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# Designing a sustainable supply chain for BMW South Africa

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## Introduction

For BMW, which is not just a brand, but also a lifestyle experience, the key supply chain requirement is predictability.

What sets BMW apart from a conventional supply chain solution is the fact that they have eliminated decentralized warehousing, which means longer travelling distances with shorter lead times, lower market price expectations with higher operational cost drivers, an agile operational footprint with a rigid pricing structure and predictable serviceability for a volatile market and consumer footprint.

With this in mind, DSV set to work on developing an entirely new and unique supply chain model. We realized from the start of this process that we are not competing with other brands, we are competing with supply chains. In a market where volatility, uncertainty and complexity is at the forefront every single day we need to leverage our strengths, our skills and our core capabilities to create a competitive advantage in the market.

The resulting model has many key characteristics that set it apart and challenge the status quo. Such elements include: a price that is valid for six years; daily delivery at the same time by the same vehicle; night time stock deliveries; price per delivery stop and two rush order daily deliveries per dealer (3 hour SLA).

Developing and implementing this model draws on advanced mathematical programming and enormous engineering and operational expertise. Ultimately, by applying mathematical modelling methodologies, DSV was able to design a supply chain that is sustainable and profitable with fixed prices for a 6-year contract period.

The engineering method applied stems from the Operations Research – Vehicle routing problem family. A vehicle routing problem is a combinatorial optimization and integer programming problem which asks the question “What is the optimal set of routes for a fleet of vehicles in order to service a given set of customers”. The objective is to minimize total route cost.

This solution looks at drivers as being the biggest asset, minimizing overtime and maximizing job security. Night time deliveries which enables exceptionally early morning receipt of stock freight at dealers, rush order lead times as fast as 3 hours from order placement to delivery and market leading track-and-trace technology which enables full visibility of freight throughout the supply chain.

Moreover, the designed solution provides short lead times over longer travelling distances – while remaining competitive on pricing, predictable on delivery and agile on capacity. This ensures client and customer satisfaction. By going above and beyond to create a world-class logistics and transportation solution for BMW SA, DSV remains at the forefront of innovative, complex and ever changing supply chain solutions.

## Problem approach

The requirements were very specific

1. Price
    a. The price submitted must be valid and fixed for 6 years
    b. Minimal transport damages will be allowed

    c. Price structure is a fixed price per delivery stop regardless of the volume of freight being delivered
    d. Centralized distribution to all Gauteng dealers
2. Speed
    a. Night time stock deliveries which enables stock availability when the dealers open in the mornings, effectively ensuring a daily delivery before 8am.
    b. 2 rush orders daily, per dealer, effectively ensuring a 3 hour lead time from order placement to delivery
3. Reliability
    a. Punctual freight hand-over and deliveries without delays
    b. Variable volumes per dealer, per delivery and over the 6 year contract period should be absorbed by the logistics supplier
    c. Variable consignees over the contract period should be absorbed by the logistics supplier
4. Predictability
    a. All product types including windscreens, tyres, body shells and engines are in scope
    b. Prompt notification to dealers on delays
    c. Daily deliveries at the same time by the same vehicle

Based on the requirements we then started with our problem approach. Deciding that the steps we will follow will be to identify the viable solution options we have. We could implement and design a completely customized dedicated solution, design a hybrid solution, servicing some of the dealers through the DSV network and some through a customized dedicated network or a full network solution.

Next we had to know what data is available for the solution design, what is the accuracy of the data that is available, and what constraints are we facing in terms of data.

Combining the data and solution options we had to create a single optimized solution that would be the best cost and service fit for both BMW and DSV. Testing the optimized solution against a realistic operation in order to test the feasibility and sustainability of the model and then lastly refine the model even further to ensure a 6 year sustainability will be achieved.

## The solution

A vehicle routing problem is a combinatorial optimization and integer programming problem which asks the question "What is the optimal set of routes for a fleet of vehicles in order to service a given set of customers". The objective is to minimize total route cost.

The sets of rules and cost drivers having an effect on the BMW supply chain can be listed as:

a. All orders have to be collected from the PDC and delivered to the dealers within the specified time windows
b. All vehicles have to start and end their day from the DSV Automotive facility in Spartan. This is due to a driver rotation schedule in order to mitigate sick leave and annual leave taken as well as to enable utilization of these vehicles during night shifts.
c. A route has to be utilized in such a way that the travelling distance is minimized while vehicle capacity utilization is maximized.
d. All routes have to replenish 3 times per day from the BMW PDC.

e. Routes have to be allocated to certain geographical areas as well as to certain dealers
f. Drivers cannot drive for more than 3 consecutive hours without being allowed a 10 minute break
g. A driver is only allowed to work 8 normal working hours per day, all other working hours are classified as overtime.

Converting these rules into a mathematical problem allows us to theoretically run through different iterations of vehicles, routes, and drivers, stop sequences and so forth until we get to a solution where the resources all work together in a way that fixed and variable cost drivers incur the least costs per day.

The current supplier's fleet (which co-incidentally was also DSV, but as stated previously, we approached this as if we had no footprint for this client) consisted out of 14 vehicles. The model output was 7 vehicles, which means that we ended up with a 50% difference in number of vehicles. What we missed at this stage is that the model works on an "open road" methodology, meaning that road conditions are perfect. No traffic, no accidents, no delays of any kind. This will however not be a realistic operational model, especially in the congested Gauteng area. So we went back to the drawing board, decreasing the travelling speed by 35%. This means that if the open road travelling speed on a national highway is 120km/h, our model simulates travelling speed at 78km/h.

The new model output was 11 vehicles, which lands us at a 21% difference in number of vehicles. Thus far this solution has been a standard optimization solution. What differentiates our solution from a standard optimization solution is the way that we applied and interpreted the answer to ensure sustainable and profitable business over the 6 year contract period.

## The outcome

With a 21% reduction in vehicles there was only a 4% increase in travelling distance per route. This allowed DSV to submit rates equal to the previous supplier's rates. However these rates will be valid for a 6 year contract period while remaining profitable over the extent of the contract period. We were able to allow for a 1.5% organic growth in volumes with an additional 29% network agility for fluctuating volumes. In total the solution designed will be able to handle up to 38% fluctuations in volume and product profile deviations over the contract period. This means that DSV is able to take the risk of an uncertain market into our domain, giving BMW peace of mind that we will handle this uncertainty on their behalf. To contribute to the sustainability of the solution and with handling the varying product profile we have implemented a resource sharing system, where site staff will go out with routes that have incompatible freight. This allows the delivery process to run smoothly even if there is large consignments or difficult freight. Where it is possible we have used delivery vehicles with tail-lifts which enables deliveries during night time with minimal additional material handling equipment. Which means that we are able to deliver into secure cages while the dealers are closed.

## Conclusion

By applying mathematical modelling methodologies DSV was able to design a supply chain that is sustainable and profitable with fixed prices for a 6 year contract period. This solution looks at our drivers as being our biggest asset, minimizing overtime and maximizing job security for them. The designed solution provides short lead times over longer travelling distances while remaining competitive on pricing, predictable on delivery and agile on capacity. This ensures client and customer satisfaction. And

lastly going above and beyond to create a world class logistics and transportation solution for BMW SA keeps DSV at the forefront of innovative, complex and ever changing supply chain solutions.

## Author:

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**Sinti van den Berg** is currently lead the Solutions & Pricing function for DSV Distribution. In her role she is responsible for creating visibility over costs, revenue drivers, cost saving opportunities and expansion strategies through the analysis of current market and data trends, innovative thinking and applying Industrial Engineering mechanisms to optimize the current fleet and supply chain network. Sinti has 9 years' experience in the logistics and supply chain environment, with specific focus on pricing and operational improvements. Sinti received her bachelors degree in Industrial Engineering from the University of Pretoria in 2008, after which she completed an Honours degree in Technology Management in 2010. Sinti has designed last mile supply chains for major South African companies like BMW, Volkswagen, John Deere, Daikin, Hyundai, MAN truck and Bus, Mercedes Benz and more recently in the e-commerce market for Avon, Amway, On the Dot and Woolworths. In 2017 Sinti received a Gold award at the 2017 Logistics Achiever Awards for the BMW-DSV Gauteng supply chain and pricing contract.