on the growth rate of both and showed the relationships between them more clearly when the number of conventional cars increased, it

1 INTRODUCTION

Oil industry become one of the most important industries nowadays since this industry already well-known since years. Thus, people always made demand for it as it is use in mostly 98 percent in people's daily life.

Firstly, oil is use for vehicle. Oil and gas act as the fuel in order to active the vehicle engine. According to Bubeck et al. (2016), about 23 percent from the usage of fuel is contributed by the transport sector. Besides, oil also use for electricity. Oil is use for generate electricity in 3 different technologies which include, conventional steam, combustion turbine and combustion-cycle technology. Last but not least, oil is use for business. Oil become an asset to Germany since World War II as Germany the only one has the largest domestic oil production at that time and it continuous till now.

According to Craig et al. (2018),Germany was one of the European countries that contributed to the first commercial oil well in 1859. Germany is a European country known for a variety of things, including festivals, education, and automobile manufacture. Germany is also a country with oil reservations, ranking 66th in the world for having oil reservations. In addition, Germany produces roughly 211,888 barrels per day, putting it in 35th position globally. Unfortunately, Germany's daily oil consumption is around 2,383,393 barrels per day, requiring them to buy more oil from other nations to meet their needs. As a consequence, overall net oil imports into Germany are at 1,835,271 barrels per day, which is enough to meet all of Germany's deficit oil consumption.

In Germany, there are many factors contribute to the higher demand of oil consumption. According to Wilberforce et al. (2017) , the transportation industry has the highest daily fuel requirement. As a result, we pick conventional cars data to be one of the elements influencing daily oil consumption patterns for our research. By definition, conventional cars have an internal combustion engine that runs on petrol or diesel to operate the vehicles. People are still using