How network modelling supports Supply Chain Design decisions

Nissan Case Study

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Project Background

Nissan SA Aftersales entrusted DSV to conduct a network design study for the aftersales supply chain. Nissan SA has recently announced that the production of the Nissan Navarra is coming to South Africa. This production strategy has created the need for Nissan SA Aftersales to have a look at the feasibility of the location and the sizes of their facilities at Rosslyn. Nissan also has a new strategy in terms of growth and this led to them reviewing their current end to end supply chain network. This network study scope included the below deliverables:

- Develop and propose a solution that includes the complete logistics flow from inbound logistics point of entry, through warehousing and outbound logistics up to the delivery at dealer or NSC.
- Study various options in terms of network optimization, best facilities, warehouse space requirements, locations and routes to be able to meet customer supply demand for SAF and SSA footprint.
- Modelling the network should incorporate volume planned up to 2022 to ensure the new solution will have the scaling capacity to service the demand.
- Benchmark the logistics network of local OEM's Aftersales and other best practice industries within South Africa and Africa (Please note the benchmark results are not included in the SAPICS presentation).

The Nissan network currently have 123 dealerships in South Africa and 42 National Sales companies in the Sub-Sahara market. The current warehouse has around 41K active SKU and 22K m^2 of warehouse space in Rosslyn, South Africa.

Network Modelling Approach

This section sets the flow for the presentation. Network modelling can be grouped into 8 high level steps for doing a successful network modelling project as per Figure 1 below. Each of these steps will be explained in conjunction with Nissan examples. These processes start with:

1. Need for the customer
    a. This section refers to understanding what the customers' needs are and what the scope of the project is. By understanding what the desired outcomes must be and what questions needs to be answered at the end. This enables us to get agreement with the customer in terms of the scope of work.
2. Strategy alignment
    a. After the deliverables of the network study is confirmed, a company needs to make sure that the business strategies are aligned to their supply chain and operational strategies. Most companies do not include this step into their studies, which can lead to massive time wasting in modelling scenarios which does not suit the

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company strategy. Some prefer to include some variants to see if the company strategy is correct.

3. Scenario Selection
    a. Now that the scope of the project is signed off and the company strategy is understood by all the parties involved, the scenarios can be selected through detailed workshops. All the options to be considered when creating scenarios will be explained in detail later in the document.
4. Data Analytics
    a. Data Analytics is a process which is at the heart of the network study and ensures the quality and trustworthiness when the results are presented. Therefore, this is a key step in the process and companies need to understand why this often extends the project timeline. Data Analytics can be performed by many tools in the market and it is important to have at least 1 person with proper skills in this department per project team. In this modelling approach the data analytics is only at step 4. This is because one can only start the modelling process once you have received that data that needs to be modelled, but in most cases the companies only request the data at this step and that would be fatal to the project timeline. Therefore, the suggestions would be to have a data requesting template setup that covers most of the areas of data required for example: customer master, supplier master, SKU master, SO, PO and warehouse movements. This data takes some time to extract from the ERP system and can then be shared simultaneous to step 1 and then the actual “Making Sense” part is when the fun starts.
5. Selecting Software
    a. In the market there are many tools available to assist you to do network modelling studies. However, there is not many that can do all the functions that is required for a detailed analysis and a combination of different tolls needs to be combined to get the desired outcome. In this step it is important to know in detail what the project deliverables are to make sure that the correct level of detail is modelled which will indicate what is the complexity level of the software required.
6. Run “What If” Scenarios
    a. Now that all the previous steps are done, it provides a good platform to start running the “What If” scenarios developed in the previous steps. What if scenarios can either be run simultaneously to provide the best optimized network or individually to have details to compare different aspects of the supply chain. With SCOR it is important to segment your supply chain to have a segmented strategy for each individual supply chain.
7. Analyse the results
    a. After all the scenarios have been run, the output data needs to be analysed and reworked into information for feedback. This requires the grouping of the results into main supply chain segments to have proper scenario comparisons. Most network modelling tools have embedded analytics functions and mapping services, which makes the data feed easier.
8. Implementation
    a. This is a step that is usually only done months or years (Hopefully not) after the study was done. If only implemented so far in advance its important to make sure that the modelled data used is forecasted to the year the implementation is planned for. Implementation is when requires an interlinked step if modelling is only done at grouped levels, but when SKU level detailed modelling is done, the feasibility of the roll out is much more accurate and can be used for rough cut planning purposes to make executive supply chain decisions. Continuous improvement and modelling

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outcomes need to be tracked to ensure the operations is operating as assumed when doing the modelling.

Figure 1: Network Modelling Approach

Need for Network Design and Optimization

The first step in the process is to ensure the need is fully understood by all parties involved in the network modelling study. From experience I can group the needs into 4 main reasons that initiate the need to do network modelling for decision making purposes namely global competition, new strategy, future growth and cost reduction.

Global competition refers to the markets that is becoming more globalized daily. Companies can now get raw materials and final goods at lower landed cost per unit than buying them locally. This cost element makes it very difficult to compete. For Nissan SA Aftermarket an example for this is where in East Africa resellers can get "Grey" parts for vehicle repairs from the UAE area at a much lower cost per unit than buying the original part from Nissan SA. Due to the macro and micro economic challenges in those areas the customers do not necessarily have the need to pay more for a repair part and competing on cost become more difficult.

Through using network modelling you can model an individual supply chain to identify optimization opportunities that would make a product more competitive due to either more efficient transport and reduction in landed cost.

New strategy can occur when a company is either bought over by another and new management changes the current strategy of the company. This requires them to redesign their current network design and test it through modelling. Nissan for instance did not have either of the above, but the need to align with the overall company strategy was of utmost importance. For them it was more based on the 2022 Strategy for the alignment of availed facilities for either manufacturing and aftersales services.

Future growth is sort of linked to new strategy as some company's new sales strategy includes future growth strategies and need to know how the network for their supply chain should look in 5 years' time. An integral part of the project was to ensure that we model based on their 2022

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strategy to ensure that the new design caters for the next few years' growth in sales. Later in this document more details around what the importance of SKU level modelling is, will be discussed.

Usually the most common reason for network modelling is to determine how to reduce cost and simultaneously increase the service levels. We have all experienced the situation where by the end of the year the budget is cut, but sales number needs to increase… The main areas from a network modelling perspective that can be tested to compare scenarios is inbound transport cost, warehousing cost, inventory carrying cost and outbound transport cost. These elements make up the bulk of the operating cost for the supply chain.

For Nissan there were various deliverables that had to be answered:

A. What are locations for NDC or RDC`s
B. What is the supply chain cost comparison for the identified scenarios?
C. To benchmark their warehouse operations to industry standards?
D. Which scenario will suit the Nissan SA Aftersales strategy?
E. What size must the NDC or RDC`s be in 2022? Related to optimal inventory holding vs policy?

Strategy Alignment

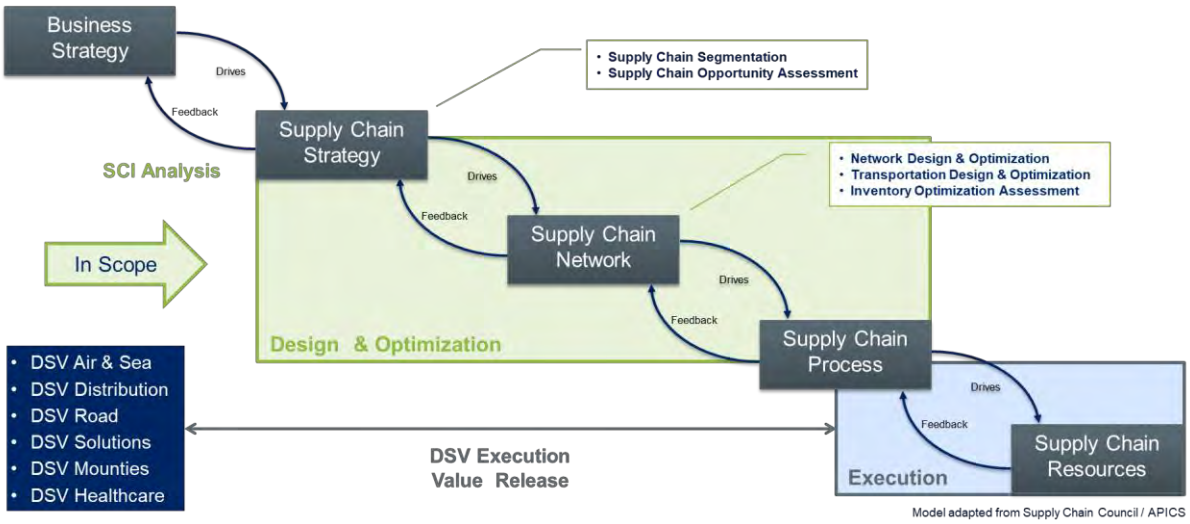

Figure 2: Strategy Alignment model adapted from SCC SCOR®

As indicated by Figure 2 above its very important that all the levels of a company have integrated strategies that drives each other. All starts with the business strategy that needs to be conducted internally by the company themselves. This need to drive the Supply Chain Strategy. The supply chain strategy is where we from DSV SCI assist to ensure all main stakeholders of the network study is on par with the supply chain strategy. This is done through a workshop with stakeholders from Finance, Marketing, Sales, Operations, Logistics and warehousing to ensure all is taken into consideration. It must be noted that this strategy must be endorsed by the company's executives to ensure it will be followed.

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The Supply Chain Strategy is what eventually drives the supply chain network design in terms of the location, number of facilities, mode to be used etc… The supply chain network is where all the Network Optimization, Transport optimization and Inventory optimization must take place. This design then needs to be documented and process mapping is required to ensure operational efficiency is achieved on a day to day basis. These processes need to be executed by someone? This can be either internal staff or can be outsourced to a 3PL like DSV to ensure service levels is achieved to end customers. This diagram provides a clear indication as to what the importance of network modelling and design is, as well as that it is the main link in the chain to ensure what the executives want to achieve and is eventually executed at operational level by staff at lowest level.

For DSV SCI the most network studies involve the items covered in the green block and was the same for Nissan SA Aftersales network study. The items that is covered by the blue is where a company as DSV can assist the study by proving estimated costing for a scenario.

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Scenario Selection

After a company knows why they want to have a network study conducted and how the network deliverables must align to the business strategy. The next step is to determine what is all actual deliverables that must be modelled or compared for different scenarios.

In South Africa there is predominantly 4 main supply chain network designs that is utilized. The first one that we refer to is the most common across most industries where a company have only 1 main distribution centre. For this design the product flow inbounds into the main DC, and then from the main DC to the customers. This type of network design is usually more cost effective from warehouse cost per perspective, but the longer time to market is a concern.

The second design, as per the figure below, is having a National DC but also a regional DC that is located closer to the coastal or inland customers. Dependent on the scenario elements selected for the inbound imports, it can either flow directly into the Main DC and then redistributed to the RDC`s or flow to RDC closest to port of entry that will act as cross-dock for all imports to other DC`s. This design offers customers a faster speed to market, but usually that comes at a premium of higher warehouse cost.

The third variable is very similar to having RDC in the regions, only difference is that the company identifies regional dealerships which is either the largest by sales or located at the best strategic locations. This network design ensures that the warehouse cost does not increase as much as outsourced regional RDC`s, but the complexity that it creates within the company can be very high. Other regional dealerships would have to buy items at a higher price than the selected super would due to super dealer being “wholesaler” in the region. You can just think how disruptive this can be for any business politics. This design also tends to create a loss of control by the OEM, because the stock will be owned by the super dealer that redistributes to the region.

The last design which is common in the automotive environment, but probably used the least, is where the items is stocked only by end dealerships. This eliminates the cost of NDC`s and RDC`s but requires very strict inventory management policies and control to be in place as there is no buffer location where stock is available upstream. This model ensures that the time to market is very quick but comes at a very high inventory holding and distribution cost to achieve the required service levels at each individual dealership.

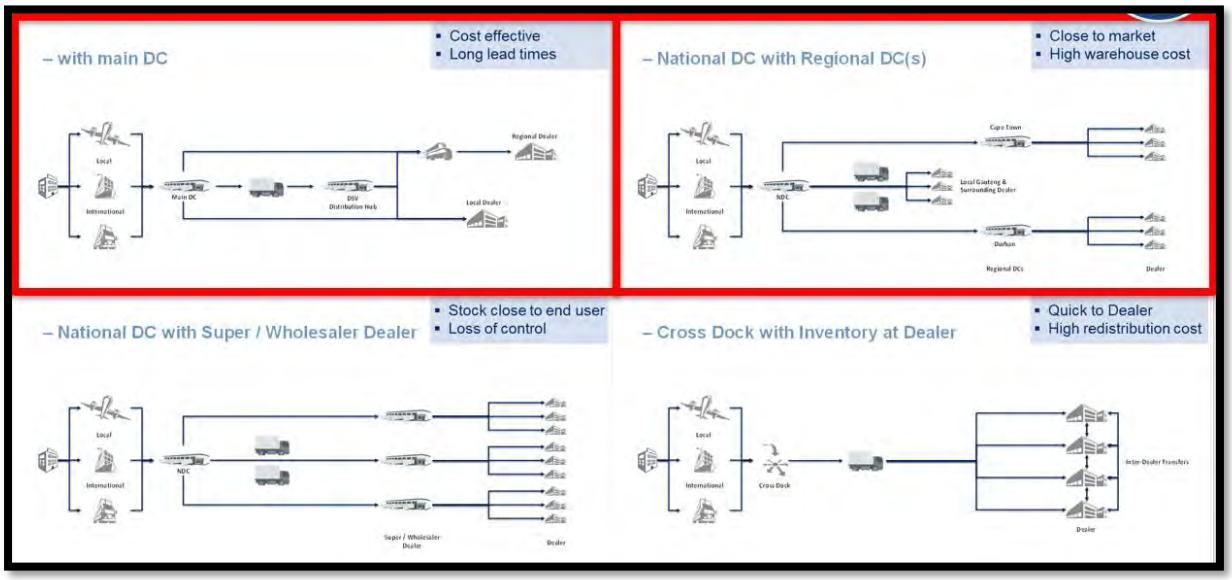

Figure 3: Automotive Network designs

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For the Nissan SA Aftermarket study the 2 designs highlighted in red was identified to be modelled. After the high-level network design is selected there is a lot of variables that must be workshopped and discussed to get the final sign off.

Data Analytics

In the modelling approach explained in this document, data analytics is done after the actual scenarios has been selected and signed off. This would then assume all data is 100% correct and in the right format, which we all know is never the case and the main reason for network modelling timeline extensions. In network modelling a best practise for doing design studies is to make sure the required data is available to answer the executive questions. This requires creating a data template that cover all data elements that is required to be pulled from the ERP system like SAP. First run an example from all the relevant master data sheets to understand data quality. Data may sometimes be overlooked as the most important element that influences the network designs outcome. The more detailed level the modelling for the design, the more detailed data is required as inputs.

Network design studies can be done at 3 levels of complexity:

- Strategic Level
    - This refers to a customer that only requires answers to be at a very high level to have some direction as to where to go in quick turnaround time.
- Tactical level
    - This is when more detailed modelling is required to answer not only strategic but also more tactical questions for example, the warehouse size that is required in 2022. This requires a bit more detailed data analysis and an understanding of the current operational procedures of the client.
- Operational Level
    - Additional modelling elements gets added and processes also needs to be understood to make sure the results can be implemented at a detailed level.

For the Nissan project the deliverables required us to do modelling at an operational feasible level, which required very detailed data analysis and processes mapping to get to the required costing per scenario. We are not going to go into all the data elements in this document as it might take many sheets to get through possible data hurdles to overcome and how to, but the next section explains a bit more on the importance of the forecast when doing modelling for a plan that is 5 years ahead in the automotive world.

Most companies that want strategic answers can do modelling at product group level for example, but when the executive questions, that needs to answered, are more tactical, you need to do SKU level modelling to ensure that it is operationally feasible and that it is also when 1 plug and play software is not enough and operational software from 3PL perspective is very important. Many companies will not invest the correct amount of time required for the 2022 forecast and just add % increases. However, this is not feasible in automotive.

Nissan has a specific plan to increase their sales to a specific target in 2022. When the sales increase to the agreed number at Financial level that figure needs to be broken down to a SKU to ensure that warehouse space for 2022 is as accurate as possible. Nissan had 41K SKU in the current data set, but the big nightmare is, how many SKU will there be in 2022? Can you say that sales increase by x% so the SKU must also increase by x%? The answer for automotive is NO. When the forecast for automotive is done it is very important to ensure that various elements be included:

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- New Vehicle Sales
    - New vehicles have new parts and existing parts. Average vehicles are between 2000 and 3000 which is made up of a combination of individual new SKU`s and other SKU's which is shared between vehicles
    - The sales trend of these individual parts must be linked to similar vehicle types and the marketing strategy for the launch to have estimated quantity per SKU
- Old Vehicles
    - Older vehicle sales deplete over the life cycle and the need for the parts does decrease, but in conjunction to that the longer a car drives the more chances there is that parts needs to be replaced
- Life time buy
    - Vehicles like most products does reach their end of life cycle but this requires OEM`s to have stock build up for a certain amount of years for example 15 years after manufacturing is stopped
- Normal Growth
    - The brand Nissan also grows at an annual rate which can be seen in the sales, which lead to more parts availability required

All these elements play a big part into what individual SKU`s needs to be planned and due to parts being standardised across multiple vehicles it is a very difficult task, that we overcame for the Nissan Aftersales network study.

Selecting Software

Now that all the data has been analysed selecting the appropriate software plays a key part in the process. The software that a company wants to use for network design studies vary and a lot of factors influence this decision. The level of modelling firstly determines the software that needs to be used for the modelling and then the data quality dictates the software required for data cleaning and the time required. When you do strategic modelling, you can get a software to do the job, but for Nissan network design the operational deliverables required us to have a combination of software supporting each other.

Data mining usually gets done through excel, access or Microsoft SQL. This enables the data to be fed into the modelling software like Supply Chain Guru or JDA strategist. Tableau can be used to have the results analysed and visualized. Inventory optimization software for specialized forecasting and demand planning. Its important to note that various software needs to be used in conjunction to make sure the best solution is developed. When DSV did the study for Nissan we were able to not only model the solutions through the modelling software, but operationally test the operational feasibility with each departments specialist to ensure the solution is implementable. Air and Sea for the port of entry details and inbound, solutions for the warehouse size and costings, IO for the forecasting and safety stock calculations, distribution for the optimized fleet and routing required.

In the end through modelling through 3PL the customer gets the opportunity to have not only general supply chain specialist but supply chain matter experts in each function assist in the solution design. In the end the solution can be developed to be either outsourced, insourced or hybrid combination of the 2.

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Run What -If Scenarios

For Nissan the following scenarios was modelled with variations in the elements modelled:

1. Scenario 1
    a. Baseline model (Current)
2. Scenario 2
    a. 2022 Baseline
    b. 1 PDC
3. Scenario 3
    a. 1 PDC Gauteng
    b. 1 RDC Durban

4. Scenario 4
    a. 1 PDC
    b. 2 RDC Durban & Cape Town
5. Scenario 5
    a. 1 PDC Gauteng
    b. 2 Africa RDC (East and West)

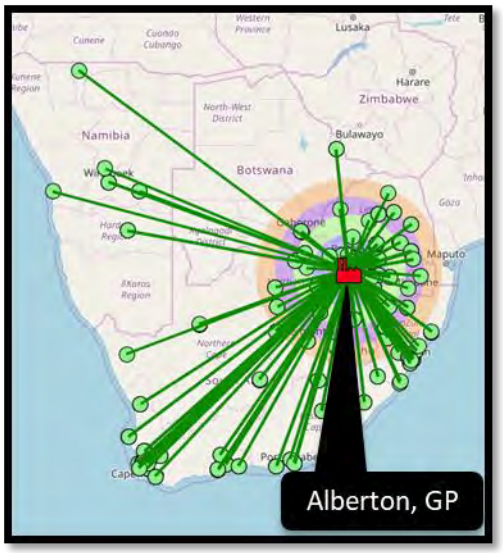
Analyse Results

For SAPICS we are only sharing the information as agreed on by Nissan. The result shared is where the 2022 Baseline is compared to another scenario and current baseline and As-Is optimized is not indicated. Firstly, the Centre of Gravity for each of the scenarios was determined. This gave some indication as to where from a strategic perspective the DC`s needs to be located based on either percentage of customer or percentage of demand served. Theses constraints can be built into the COG model to ensure applicable service levels achieved.

Please also note that Nissan has not shared in this document any information regarding their selection of the indicated models and stays confidential to them.

1 DC Network flow

The COG for 1 DC was in Gauteng South.



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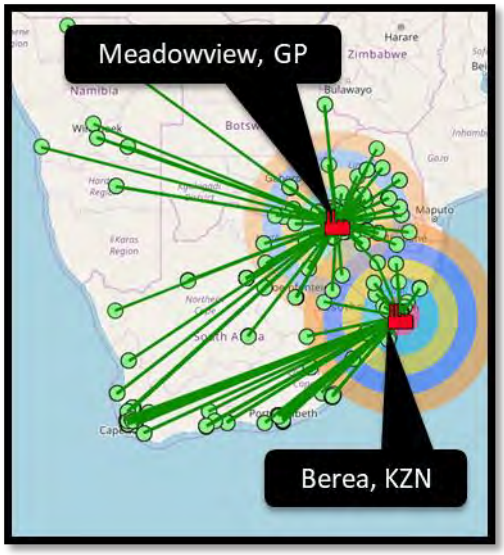
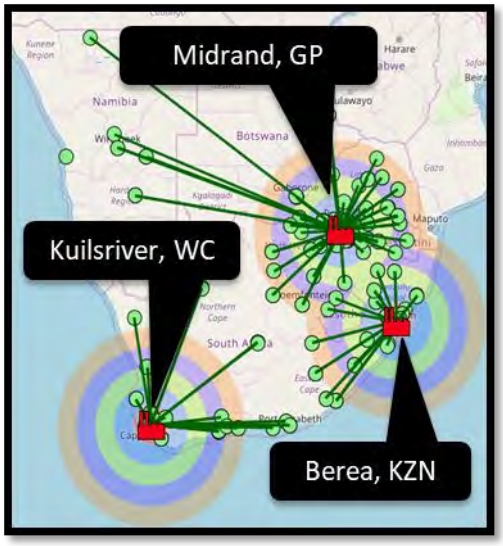
2 DC Network flow

The COG for 2 DC was in Gauteng and Kwa-Zulu Natal.



3 DC Network flow

The COG for 3 DC is in Gauteng, Western Cape and KwaZulu-Natal.



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Africa RDC`s network flow

The COG for east and West Africa is Kenya and Ghana respectively.

The results for the above scenarios are very similar to most industries in SA based on other network studies done. Demand is split into these 3 provinces with Gauteng usually having 50% and more of the national sales.

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Results summary adapted for SAPICS purposes:

	Compared to Baseline 1 DC (Future)			
Scenario	1 DC	2 DC	3 DC	1 PDC Africa 2 RDC
Increase in Total Supply Chain Cost	-	1%	2%	3%
Increase in % Demand Serviced Same Day	-	11%	20%	1%

The total supply chain cost refers to warehouse, distribution, transport and inventory carrying cost. For the results for SAPICS we are referring to the nett impact of all the elements mentioned above. When comparing the results of the different scenarios to 1 DC 2022 as the baseline there is an increase in total supply chain cost of 1% from 1DC to 2DC scenario and 2% increase from 1DC to 3DC scenario. The increase in cost needs to be compared to impact on service level. For this project we looked at the responsiveness to the dealership for car services. Ultimately customers want their cars to be serviced or repaired as quickly as possible and this requires having parts available closer to demand regions across SA. We looked at the % of the demand that you can service on the same day, which refers to order in morning and received same day for use on vehicles servicing and repairs.

The study results show that the main decision for a company is what the % cost that they are willing to pay to have same day service level increase. For the 2DC network and a 1% increase in supply chain cost as per this study, same day service level can be increased by 11%. For the 3DC network and a 2% increase in supply chain cost as per this study, same day service level can be increased by 20%. For the Africa RDC network the trade off is 3% increase in supply chain cost vs the 1% increase in service level same day. This is either very low due to in East and West Africa it is not easy to have same day deliveries at all and only when looking at 4-5-day service level will this model have more impact on customer service.

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Nick is currently working at DSV as the lead for Sub-Saharan Africa Supply Chain Modelling. Throughout his career he has developed supply chain solutions for various industry leading organizations in Oil and Gas, hi-tech, banking and automotive industries. His ability to provide supply chain advise from strategy, operations to end customer service is what drives his passion for work. Nick continuously ensure he stays up to date with the global supply chain trends through being certified as CPIM (BSCM), SCOR-P, CSCP and CPF and attending supply chain events ever time allows it. He believes that having a balanced lifestyle is key to any individual's future success.

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He has 29 years of successful experience in various areas within the automotive, procurement and supply chain environments. Some of his career highlights include being a key role player with the successful implementation of the SAP ERP system at Nissan South Africa. Implementing and managing the global supply chain with the introduction of a Yacht manufacturing facility in China. Sourcing of raw material from Australia for manufacturing of parts in Vietnam to use at the manufacturing facility in South Africa. For Flip, a successful business is built on Good people, Good systems and a clear strategy. Flip is a firm believer that there should be a good balance between his high paced professional career and his love for his family.

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