

## INTISARI

*Vehicle Routing Problem with Compartment* (VRPC) merupakan salah satu varian VRP yang merupakan pengembangan dari *Capacitated Vehicle Routing Problem* (CVRP), dimana kendaraan yang digunakan memiliki kompartemen untuk misahkan beberapa jenis produk yang akan didistribusikan. VRPC ditemukan pada sistem nyata berupa pendistribusian bahan bakar, minyak, limbah daur ulang, maupun pendistribusian makanan.

Dalam penelitian ini, kami mencoba mengembangkan model matematis VRPC dalam bentuk *Mixed Integer Nonlinear Programming* (MINLP) dengan beberapa karakteristik tambahan yaitu *Split Delivery*, *Multi Product*, *Time Windows*, dan *Stochastic Demand*. Pada awalnya, dibangun sebuah model matematis VRPC dengan karakteristik yang telah disebutkan kecuali karakteristik *Stochastic Demand*. Model tersebut kemudian dilakukan verifikasi dan validasi terlebih dahulu untuk kemudian dilakukan proses pengembangan model matematis dengan karakteristik *Stochastic Demand*.

Model dengan *Stochastic Demand* dibuat dengan membangun skenario-skenario diskrit. Permintaan konsumen dipertimbangkan sebagai *discrete time process*, kemudian akan dimodelkan menggunakan skenario diskrit yang berbeda-beda terhadap waktu. Perubahan permintaan konsumen terhadap waktu dianggap mengikuti distribusi probabilitas normal. Perhitungan *stochastic* dilakukan dengan *robust approach* dengan pemilihan skenario *demand* tertinggi sehingga didapatkan hasil dengan minimal terjadinya *kemungkinan unmet demand*. Analisis sensitivitas dilakukan menggunakan metode *Brute Force Approach* yaitu dengan mengubah-ubah nilai parameter dalam model, dan dihasilkan bahwa parameter jumlah *demand* dan parameter kapasitas kompartemen signifikan mempengaruhi solusi optimal.

Kata Kunci : *Vehicle Routing Problem with Compartment, Mixed Integer Nonlinear Programming, Stochastic demand*

## ABSTRACT

*Vehicle Routing Problem with Compartment (VRPC) is one of the VRP variants and also an extension of Capacitated Vehicle Routing Problem (CVRP), where the vehicles that is used to transport some products have a number of compartments to separate some type of products to be distributed. VRPC have related application in petrol distribution, oil distribution, waste collection/distribution, and food distribution.*

*In this research, we try to develop the mathematical model of VRPC as Mixed Integer Nonlinear Programming (MINLP) with other VRP characteristics such as Split Delivery, Multi Product, Time Windows, and Stochastic Demand. In the first step, we develop the mathematical model of VRPC with characteristic that we mention before, except for the Stochastic Demand. The mathematical model is then verified and validated in advanced for the process of developing the mathematical model with stochastic demand.*

*The mathematical model with Stochastic Demand is developed by constructing discrete scenarios. Demand is considered as discrete time process, then will be modeled using different discrete scenarios. The change of customer demands over time is considered as normal probability distribution. Stochastic process is solved with robust approach by looking for the most demand under each scenarios, so that the solution generated deals with minimum probability of unmet demand. Sensitivity analysis using Brute Force Approach method performed by changing each parameter value within the model, and have the result that total demand and compartments capacity significantly affect the optimal solution.*

*Keywords : Vehicle Routing Problem with Compartment, Mixed Integer Nonlinear Programming, Stochastic demand*