

University of Pretoria etd – Stark, V A (2005)

**DEVELOPMENT OF A SUPPLY PLANNING METHODOLOGY IN THE  
AUTOMOTIVE INDUSTRY**

**By**

**Vanessa Ann Stark**

**Submitted in partial fulfilment of the requirements for the degree**

**MASTER OF ENGINEERING (INDUSTRIAL ENGINEERING)**

**In the**

**FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY**

**University of Pretoria**

**Pretoria**

**October 2004**

## ABSTRACT

V Stark<sup>1</sup>, CD van Schoor<sup>2</sup> & JJ Strasheim<sup>2</sup>

<sup>2</sup>Department of Industrial and Systems Engineering  
University of Pretoria  
[vanessa.stark@bmw.co.za](mailto:vanessa.stark@bmw.co.za),  
[chris.vanschoor@up.ac.za](mailto:chris.vanschoor@up.ac.za)  
[joan.strasheim@up.ac.za](mailto:joan.strasheim@up.ac.za)

Key words: Supply Chain; Automotive; JIT; JIS; OEM; Suppliers; Supply Planning  
Methodology; Outsourcing; MIDP

Supply Planning in the Automotive Industry is a vital ingredient for Supply Chain Integration. The role and function of a Supply Planner, although clearly defined in European developed methods, lacks the practical dimension. This paper describes such a practical approach that was developed for Supply Planning in the South African Automotive Industry. The framework highlights all the aspects – from a business and functional perspective - that need to be considered on a global and local scale. The framework describes the role and responsibilities of the Supply Planner as an active supply chain designer during the product/production development process.

## OPSOMMING

Voorsieningsbeplanning in die Motorindustrie is 'n noodsaaklike element van Voorsieningskanaalintegrasie. Die rol en funksie van die Voorsieningsbeplanner, alhoewel duidelik gedefinieer in Europese benaderings, kort 'n praktiese dimensie. Hierdie artikel beskryf so 'n praktiese benadering wat ontwikkel is vir Voorsieningsbeplanning in die Suid Afrikaanse Motorindustrie. Die raamwerk lig alle aspekte uit – vanuit 'n besigheids- en funksionele perspektief – wat oorweeg moet word op 'n globale en plaaslike vlak. Die raamwerk beskryf die rol en verantwoordelikhede van die Voorsieningsbeplanner as 'n aktiewe ontwerper van die voorsieningskanaal gedurende die produk/produksie-ontwikkelingsproses.

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<sup>1</sup>The author was enrolled for the M Eng (Industrial Engineering) at the Department of Industrial and Systems Engineering, University of Pretoria

## Summary

With the near termination of the Motor Industry Development Programme (MIDP), and the ever-increasing levels of competition, the need to uplift the South African Automotive Industry to world class levels is imperative.

One of the important developments of the last decade in Automotive Supply Chain Management is “Lean Manufacturing”. The challenge lies in balancing the fulfilment of customer orders through the availability of stock, and reducing the cost of carrying unnecessary inventory.

OEMs are moving towards implementing supply methods such as Just-In-Time (JIT) and Just-In-Sequence (JIS). This means that suppliers produce and deliver their parts as close to the time of fitment as possible. Many opportunities exist when such supply methods are implemented – stock levels are reduced, even though variants have increased; part quality is improved through the minimization of part handling; non-value adding activities such as waiting times, buffer times, etc are reduced.

A JIS-type delivery is the most advanced supply method to date. If all suppliers could deliver their parts in this fashion, a drastic reduction in cost to customer would result. The OEMs of South Africa need to investigate opportunities to uplift their suppliers to become capable of adopting such worldwide trends.

The difficulty in realizing this challenge is having a key role player investigate and execute these opportunities on a day-to-day business level. The Supply Planner, is extremely important in the planning phases of a multifaceted vehicle project. Numerous functional team members – from Quality to Packaging – have to come together and design Supply Chains. The responsibility of the Supply Planner is to integrate these functions and design optimal logistical processes – from first tier Suppliers to the OEM Assembly Fitment.

European Methodologies clearly define the role and function of the Supply Planner, but lack the application thereof. The aim of this dissertation was to develop a hands-on approach for Supply Planning in the South African Automotive Industry.

An industry case study was undertaken at BMW (South Africa) Rosslyn Plant. The pilot project involved the transformation of a supplier from JIT to JIS supply. From the experience gained in generating numerous alternatives, as well as the research

conducted prior to and during the project, a new, more practically focused method for Supply Planning was developed.

The method provides a logical way of approaching such investigative projects. The aspects covered in this method include - guiding the planner in addressing all logistical activities in a vehicle project; identifying the impact of these activities on other processes; generating improved alternatives; analysing logistical costs; ensuring that current trends are considered and incorporated where applicable; and dealing with everyday business issues. By following this guideline, a more value-added solution, in terms of cost, time and quality can be achieved.

The Supply Planner therefore has the potential to dramatically improve supply chain processes, whilst enhancing Supplier and OEM business practises.

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## Chapter One

### **RESEARCH PROBLEM**

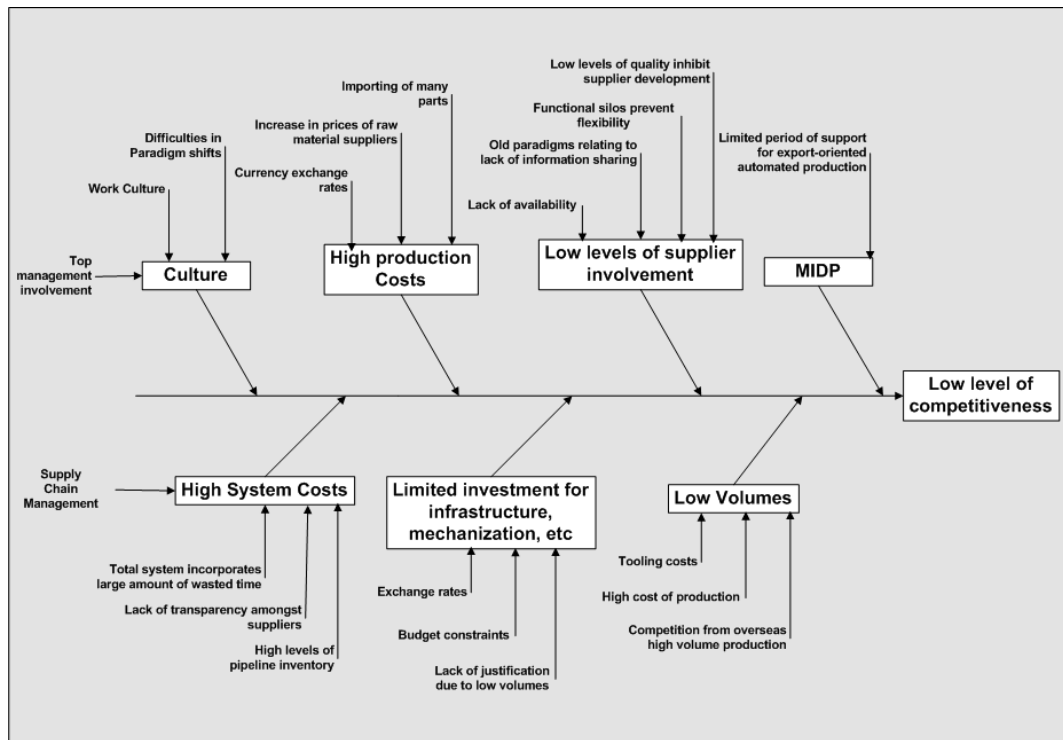
## 1.1 Background

The automotive industry is a complex network of supply chain members that coexist in interdependent relationships in order to satisfy customer requirements in an ever-evolving competitive global market. Although South Africa is an emerging market, the automotive industry plays a vital role in our economy and has become a key player in the quest for further national development. It currently constitutes 5,6% of the Gross Domestic Product and is the third largest sector after mining and agriculture. It also accounts for 28,5% of the country's manufacturing output. For these and many other reasons, the AIDC (Automotive Industry Development Centre), in conjunction with the 'Blue IQ automotive cluster initiative', was established to develop the industry even further.

However, when South Africa is compared to global automotive markets, it becomes clear that a false sense of competitiveness exists. Firstly, South Africa produces only 0,73% of the world's vehicle output. Furthermore, South Africa has been awarded export-oriented support by the Motor Industry Development Program until 2012 (It was extended from the previous agreement of 2007). This means that SA will be 'safe' until the program's termination, after which the industry must be able to stand alone amongst global competitors and remain viable contenders. 2012 therefore marks the turning point for South Africa's Auto Industry. Economies of scale, higher import taxes and limited investment from overseas partners, all serve as a threat to the industry's survival.

When looking at SA's situation in an objective manner, there are numerous reasons for our low level of competitiveness. The diagram in Figure 1.1-1 below gives a high level indication of some of the causes and effects of South Africa's weak position in comparison to global markets.

Figure 1.1-1: Cause and Effect Diagram



Source: Production and Operations Management, Chase et al, 8<sup>th</sup> Edition, 1998

According to Virag and Stoller, a further development that may threaten our competitiveness levels, if not addressed, is the fact that “OEM’s are moving toward a more systems-oriented approach in which a limited number of system suppliers or system integrators – with design, engineering, and other advanced capabilities – supply fully assembled and tested modular systems. OEM’s expect these system suppliers and integrators to coordinate both internal and external product development activities with their own supply base.” [1]

The global trend for streamlining the supply chain has called for a closer look at first and second tier automotive suppliers. According to the Automotive Consulting Group, Inc., “Suppliers are being asked to assume greater responsibilities in engineering, product development, warranty, and global support while meeting stricter quality and timing standards, and price-reduction requirements. The effects of these demands are cascading through the supply base.” [2] There has been a dramatic change in the roles played by the assembler and then separately by the supplier. No longer does this traditional picture exist. OEM’s are moving toward a more integrated systems approach with their suppliers. Restructuring of the supply base has become a necessity for survival. There now exists a fundamental shift from a tier

perspective to a focus on competitive position based upon core competencies and integrated supply based management.

The extended enterprise calls for “simultaneous synchronous engineering”. This refers to the process that each supplier manufactures on a make to order basis at a rate that is as close as possible to that of the higher level supplier. This cohesion is best investigated and implemented in the early stages of supply planning and development.

The role of the supplier is directly affected by this trend. It therefore is imperative that they embrace this paradigm shift and move towards a more integrated, synergistic approach.

## 1.2 A Localised View

The South African automotive OEM's, and specifically for this dissertation, BMW, “produce to high developed-world standards, but are having to cope with low developing-world logistical standards.” [3]

The OEM's are moving more and more away from in-plant sub-assemblies and in-house sequencing so as to focus on their core competency of “assembly”. This in turn is forcing suppliers to take on more responsibility and to get up to speed with global competitiveness standards. The way in which a vehicle is assembled today, is not what it used to be. At BMW, the aim to produce a customer ordered car in ten days is a reality, but not without a huge amount of integrated effort from all stakeholders. BMW's set of systems that propose to tailor make a vehicle within this ten day period – from customer order placement to customer delivery - sets a precedent for all supply chain members to keep up to speed with the OEM's demand for high quality products, cost effective processes and timely logistics.

A large part in achieving this target of the 10-day car is to minimize waste in the total supply chain. The JIT philosophy presides here, where any form of waste, be it time, inventory, handling, etc, must be removed from the system. This not only will reduce the overall cost considerably, but also enable the system to become more flexible and able to react quickly to any changes that may be necessary.

## 1.3 Problem Definition

From a holistic point of view, there are numerous driving forces for supply chains of all types of industries to move towards a more integrated, synergistic management approach. There are many new trends and philosophies that have been brought forward – from outsourcing, collaboration and virtual integration to mergers and acquisitions – that all try and create this desired synergy. It has also become evident that these approaches are not always well suited

to every environment and that “custom-made supply chains” is the new recipe for successful integration. Although this may very well be the answer for true synthesis, there is a significant “gap” between the theoretical implementation and the actual execution thereof. Albeit most world-class organizations are aware of these trends and proposed action plans, the reality of everyday silo functionality within the firms restricts this crucial development process.

The Automotive industry’s modus operandi is no different. The need to develop the supply chain in order to reduce costs is a resolute aim for automakers. The ever-increasing number of variants per part family has forced OEM’s to refrain from keeping large amounts of stock. The space and investment required for the “in-case” principle per variant is far too great. As an industry with one of the most complex network of supply chains, the task to integrate these interdependent processes is not an easy one. For true fusion, each and every facet of the supply chain process needs to be considered, understood, investigated and developed in order to gain a total system perspective. Without this view, overall sub-optimisation may be realised as a result of localised improvements. This role of translating trends, knowledge and experience into practical execution plans will serve to bridge this fundamental gap. If this function can be brought to the fore and built upon, it can serve as an indispensable catalyst for supply chain integration.

For the automotive industry, this very new role is currently being carried out by the so-called “supply planner”. Its development and emphasis is still embryonic and its potential not yet fully recognised. This dissertation will attempt to highlight the supply planner’s significance in playing the part of developing the supply chain through its unique interaction across all functional silos. By endeavouring on an industry case study to transform a section of the supply chain within the South African automotive industry, in accordance with current global trends, both generally and industry specific, this supposition can be explored and tested.

### 1.3.1 Automotive supply chain problem

There is a universal trend to increase, improve and implement JIT philosophy-based processes. There is sound reasoning for this phenomenon.

As mentioned earlier, a car is assembled according to the sequence of customer orders received from marketing and sales. What does this make-to-order philosophy mean for the manufacturing environment that produces these vehicles? For the OEM, it means that all parts and components should ideally be delivered directly to the line, in the same sequence that the customer orders are received from marketing. This concept of “synchronous simultaneous manufacturing”, has huge implications for both the OEM and the suppliers. In order for it to succeed, the OEM and supplier must be fully committed to make it work. Stable systems must exist between them and a common goal of reducing costs across the supply chain is essential.

In physical terms, the number of steps – be it processes, storage, handling or transport – must be reduced and/or eliminated from the supply chain.

If all suppliers could manufacture/assemble their components exactly in tune with the OEM, a truly streamlined supply chain could be achieved. This means that when the body of the vehicle is dropped onto the line at an OEM such as BMW for the start of assembly, a “call-off” is sent to the suppliers to produce that particular part for that particular order. The supplier then manufactures/assembles the respective part and delivers it to the line in time for its fitment to the body. Although possible in many instances, this scenario is not always viable. If a supplier is situated far from the assembly plant, or the component is batch produced owing to certain constraints within the suppliers’ plant, a different approach has to be sought in order to optimise the supply chain processes.

From the viewpoint of the OEM, the suppliers should be delivering a fully-assembled, in-sequence part directly to the line. This approach offers the largest window of opportunity to reduce costs – “the cost of Logistics has risen to the level of the cost of production.” [3] This calls for an urgent need to develop the suppliers. The aim is to synchronise the suppliers’ processes in a way that favours a Just-in-sequence (JIS) supply. Considering the many non-JIS suppliers that feed the assembly plant, a huge window of opportunity exists to transform and develop these suppliers.

#### **1.4 Project Aim and Scope**

The aim of this dissertation is to analyse the scope and requirements for supply planning in the South African automotive industry from both a theoretical and practical perspective. Based on this knowledge, a generic framework for developing and integrating the supply chain will be designed by considering the influence of the South African culture and environment on the supply planning procedure. This outline can then act as a catalyst in supply chain transformation processes.

In order to achieve this, the following specific objectives have been set:

- The evaluation of the Automotive Industry in South Africa in comparison to Europe
- Research of current trends in Logistics, Supply Chain Management and Automotive Specific trends both on a Global and Local scale
- The effect of Supply Planning in the Automotive Industry
- The evaluation of current Supply Planning Methodologies and their relevance to European and South African Automotive conditions
- Identification of the opportunities of using the Supply Planner as a catalyst for change

- The development of a more practical based Methodology for playing the role of the Supply Planner

## 1.5 Project Approach

The key phases of the execution of this dissertation are detailed below:

**Phase 1: Supply chain trends:** investigation of global and national trends for supply chain management – both in general and automotive industry specific

**Phase 2: Supply chain/planning methods:** analysis of methods that serve to integrate the supply chain

**Phase 3: Supply planning in practice:** Industry case study

**Phase 4: Supply planning application requirements:**

- Business issues
- Practical implications
- Limitations
- Constraints
- Implementation requirements

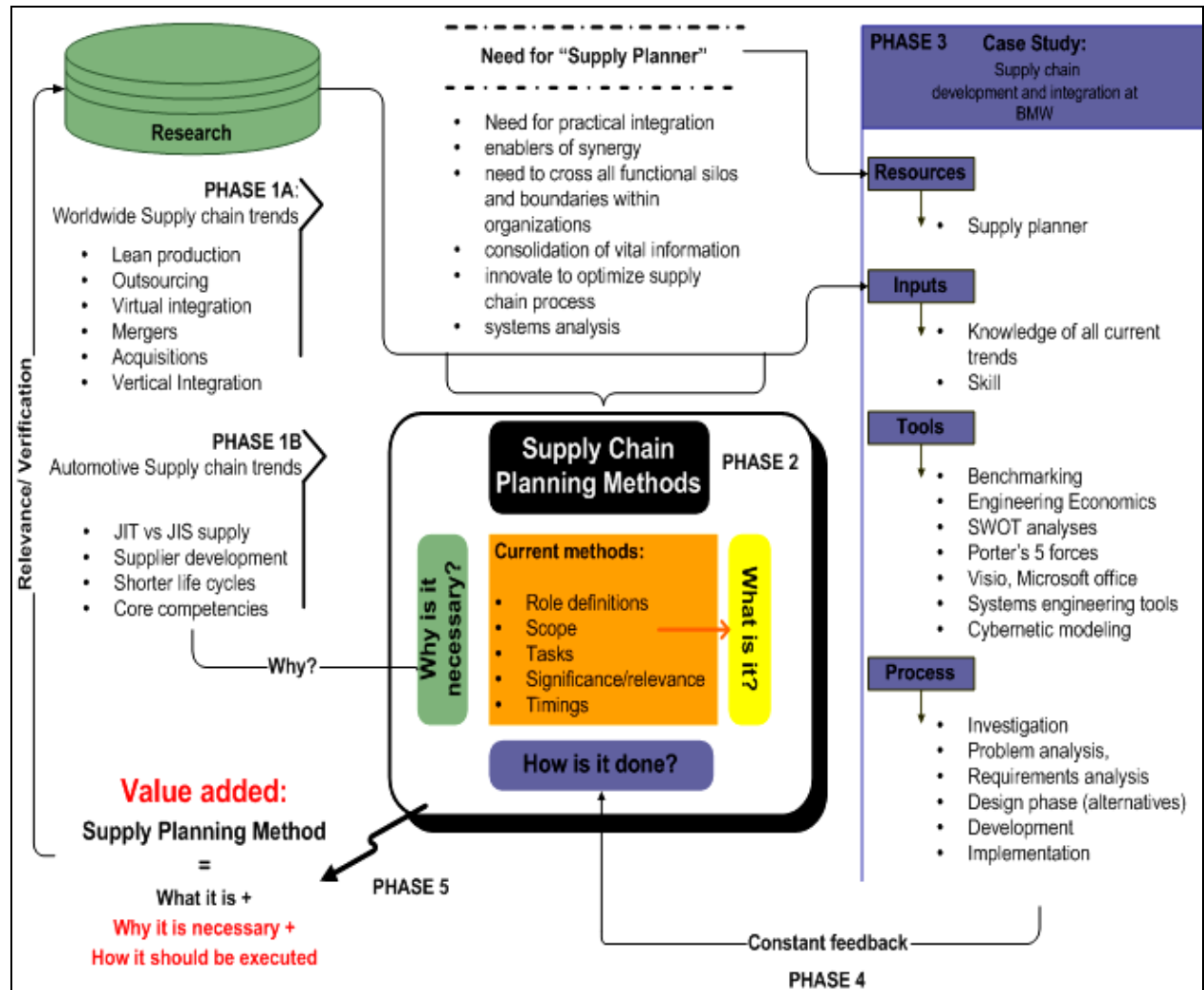
**Phase 5: Developing an improved method / model** to illustrate a proposed approach for supply chain integration in the Automotive Industry

**Phase 6: Verification and verification** of the developed framework and/or approach

Figure 1.5-1 illustrates the interrelationships amongst these phases and the way in which they will be executed.



Figure 1.5-1: Dissertation Approach



### 1.5.1 Stakeholders

It is important to state the parties that will play a role in the execution of this research study. Each of the following institutions will contribute and support in the consummation of this dissertation.



*Government initiative for Gauteng. Supports the AIDC to develop the automotive industry through the “High Valued Manufacturing” project*



*Automotive Industry Development Centre provides industry specific expertise to OEM’s and suppliers. Also a partner of the new Supplier Park in Rosslyn aimed to consolidate SA’s logistic activities*



*Recognized resource to study, develop, improve and benchmark supply methods and integration techniques necessary for this dissertation (Industry Case Study)*



*The Fraunhofer-Gesellschaft is an international partner for research in all fields of the engineering sciences. It is Europe’s leading organization for technical and organizational innovations. Its affiliation with the AIDC will serve as a support function for this dissertation*

## Chapter Two

### **RESEARCH OF CURRENT SUPPLY TRENDS**

## 2.1 Introduction

Supply Chain Management is a very broad yet diverse subject. Its importance has only recently been recognized as the future means of sustained profitability for most organizations. There are numerous methods, techniques and tools that have been brought forward to aid in the integration of the supply chain processes. In order to develop any supply chain, awareness of global, local and industry specific trends is imperative. Without up-to-date knowledge, decisions with regards to uplifting competitiveness levels become difficult to make.

## 2.2 Defining the Supply Chain

The Supply Chain, according to Christopher et al [4] is a network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer.

This definition indicates that the chain is not linear, but rather a network structure within which all the activities, material and information flow. The ultimate customer for each organisation within the supply chain is the supplier to the next tier – be it one or many. The supply chain is therefore made up of many links (each being made up of the three major entities, the customer, company and supplier) – some connected to the same one, whilst simultaneously attached to another chain. By taking a closer look at the intricacies of the cross-network structure of an entire supply chain, it becomes clearer as to why the integration thereof is extremely difficult to manage.

Many companies have finally realised that supply chain logistics accounts for a substantial amount of the cost to customer. However, the goal to have a transparent supply chain is still lacking. Why? Many corporate cultures inherently believe that it's a matter of companies competing against companies within supply chains. This is very wrong. It has now become an issue of supply chains competing with supply chains and the organisation is a mere link in the chain. The extended enterprise is not a new phenomenon. Companies should not view themselves in isolation. They should realise that if there is a weak link in their supply chain – from the nth tier right through to the final customer – their survival is under threat. So what is the paradigm shift? In today's business world, an organisation should view its position in the context of its own supply chain – from start to finish, including all sub-suppliers and sub-customers of downstream and upstream players.

If companies can start seeing themselves as a mere link of an interlocked chain, all the consequent philosophies of supply chain integration will be realised. When the perspective shifts from company-wide strategies, to supply chain integrated strategies, a whole new approach to the running of the individual players (companies) is unavoidable.

Many companies strive to optimise their business – to make money in other words. This of course is the point of any organisation. However, by optimising only one link in the chain won't necessarily result in the optimisation of another link. Most companies will retort that it's not their prerogative to ensure the profitability of other suppliers or customers! These companies fail to see that each link affects the other like dominoes.

“For most supply chains, approximately 6% of activities in the supply chain actually add value.”  
[5] The longer the product or service takes to reach the customer in the right place, at the price and the expected quality, the more costly it becomes for the customer to purchase in order to recover the lost value. This has brought on the common trend in all supply chains to SHORTEN the time it takes for a product to reach a customer, which in turns means that the supply chain needs to be condensed. By reducing the time it takes from the first supplier to the ultimate customer, less money is spent on non-value-added activities. By merely transferring costs in the pipeline to another customer, may translate into an 'optimised', cost saving activity' for an individual link (company), but it does not make the cost of the product less. When inventory, in all its forms, lies in the pipeline without getting any value added to it, the resulting costs don't merely disintegrate; they are rather transferred to another supply chain member until the cost is absorbed or rather dissipated at the end of the chain. The problem of course is that the end supply chain member is YOUR ULTIMATE customer.

Hence, the more non-value-added activities present in the supply, the more the customer has to pay. The more the customer has to pay, the less satisfaction is obtained and the more vulnerable and susceptible your company (individual link) is to losing that customer to your competition.

There is sufficient evidence as to where the future of managing supply chains lies – cost minimization through total system optimisation. There are many propositions to combat the obstacles associated with integrating the supply chain. A closer look at these philosophies and techniques will be dealt with, as well as their appropriateness and relevance to the automotive industry environment.

## **2.3 Global Supply Chain Trends**

This section deals with the research of current global supply chain trends. There are numerous different methods and philosophies for developing supply chains, so a closer look at some of the more current trends will be dealt with in the following paragraphs.

### 2.3.1 Global race for integrated supply chains

“The business environment is subject to a number of significant forces that are driving change in the logistics and supply chain arena. These include:

- Globalisation
- Consolidation
- Integration
- Focus on core competency
- Collaboration
- Shorter product life cycles” [5]

Tarlton also mentions that supply chains have been classically considered as a sequential chain of participants passing physical goods, information and money to and fro in a linear fashion. However, with the advent of the Internet, dramatic increases in outsourcing and the compression of time, the supply chain is shifting to integrated demand networks. Material is no longer pushed down the chain but pulled by demand signals with flows managed by overall co-ordination facilitated by central access to information. He highlights that this paradigm shift is associated with various other shifts inside businesses:

- From functions to processes
- From profit to profitability
- From products to customers
- From transactions to relationships
- From inventory to information

The most significant factor for these changes to take place is by focussing on customer service. As mentioned previously, each member in the supply chain is a customer to the next and this is the way in which all businesses should view their position in their own demand network.

### 2.3.2 Improving Value across the Supply Chain

A way to “analyse the supply chain to improve performance is the review of value added over time.” [5] By showing where the product sits idle and no value is added, a clear picture of where potential improvements can be made is highlighted. The actual time spent on adding value to the product/ material is commonly as low as 5% of the elapsed time. “This gives an indication of the massive potential improvements through focus on the supply chain” [5] For a global organisation the supply chain processes can have a significant impact on the organisations’

financial performance. In a recent study by the Corporate Executive Board, they found that the financial performance of major organisations that focus on supply chain management is significantly better than those organisations that do not: “While widely divergent in industry, elite cost cutters is unified by a single minded focus on reducing materials and supply chain – as opposed to SG&A – costs.” [5]

### 2.3.3 Outsourcing

“There is a significant global thrust towards outsourcing and logistics activity is no exception to the rule. According to Armstrong & Associates 2002, the penetration of Fortune 500 organisations is now significant. This trend is well documented in the developed economies, but unfortunately poorly developed in South Africa. Although South Africa is behind this trend, it is progressing in a similar manner driven by similar issues. Progress is often accelerated when the local business has a multinational parent.” [5] Although Tarlton mentions this in the general sense, it applies to the Automotive Industry quite aptly. The manufacturers that have a parent company based in a developed economy has considerably more potential than other counterparts without this advantage, to develop their supply chains according to world class trends and standards.

In keeping with the desire to focus on core competencies and outsource those activities that could be done more efficiently by a service provider, Tarlton suggests that special care must be taken to ensure that these localised improvements do not cause deterioration in total cost. Much more critical is the effectiveness of the supply chain. An integrated view considering the entire supply chain allows companies to find the optimum solution to create the greatest value for the business as a whole, rather than localised optimums in specific functional areas. To re-iterate this suggestion, a look at the work of Baker [6] will be useful. His first-hand experience in outsourcing gives a different perspective on the practicalities of such an activity.

According to SAPICS, the Professional Society for Supply Chain Management [<http://www.sapics.org.za>], outsourcing can be defined as the ‘Process of having suppliers provide goods and services that were previously provided internally.’

The main reasons for outsourcing are:

- Reduce and control operating of overhead costs
- Improve company focus
- Access to capabilities of suppliers
- Free resources for other purposes
- Avoid future capital requirement
- Resources are not available internally

- Function is difficult to manage or is out of control

For South Africa, accessing the supplier's capability is a huge step forward in developing suppliers and in turn developing the automotive industry. This does not mean that outsourcing is the only way to progress the industry, but it should, where applicable, be investigated.

According to the lessons learned by Baker [6], he defined three rules for using outsourcing as a tool:

1. What do you want?
2. When do you want it?
3. What do you want to pay?

He says that if the first question cannot be answered, then outsourcing is not the answer. From his experience, he has devised 10 lessons that he has learned. We will briefly discuss them now.

#### **Lesson 1: Understand your cost**

There are many hidden costs involved in outsourcing. In order to recognise which costs will be eliminated, reduced or increased, it is imperative to understand your own cost first. Some costs that go unnoticed are maintenance, the selling or acquiring of fixed assets, other costs encountered as a result of sub-processes that were previously carried out in-house. If you don't know what costs to compare with the outsourcing of the function, you won't be able to determine if there is a saving or not.

#### **Lesson 2: Our drawings do not reflect what we want**

Although this lesson seems irrelevant, it has a huge impact on the product that is expected to be received from the supplier. If the details of the product or service are not clearly defined, you will not receive what you think you want.

#### **Lesson 3: Understand what has been quoted**

The only way to decipher as to whether the quotation received from a potential supplier will be a saving or cost more than the present in-house function is to understand what has been quoted. The way to do this is to work off your own costed bill of materials so you can identify major cost drivers. This is very important as we're pushing for major cost reductions. If both the supplier and you understand key cost drivers and their (supplier's) required margin, it makes negotiations more productive and focused.



**Lesson 4: How much outsourcing can you afford?**

Understand the value of your machines, tools, fixtures and related assets. Will the assets be used and taken over by the supplier? Will it be sold or scrapped? All these factors influence the accounting matters with regards to timing. Know how much outsourcing you can afford and what cost factors will impact you financially.

**Lesson 5: Watch your raw material and the 'bridge build'**

The transition period as you move the operation from internal to external with a supplier must be carefully planned. Material lead times, production schedules, forecasts and speed with which the supplier can ramp up operations can all impact the amount of raw or work in process inventory which may remain at the time of outsourcing.

Make sure you have planned for a sufficient amount of inventory - bridge build – in the event the implementation date slips or there are issues with production or fit-up of first part. In other words – have a good implementation plan.

**Lesson 6: Supplier selection: Quantitative factors**

- Are they profitable – do not partner with someone financially struggling
- Overhead allocations? What amount and do they apply to the cost roll-up?
- History of price adjustments? Do they 'low ball' to get the business and then increase prices. Do they have a history of cost reductions?
- Facility percentage capacity? How well can they accommodate your business within existing capacity/
- Delivery performance?
- Quality performance?
- Warranty performance?

According to Baker, of the three traditional performance measures – cost, quality, and delivery – delivery and quality tie for first place. He argues that if you don't have the quality product at the right place and time, it doesn't help if you got it for a cheap price!

**Lesson 7: Supplier selection: Qualitative factors**

Qualitative factors are based on judgment, opinion or experience and are critical to supplier selection

- Is the supplier about to install a new computer system? Huge problems may arise as a result and so the full understanding of the system and its implementation must exist from both sides.
- Is there a history of successful projects with the supplier?
- Distance from your location to the supplier can influence timeliness of delivery, etc.
- Does supplier have resources to complete the project? Engineers, labour, experience, expertise?
- How is suppliers' safety or environmental record? Environmental violations could shut them down.

#### **Lesson 8: Performance expectations**

Excellent understanding of performance expectations and how they will be measured are imperative as to how the supplier will perform in the long term. Also, charge back procedures should be clearly specified to avoid conflict. The lesson learned here is that both you and the supplier should agree on measurements so that both can report to respective management.

#### **Lesson 9: Communicating material requirements**

Once the function has been outsourced, it becomes evident that communication about whether to increase or decrease material requirements was far more flexible – this is due to differences in planning methods – you may recalculate your MRP requirements on a weekly basis, whereas the supplier may work on a monthly one. If requirements are sent to the supplier via EDI, they might not fully understand the information received.

Do not underestimate the time and detail necessary to clearly communicate material requirements. Savings disappear quickly when you are short on parts.

#### **Lesson 10: Approach target costing cautiously**

In general, suppliers request a benchmark cost or price when negotiations are in place. It therefore is critical that the target cost/ price submitted to the supplier is accurate and include all appropriate cost elements. If a price that is submitted is too high or too low, it can nullify the entire process.

### **2.3.4 Domino Effect**

This effect provides some cautionary measures when considering the outsourcing of an activity. By outsourcing an activity to a third party, either the supplier or a logistic service provider, a certain degree of control is lost which "can either give success as a company...or give you

failure!" [7] To increase one's chances of having the dominos fall in one's favour – i.e. the chances of successfully outsourcing an activity, a number of factors can significantly influence the way they fall.

According to Voortman [7], the first aspect to consider is the alignment of your supply chain. It must first be ascertained whether all the role players - suppliers, distributors, etc are correctly aligned to your business goals, objectives, mission and customer service.

Secondly, all staff members – from procurement person to maintenance person who services your machines in order to satisfy your customer's orders, etc must all be aware of their role in the domino process.

The next important factor is whether all your external participants in your supply or value chain appreciate that they are part of YOUR process. Do they appreciate that they can "mess up" your whole logistics process if they do not do the right things right? The modern concept of boundary less logistics sees the importance of external suppliers and distributors who are actually PART of YOUR process.

Lastly, do bottlenecks occur in the domino process? This bottleneck can be:

- A weak procurement team who never manages to get the supplies for production on time, or
- A production team that always under forecasts, or a maintenance team that does not properly schedule preventative maintenance, thus bottlenecking production with constant machine down-time, or
- The packaging team who under-forecasts demand and has inadequate stock to package the produced items, or
- The transport manager who is disorganized in his route planning and scheduling of trips to customers

So what can be done to improve the situation? Voortman suggests the following:

1. Identify what the bottleneck is
2. Stay focused on the problem until it is finally resolved
3. Only move onto the next bottleneck problem once the previous one has been adequately resolved
4. Break the Elephant in to Bite-sized chunks. Problems should be broken down into smaller, more manageable chunks so that they can be properly dealt with.
5. Solve the biggest or primary problems first – although not the easiest thing to do – it is the only way to get to the root cause of the problem.

Voortman mentions that this causes an unusual phenomenon to take place. The value built into the system at the beginning of the domino process starts working its way through the domino effect. Ripples of improved quality and improved processes (from solved problems) starts working its way to the next member in the chain. We then start seeing the improved domino effect working its way to the end of the dominoes, rolling out increased profits and customer satisfaction.

Although I am in agreement with the ripple effect of the improved processes from a higher tier supply chain member to a lower one, it is not a forgone conclusion that if the processes are improved at the top, that the bottom tiers will be improved in a similar fashion. This can only be true if each supply chain member is directly involved in the process improvements of the other. This means that close relationships, excellent communication, transparency of information and processes of all partners should be in place first before any domino-like effect can take place. He goes on to mention that the customer starts the domino effect since he is at the top of the chain. This is definitely true – without the customer order, there should be no product. The question is how much of the product is needed, when it is required, and at what price it should be sold for. The customer therefore impacts all logistical activities that are needed to meet his requirements. This makes up the so-called marketing mix and the supply chains that are able to fulfil these requirements in a more cost effective way, are the ones that obtain the competitive advantage needed for sustained profitability.

## **2.4 Global Trends in the Automotive Industry**

Now that the global trends for supply chains have been brought forward, a more focused look at the automotive industry can be dealt with. Parallels can be drawn between these generic supply chain trends and those associated with the Automotive Industry and in so doing provide a broader perspective on how the supply chain can be viewed and developed to optimise processes and reduce overall costs.

### **2.4.1 Automotive supplier industry: New paths of profitability**

According to a study done by the consulting firm, Accenture [8], the automotive industry is evolving in a sense that automotive suppliers are being forced to acquire and merge with other suppliers in an attempt to meet the ever-increasing demands of OEM's to take on more responsibilities as OEM's focus on their core competency of assembly. "OEM's are moving toward becoming keepers of their brand image, design capability and marketing responsibility which in turn means that suppliers are put under more stress. Tier-one suppliers continue to get bigger and fewer, taking on module and systems development. The supplier must therefore add value from the development to the production of the car, or else it is a zero-sum game. Building

that value will come through innovative technologies, process advances and recreating roles. “[8]

This trend re-iterates the need for suppliers to be developed and become attuned to the OEM's processes and strategy. This development can not be done in isolation and so the OEM and Tier-one supplier are under even more pressure to collaborate and work together towards streamlining the supply chain.

#### 2.4.2 Lean production puts pressure on Logistics

To echo the stance on streamlining the supply chain, a quick look at the influence that logistics has on lean production is needed. According to Encyclopaedia Britannica Online (an extract from Automotive News) [9], logistics operations are playing an increasingly important role in the auto industry's quest to achieve cost savings and manufacturing efficiency. The science of moving automotive components from the supplier to the final assembly always has been a vital part of manufacturing. The drive to lean productions and increased manufacturing flexibility makes logistics even more important. “Combined with the relentless pressure to reduce costs, automakers and suppliers are asking specialist companies to handle more of the task of getting the right parts to the right place at the right time.” [9]

Suppliers want help in meeting automaker demands for frequent, small-batch delivery of sequenced parts. Tier 1 suppliers producing modules need help both in collecting parts from Tier 2 suppliers and in delivering sequenced modules to customers. Automakers want to minimize component inventory and prevent expensive interruptions in parts flow that can shut assembly plants. Logistics is a long way from each supplier shipping crates of parts to the door of the assembly plant.

This calls for a functional role in the form of a supply planner to meet the OEM's demands whilst developing the supplier and enforcing the JIS principle. There is therefore a definite need for a supply chain catalyst.

#### 2.4.3 Effects of global trends on automotive suppliers

New paths of profitability for the automotive supplier industry have to be explored in order to keep up with the ever-escalating levels of competitiveness worldwide.

According to a study done by Accenture in 2002 [8], “*European automotive suppliers are facing some of their toughest times ever. Intense cost pressures, consolidation, along with globalisation are just some of the overarching problem areas.*” It seems apparent that suppliers are being pressured by OEM's to reduce their prices whilst providing more value. This is

hindering their profitability. In this way, suppliers are currently being forced to acquire and merge with other suppliers – owing to the demands of OEM's to work with full service providers. The same Accenture study revealed that *"75% of industry experts agree that only three to five Tier-one suppliers per module/system will survive. Many suppliers will continue to merge with others or join in alliances. Some will go out of business. The result will be further concentration and reduction of direct supplier contacts for OEM's."*

If this prediction proves to be true, it creates the need for OEM- Tier-One supplier relationships to strengthen and work even more closely together. If the lower tiers merge to establish a derivative of vertical integration for the purpose of improving integration levels amongst themselves, then so be it. The fact that more and more OEM's demand that they focus on their core-competency of merely assembling a vehicle, stresses the need for a more effective and efficient supply of parts to the OEM's. In reference to the Accenture study once again, "OEM's are moving towards becoming keepers of their own brand image, design capability and marketing responsibility, the suppliers must add value from the development to the production of the car, or else it is a zero-sum game. Building that value will come through innovative technologies, process advances and recreating roles.

*"As more changes take effect in the automotive industry, what was once a straightforward value chain will become a more complicated network. Every supplier will need to decide what role it will take on in this network. Some will choose to do everything, while others will specialize. Some suppliers will serve one OEM; others will set cross-OEM standards."*[8]

The role of the tier-one supplier will never fall away in the case of large automotive manufacturers who rely on the timely, cost-effective, high quality supply of final vehicle parts. Hence, the need for higher levels of integration between tier-one suppliers and OEM's! Already, individuals from suppliers, OEM's and engineering companies are increasingly coming together to collaborate on projects. All participants in the supply chain are becoming ever more interdependent.

#### 2.4.4 A closer look at supplier partnerships

According to Nancy Wendorf, 2002 [10] *"... supplier partnership building has become a critical strategic skill. A successful supplier partnership can provide access to world-wide markets, multi-various technology and other resources. A supplier partnership can give you the capability to handle change and hedge risks... corporations that build a capability to have strong supplier relationships, enhance their competitive advantage by leveraging the capabilities of their supplier partners, this effective marriage, in turn, can lure more desirable and more powerful partnerships as the global marketplace becomes ever more competitive."*

Supplier partnerships can take on many different forms. They range from ventures such as mergers, acquisitions, joint ventures, licensing agreements to the more informal, strategic alliance referred to merely as 'partnerships'. The latter is the more common choice for many corporations owing to the ease and speed of its formation. There are numerous reasons for establishing these alliances, and each one has its unique framework, business/ management systems, control, performance assessments and logistic requirements. In essence, each type of alliance is a form of outsourcing one or other activity to a supplier or service provider. Many aspects have to be carefully considered to ensure that the alliance is a success for both parties involved.

## 2.5 Local Research and Supply Chain Trends

The previous paragraphs outlined some of the main supply chain trends that exist world-wide. These trends are sometimes based on different assumptions when compared to the South African environment. It therefore stands to reason that local developments be investigated to understand what currently works and how these global trends can possibly be adapted to suit the conditions in South Africa – both generically and automotive industry specific.

### 2.5.1 Information sharing between customers and suppliers

"Africa still has a lot of catching up to do with the rest of the world if it wants to be considered a world class continent in the field of supply chain management." [11] (Rueben Badana, CS Holdings) African companies continue to function as individual silos without any collaboration between them. More importantly, our people are not multi-skilled, and most are not even skilled at all. *"Most companies tend to focus on educating their office workers and neglect those employees who are actually carrying out the physical work. They need to ensure that the business strategy that is developed in the boardroom is filtered down to the lowest level and then implemented correctly,"* says Badana. [11]

"A lack of understanding the concept of supply chains often hinders the successful implementation of supply chain management. Supply chains are global networks used to deliver products and services, stretching from the primary raw materials up to the final end consumer". (Jan de Ruyter, SAPICS Managing Director) [11]. According to de Ruyter, for the supply chain to work smoothly, there must be collaboration and co-operation between the various parties in the chain. On a macro level, infrastructure such as an efficient communication network, road and rail links, and a dependable banking system are required. This will ensure that supply chains can operate efficiently and are able to compete globally.

Unfortunately, African countries are averse to sharing information with their suppliers and customers, especially across national borders. Consequently, they are unable to develop true partnerships that ultimately lead to effective supply chain management,” says De Ruyter.

Badana points out that African companies still rely on the three-quote system before placing an order. “In World-class practices, price is no longer a determining factor in choosing a supplier. Instead, the industry is beginning to demand reliability and responsiveness – the ability to deliver on time”, he says. “In Africa, however, most companies are still wont to carry extra stock in case their supplier lets them down. Reliability and responsiveness are principles that need to be fostered on this continent in order to enhance the flow of the supply chain.

## 2.6 Local Automotive Trends

### 2.6.1 South African environment

The automotive sector is the Pretoria area's biggest employer, biggest exporter, and biggest consumer of water and power.

The advancement of logistics in South Africa is crucial because original-equipment manufacturers (OEM's) are producing to high developed-world standards, but have to cope with low developing-world logistical standards. South Africa will not be able to hide behind its developing country status, and must urgently raise logistical standards to those of Europe, Japan and the US.

An extract from Martin Cramer's Engineering News Online Manilal [3] states that *“a large number of suppliers are currently unable to export because of their inability to meet industry quality-cost-delivery standards, because of their limited capacity, limited access to the latest technologies and lack of financial resources to be globally competitive. Many tier-two and tier-three suppliers are not part of the original-equipment manufacturers (OEM) supplier development programmes available to tier-one suppliers. In turn, tier-one suppliers, although highly competitive and linked into international networks, generally lack capacity to develop lower tier supplier into international standards. Some lower tier suppliers are generally the least competitive in the supply chain, but are also the least able to afford competitiveness improvement programmes.*

*To give suppliers the opportunity to access competitiveness improvement initiatives, a three-way partnership model has been developed between suppliers, the Department of Trade and Industry (DTI) and the AIDC. DTI's financial support will continue to make the programmes more affordable and suppliers will have to make sliding-scale contributions to the cost of the interventions conducted by the AIDC. Typical interventions are organisational design, strategic*



*planning, production strategies, logistics and logistical re-engineering, quality assurance, design engineering and testing, HR development and project management.*

*The automotive industry is the largest sub-sector in the manufacturing sector of the economy and contributes 5,7% of the gross domestic product. It employs 280000 people directly. Automotive exports have increased at a fast rate of 39% a year since 1995, rising from 15 800 units to 108 000 units in 2001.*

*There has been a corresponding increase in component exports during the same period, reaching a predicted value of R24-billion in 2003.*

*In spite of this success, South Africa still has major disadvantages when compared to other automotive-producing countries.*

*It has high logistical cost due to the long distances from major markets. It also has lower productivity per worker and lower levels of automation compared to other countries.*

Various competitiveness improvement programmes are required to make the local supplier base globally competitive! Comparative figures from recent surveys indicate that South Africa faces significant challenges to maintain and defend its position in the global automotive industry. *“This is especially true for tier-two and tier-three suppliers that have less access to international partnering and best practices than, for example, tier-one suppliers.”*[3]

The extract in the next paragraph conveys the current issues that the South African automotive manufacturers and suppliers need to address in order to work together towards boosting their overall competitiveness. It also shows the hierarchy of power that exists from the OEM through to the lower tiers. This in turn re-iterates the need for developing the South African automotive supplier base in order to uplift them on to the level of their automotive manufacturers.

## 2.6.2 Levels of Supplier integration

*“The primary reason why these components (engines, gear boxes, cockpit, front and rear screens) are not of local origin is due to economies of scale and the lack of local abilities in terms of certain technologies”*[16]

As an example, thirty-five local suppliers provide the BMW Rosslyn facility with sheet-metal, high density plastic components, wheels, tyres, suspension systems, prop shafts, fuel tanks, steering wheels and radios. These companies either have a technology licence in place or a joint venture agreement with the automotive manufacturer or are wholly-owned subsidiaries of

the company, thus introducing a great deal of technological knowledge into these suppliers. The challenge that now exists is to use the knowledge that these suppliers already have and transform it into benchmarking activities for fellow suppliers that do not have the advantages of being a subsidiary. The problem lies in the willingness of competitors to share this knowledge. It can not be stressed enough that all South African suppliers should be working with and not against one another.

### 2.6.3 First to n-tier supplier roles

Fernandes states that *“It is a commonly-held view that the weakness in the South African automotive industry lies down the value chain.... While we have world-class first-tier suppliers and assemblers, the same cannot be said for all second- and third-tier suppliers.”*[17]

According to Fernandes, most second- and third tier suppliers do not have an international partner, which creates a problem in that they do not have access to the latest technology that the first tier supplier has, as OEM's have supplier development programmes that aid their first-tier suppliers. As a result, the second and third- tier suppliers cannot always adhere to the high standards of first-tier suppliers.

*“Realising the need to develop the automotive industry across the value chain and develop the weaker section of the chain, the AIDC and the Department of Trade and Industry (DTI) have put together a supplier development programme.”* [17] The programme is focused on developing existing tier-two and three suppliers, such as press manufacturers, die-casting companies and welding specialists.

This programme focuses on the continuous, competitiveness development of existing tier-two and three suppliers to make them locally competitive and ensuring they can supply at the standard and quality expected by first-tier suppliers, both locally and internationally.

This initiative is imperative for the survival of the auto industry in SA as a whole. However, since these extensive tier-two and three programmes already exist, not only in Gauteng but also in the other automotive haven of SA, East London, it makes sense to target the further development of first-tier – OEM integration. For the purposes of this dissertation, the focus of supplier development lies within this higher level supply chain link. Its purpose, however, extends far beyond the first tier boundary. An optimised first-tier-OEM supply chain may not necessarily result in an entirely efficient automotive supply chain network.

#### 2.6.4 Subsidiary influences

The fact that many first tier suppliers and OEM's are subsidiaries to their international mother-companies can be both advantageous and disadvantageous. The restrictions that these companies can impose on their South African affiliates can also restrict the development of the local industry. Some SA OEM's are constrained to use certain suppliers that are approved by the holding company. This is due to international quality standards that most local suppliers can not live up to. However, because these subsidised OEM's and suppliers have the capabilities and means to adhere to these strict standards, a window of opportunity exists for the further development of not only their current processes, but also those of the lower tiers who have the opportunity to benchmark and learn from them. The more the tier-one-OEM supply chain is improved and developed, the more opportunities exist for the improvement of the lower tiers.

#### 2.6.5 Motor Industry Development Program (MIDP)

The Motor Industry Development Program was introduced in 1995 to encourage the local industry to become more export-focused. The MIDP has assisted in transforming the South African automotive industry from its previous inward-looking orientation to an export-driven industry. What many automakers and suppliers do not realise, is the absolute urgency of change that is required to remain competitive without the aid of development programs that currently exist, but are set to fall away in the year 2010.

### 2.7 Conclusion

This chapter highlighted the importance of supply chain management, both in the generic sense and specifically for the automotive industry, which is highly dependant on efficient process chains. Many lessons can be learned from other industry fields through their solution techniques, tools as well as methods of managing the supply chain. It should be the aim of all organisations to share valuable information, improve their processes and become globally competitive. This can be achieved through effective and efficient planning in a automotive supply project. The study and application of these global trends should be inherent to the planning of supply chains in such a project.

The automotive industry in South Africa is vital for future economic growth and so the logistical processes must be optimised to become cost effective. The only way this can be achieved is through continuous improvement of processes that follow the global best practises. A possible approach to achieve this is the objective of this dissertation.

## Chapter Three

### **SUPPLY PLANNING**

### 3.1 Introduction

There are numerous methods for managing the supply chain – both in general and automotive industry specific. Of the many methodologies perused, the most comprehensive and relevant is that done by EBP-consulting in Germany. This method deals specifically with the role, tasks and effects of the so-called “Supply Planner” within the automotive industry. Although this approach represents a thorough description of what the supply planner does, the roles that he/she plays and effects that he/she could have on the planning function within the organization, there is a practical element that is lacking. Owing to its comprehensiveness, only the EBP methodology will be addressed and used as a reference to the further development of a framework for Supply Planning in the South African Automotive Industry.

### 3.2 The EBP Supply Planning Methodology

The EBP Methodology as outlined and explained in the following paragraphs will firstly be used as a guideline for the execution of an industry case study and secondly as a foundation for the development of a more practical method of supply planning. This extension will be based on the knowledge and experience gained from this project. Before elaborating on this extension, a brief overview of the role that EBP-Consulting plays in the automotive industry must be conducted. EBP is directly involved in designing and developing methods and tools that are used in the planning, developing and designing of automotive projects. They consult to the BMW Group on a support basis and aid in enhancing the efficiency and effectiveness of vehicle projects. [[http://www.ebp-consulting.de/html/kontakt/index\\_kontakt.html](http://www.ebp-consulting.de/html/kontakt/index_kontakt.html)]

#### 3.2.1 Purpose and scope

This EBP methodology deals with the roles, tasks and effects of “Supply Planning” within the automotive industry. It focuses specifically on what activities should be carried out to:

- Reduce logistical costs per vehicle
- Increase in supply reliability (security)
- Reduction of supply time
- Increase in JIT/JIT supplies
- Decrease in logistical space required

It shows that all JIS/ JIT supplied parts to OEM's are objects of supply planning. It stipulates further that supply planning should deal with the planning of internal and external processes between suppliers and customers within the supply chain. This includes the following:

- Determination of supply chain/delivery concept

- Determination of material flow between the first tier supplier and the assembly plant of the manufacturer
- Integration of material flows in layout structure of the manufacturer

### 3.2.2 Importance of supply planning

The ever-increasing planning scope has to be managed in shorter time windows. According to the Braun [19], there is currently a 30 month horizon (from Supplier Selection until Start of Production) available in which synchronized planning per part family is required. This horizon is becoming smaller and smaller owing to the following factors:

- Decreasing product life cycles and product development times
- Increasing numbers of SOPs (Start of Productions) per time unit

Together with this challenging constraint, the scope and complexity of the actual planning is also increasing at a rapid rate. These include:

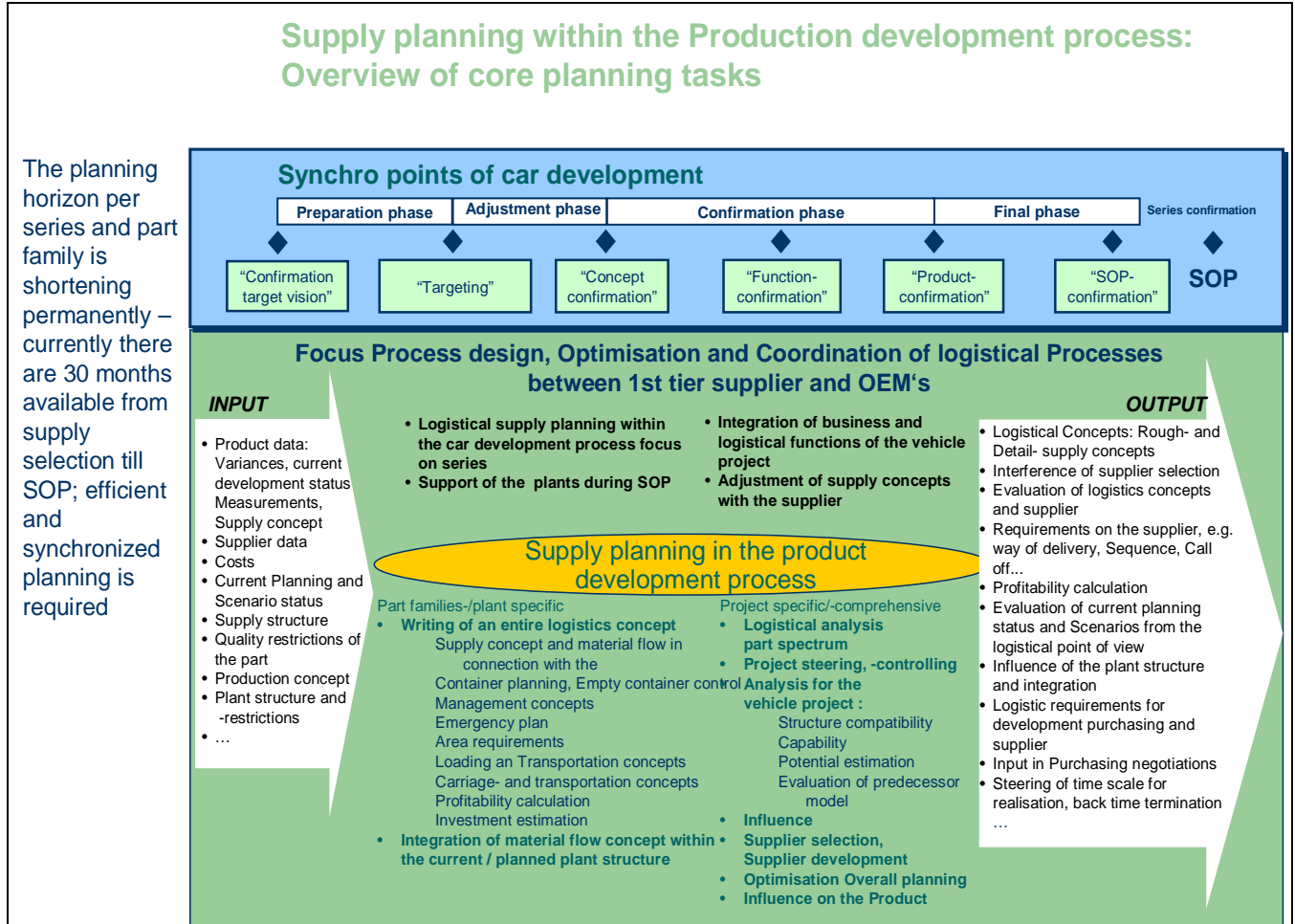
- Structural implications:
  - adjustment of plants based on changing market conditions
- Production systems:
  - Time critical part families and processes
  - Concentration of core competencies requires lean stock supply processes
  - Increases in JIT/JIS supply methods
- Product complexity and individuality:
  - Increases in number of part families
  - Increase in number of variants
- Allocation within plant:
  - Separation of simultaneous series production
  - Series allocation
  - Cross-plant coordination of supply processes per part family
- Supplier
  - Increase in JIT/JIS supplies
  - Supplier capability
  - Logistical costs evaluation during supplier selection
  - Multi-plant deliveries

### 3.2.3 Overview of core planning tasks

EBP shows that the supply planning function lies between the preparation and final phases of vehicle development process and that these tasks involve the design, optimisation and coordination of logistical processes between the 1<sup>st</sup> tier supplier and the OEM's. The diagram in

Figure 3.2-1, taken as an extract from Braun’s supply planning methodology, shows the inputs, processes and outputs of the supply planning process.

Figure 3.2-1: Core Supply Planning Tasks



Source: EBP Consulting Supply Planning Methodology, Braun J.

Braun [19] highlights that the supply planner is responsible for additional tasks. These encompass:

1. **Project/ part family comprehensive planning through the development of supply concepts as well as the organisation of supply planning within the context of vehicle projects**
  - a. Logistical analysis of part supply spectrum
  - b. Project steering and controlling
  - c. Analysis of structure capability, complexity and feasibility for the vehicle project
  - d. Influence supplier selection, supplier development
  - e. Optimisation of overall planning

- f. Documentation of supply methods
- g. Design of whole logistical concept:
  - i. Part based supply concept and material flow concept
  - ii. Packaging planning and returnable management
  - iii. Management concept
  - iv. Emergency plan
  - v. Area requirements
  - vi. Loading and transportation concepts
  - vii. Carriage and transportation concepts
  - viii. Profitability calculation
  - ix. Investment estimation
- h. Integration of material flow concept within the current / planned plant structure

## **2. Development and implementation methods/standards**

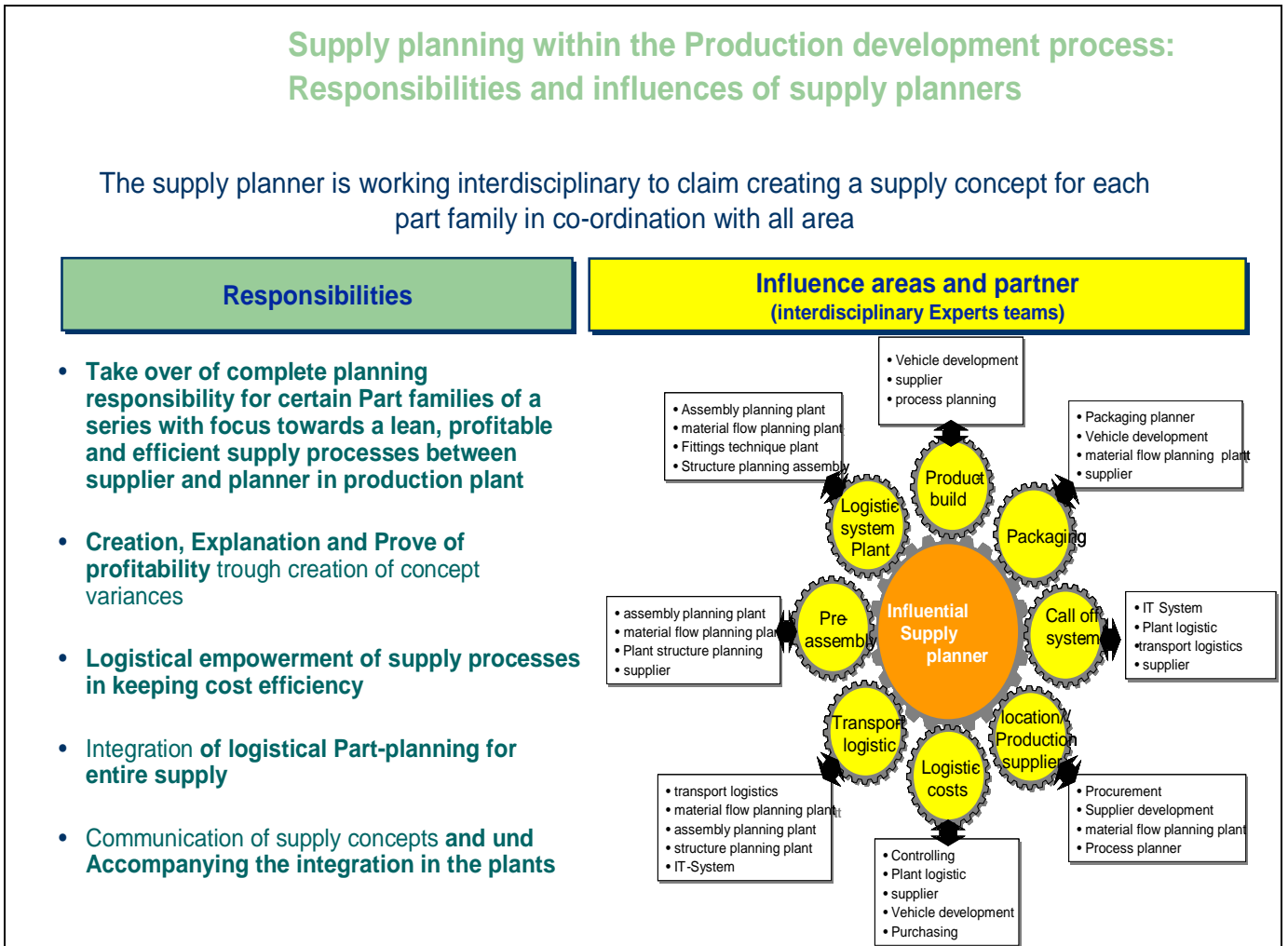
- a. Design/ development and implementation of literature sources and tools
- b. Broadcasting of best practices
- c. Systematic further development of planning basics
- d. Know-how transfer (further plants / vehicle projects)

## **3. Organization and steering of the implementation process of the supply concepts**

The methodology goes on to demonstrate the responsibilities, areas of influence and interactions with interdisciplinary team experts. The diagram in Figure 3.2-2 shows these facets in more detail.



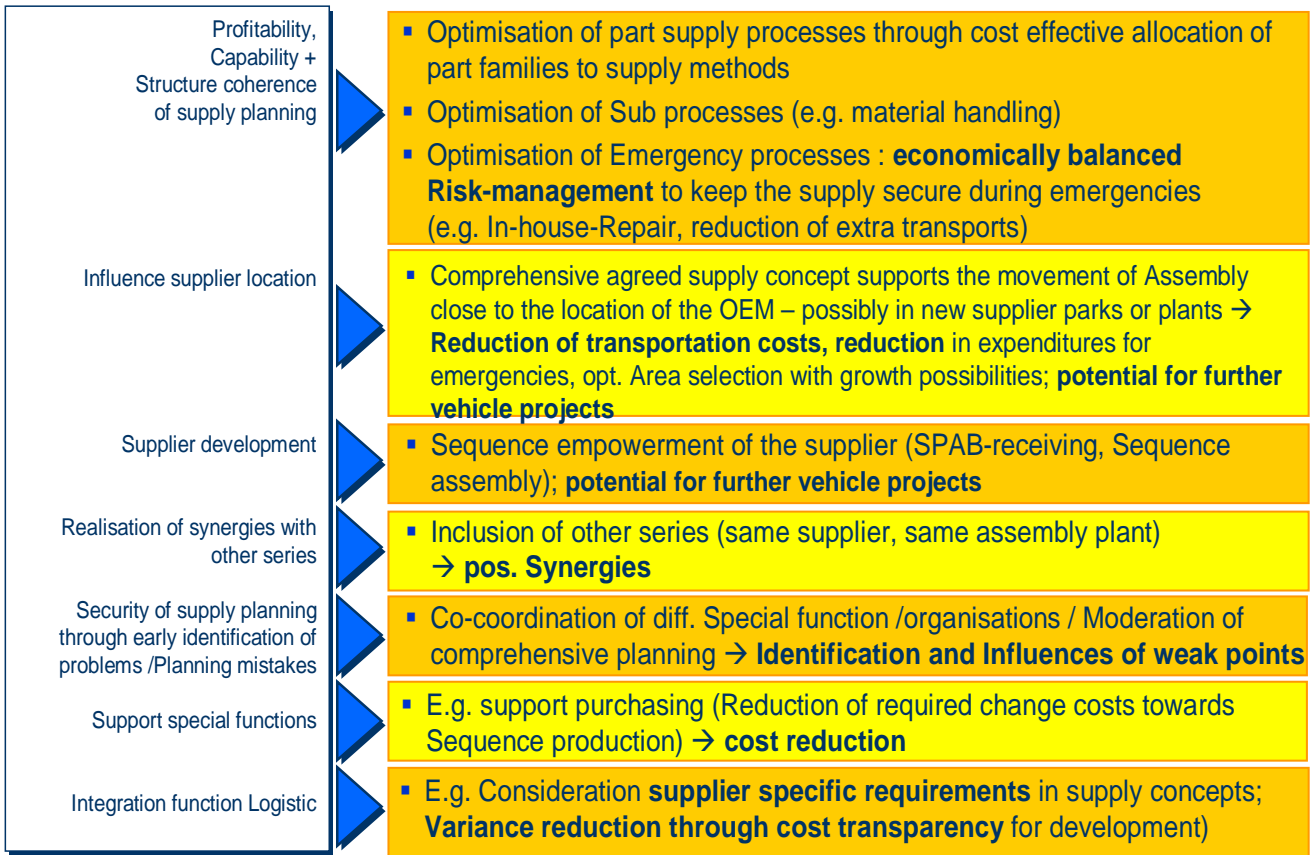
Figure 3.2-2: Responsibilities and Influences of the Supply Planner



Source: Extract from EBP Consulting Supply Planning Methodology

The supply planner’s role of integrating the activities necessary to fulfil the detail planning function in a vehicle project is extremely important. The effects that this role has on profitability, supplier location, supplier development, synergies with other series, reliability of supply, special function support and the integration of logistical function within the organization can not be underestimated. These effects are depicted in the diagram below. It sums up the potential influence that a supply planner can have on redefining the supply chain.

Figure3.2-3: Effects and Potential of Supply Planning



Source: Extract from EBP Consulting Supply Planning Methodology

Through the performance of these activities, the supply planner undertakes to minimize or eliminate the steps in the pipeline. These steps include but are not limited to:

- storage
- transport
- receiving
- picking
- packing
- containerisation
- boxing
- sequencing
- shelving
- offloading
- stock removal
- empties collection

### 3.3 Conclusion

This chapter highlighted the importance of the Supply Planner in the Automotive Industry. Its role and impact in the industry encompasses all the facets of supply chain management – integration and optimisation of current processes into globally competitive operations. The Supply Planner has to cross organisational and functional silos and so serves as a catalyst to integrating the supply chain.

The EBP methodology discussed here, although very thorough, was formulated in the context of European conditions and constraints. South Africa offers a very different set of constraints and conditions. In order to ensure that this framework remains applicable in the local context, various adaptations of this Model are necessary. The task now is to use this methodology in executing this “Supply Planning” role and discover the needs, constraints and opportunities that exist in the South African automotive industry.

## Chapter Four

### **SUPPLY PLANNING IN SOUTH AFRICA**

## 4.1 Introduction

The motivation for this dissertation, as mentioned in Chapter One, is to contribute towards the development of the supply chain within the automotive industry of South Africa. This is not only because the industry is in need of an upgrade owing to the near termination of certain incentive programmes that are currently running, but also because it has the potential to significantly contribute to uplifting South Africa's economy.

Most automakers in South Africa are supported by their international holding companies, which play a huge part in making sure that the South African subsidiaries keep up to speed in becoming and remaining world-class companies. However, South Africa offers a very different set of conditions, influences and environmental factors that sometimes nullify the principles and standards which are set by the overseas manufacturers. Also, the development status of the lower tier suppliers in South Africa is not at on the same high level as in Europe, America and the Eastern seaboard countries. There are many reasons for this large gap but the main concern lies in how it should be bridged so that more local content can be introduced and, through optimised processes, more exports can be realised.

From the current trends – both worldwide and nationally – it is clear that the way forward for most organisations is to run a lean supply chain. For the Automotive Industry, this means that there is a definite movement towards a JIS (Just in Sequence) approach. There are numerous reasons for this as vehicle projects are far more complex and demanding. The number of variants for each part family is forcing suppliers to deliver according to customer orders and refrain from keeping stock at the line. The amount of stock that would be required for each variant is too great for this type of supply method to be viable. OEM's are also moving towards a more focussed approach of concentrating on their core business of assembly and transferring more and more responsibilities onto the lower tiers. According to the domino effect, if the OEM's can implement world-class processes and sustain them, then this excellence should cascade throughout the supply chain to the lower tiers. The problem for South Africa lies in the fact that our lower tiers are not as advanced as some of the OEM's and therefore do not have the infrastructure, nor the expertise to keep up with the pace of the OEM's. This therefore means that it is up to the South African OEM's to take responsibility for jointly developing their lower tiers. It is in their interests to ensure that quality parts are delivered at the right time and the right place. With the added advantage of having international know-how, the OEM has the capability to add value to their supply chain. The stronger and more lean the supply chain, the more competitive the product can become.

Just as there is a great need for this development of the automotive supply chain, so too is there a need for an enabler to execute this change. Without such an initiator, no advancement

will be achieved. The complex set of organisational and disciplinary functions within a vehicle project makes this type of transformation a cumbersome task. The inherent ways of doing business through functional silos inhibits the potential to fully integrate all facets of the project that are essential to its success. It is for this reason that a so-called “supply planner”, which is a fairly new but fundamental role in a vehicle project, is the catalyst for supply chain integration.

By personally playing this part in the planning phase of a vehicle project at a leading car automaker in South Africa (BMW), first hand knowledge and experience was gained into the practicalities of developing the supply chain for a specific part family. From both this knowledge and that sourced from the appropriate literature, a guideline/approach as to how such a project should be addressed and executed was prepared.

## 4.2 The South African Environment

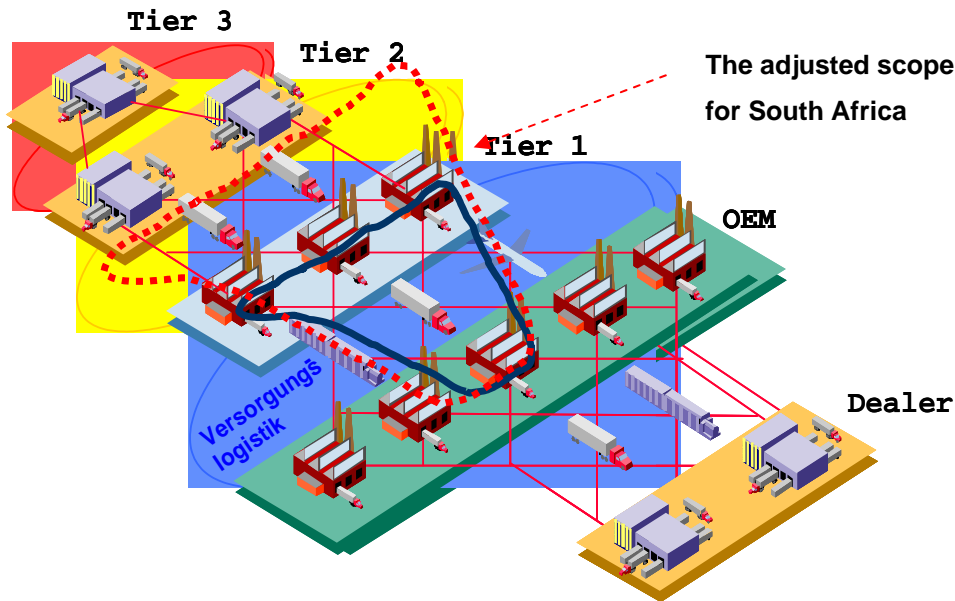
From the lessons learned from the industry case study that was undertaken at BMW South Africa, a different set of premises exist for most of the aspects of Supply Planning. These differences, highlighted in the following paragraphs, serve as part of the input to the development of a practical Supply Planning Methodology.

### 4.2.1 Scope

The scope of supply planning in terms of the interface between the 1<sup>st</sup> tier and OEM needs to be extended slightly. This is due to the fact that the supply chain between the OEM and 1<sup>st</sup> tier is highly influenced by the supply of parts from the 2<sup>nd</sup> tier supplier. The reason being is the fact that a large number of parts purchased by the 1<sup>st</sup> tier supplier are imported. South Africa can not avoid its unfortunate geographic position in terms of overseas supply distances. In Europe, supplies can be delivered to any destination via road freight, whereas in South Africa, parts come into the country either via air or sea freight. This in turn results in high lead times, more pipeline inventory to buffer the gap between supply and demand, and high transport costs. It is therefore unavoidable to ignore consideration of these factors during the supply planning process.

The EBP supply planning methodology indicates that the scope of the supply planner lies between that of the OEM and the first tier supplier only. In South Africa, the role of the supply planner must span this link as well as the link between the first tier and its second tier suppliers. The level of detail that is required in terms of planning this link in the supply chain is of course not as much as between the OEM and tier-one. However, when developing the first tier, the effects on the second-tiers must not be overlooked. Below is a diagrammatical view of the extended scope for South African supply planning.

Figure 4.2-1: Extended Scope for SA



#### 4.2.2 Just in sequence philosophy

According to the EBP methodology, JIS (Just in Sequence) means that the chain flows as follows:

- Produce in sequence at supplier
- Transport
- Dispatch and transport to assembly manufacturer (OEM)
- Offload and prepare for fitment
- Fitment of part in sequence

This is correct according to the theory of JIS and this too, is possible in South Africa. However, there are a number of constraints that inhibit the exact adherence of this procedure. The aim for South African automakers and suppliers is to find a medium that supports the JIS strategy through an order related supply method. Some of the constraints that South Africa face in this regard are listed below.

##### a) Transport

South Africa faces many potential risks when executing a JIS supply method. Reliability of deliveries is very different from that experienced in Germany where time is of the essence. Security considerations such as high-jackings and a higher incidence of breakdowns and accidents, etc are not uncommon in SA and thus need to be considered when calculating time

lines and buffer stock. As the principle goes, risk must be planned for through contingency plans. This normally results in extra stock on hold to safeguard against these eventualities. The German philosophy for JIS means minimal buffer stock at both the supplier and the OEM. For South Africa, it means the minimal emergency buffer stock required to compensate for the possibility of a line stoppage.

In addition to these constraints, South Africa lacks the transport infrastructure that is so prevalent abroad. The main means of transport within South African borders is road transport. In Europe, rail transport is predominantly used to get goods from A to B. This type of transport is extremely reliable and cost effective for European conditions. However, South Africa is a vast country that lacks efficient, safe, reliable and well-connected rail systems. Careful consideration of truck turnaround times, emergency concepts and load optimisation is imperative when planning supply chains in South Africa.

#### **b) Packaging**

Another aspect that is affected by South African conditions is the packaging concepts. The long distances that the trucks must travel to reach the harbours for shipment and receive imported goods has a large impact on the design of the packaging. A pallet or stillage that is designed in Europe may not be viable in South Africa because of the distances that the part must travel and the type of roads that the truck will encounter. A large number of these stillages must be redesigned to cater for these constraints. However, on the contrary, a redesign in the packaging concept may too have a negative effect on quality in that the design does not sufficiently protect the part from dust, rain, forklift damage and other external factors. All these factors must be carefully considered when determining the type of container that should be used between the various destinations. A stillage design for a part being transported between a harbour and a location inland will differ to that of a route that spans a few kilometres.

#### **c) Economies of scale**

The fact that South Africa needs to be competitive with low production volumes has a huge influence on which supply method should be chosen to reduce overall system costs. To try and create some form of economies of scale, a large number of suppliers produce their products in batches. This is done to optimise their production processes, reduce machine costs and improve resource utilisation and efficiencies. For the OEM, the ideal would be for the supplier to produce in sequence – the so-called simultaneous synchronized manufacturing – so that the sequencing step is incorporated in the production process and need not be done as an additional step in the supply chain. However, if this causes the supplier to increase his production costs, it defeats the object of minimizing system costs. One can therefore not overlook this situation. An adapted form of the JIS philosophy must be developed to account for



this constraint. Many may argue that this process of producing products in batches is a JIT-based philosophy and not of a JIS nature. This is only partly true. By viewing the operation at the supplier in isolation, yes, it is a JIT type production. But, when looking at the production process in the context of the entire supply chain, it can still be seen as a form of JIS supply. If the supplier can sequence the parts before dispatch, then the supplier is delivering on a JIS basis. The view of JIS for South Africa therefore should include this type of supply method in the overall definition. This JIS-type supply chain would therefore change to comprise the following steps:

- Produce in batches at supplier
- Sequence parts according to OEM requirements
- Dispatch and transport to assembly manufacturer (OEM)
- Offload and prepare for fitment
- Fitment of part in sequence

This supply chain process shows how the sequencing activity is done before the product is delivered to the OEM. If the sequencing activity was done at the OEM (in-house), then the type of supply would not be classified as a Just in Sequence but rather a JIT supply. According to supply chain trends, this is exactly what is not desired by OEM's and so the drive towards shifting more responsibility (sequencing in this case) onto the supplier is realised by transforming this JIT supply to the JIS scenario depicted above. For South Africa, this is sometimes the only way to accomplish this upgrade in supply chain development.

#### **d) Automation**

Continuing with the impact of low volumes on South Africa's automotive industry, mention of its influence on automation can not be omitted. Almost all of the plants in Europe are considerably more automated than those in South Africa. Our low volumes and cheap labour costs inhibit the justification of making a supply process robotic. This can significantly reduce the chances for South African manufacturers to become more competitive. Although our labour is cheaper, quality is sometimes compromised as a result. When planning the supply chain in South Africa, innovative ways of optimising the process without using automation as a tool, has to be found. Supply Planning will therefore play an even more important role in supply chain transformation in South Africa.

#### e) Timing Constraints

South Africa's geographical location in terms of world markets creates a number of logistical problems that do not exist in places like Europe and Asia where resources are all readily available and easily accessible in short time frames. In South Africa, the lower tier suppliers lack the expertise, technology and machinery required to produce products that are on the same quality standard as those produced by companies in first world countries abroad. For this reason, OEM's and some higher tier suppliers are forced to import a large portion of vehicle parts. This not only increases transport costs, but also creates a timing constraint. The long lead times force them to keep a large amount of buffer stock to minimize risk and these in turn pushes up overall holding costs and ultimately supply chain costs. There is an urgent need for suppliers to upgrade their processes, improve their quality levels and become reliable partners to their next level customers. The wont for localisation is heavily understated and can not be emphasised enough as a major ingredient in becoming more competitive in the global sense.

#### f) Technology

Europe's stable economy and high level of technology has a huge impact on potential supply chain cost savings. Referring directly to the assembly of vehicles according to customer orders, a high sequence adherence from the paint shop equals a very stable supply chain for the lower tiers. This means that the advanced technology in the paint shop that aids in producing a reliable output, provides the ability to predict the sequence required from suppliers at an earlier stage which in turn can aid them in optimising their production processes and material planning. When an OEM can accurately predict the sequence of production over a fixed period, it means that the 1<sup>st</sup> tier can also accurately predict their production quantities. These can then be optimised, which in turn means that the 2<sup>nd</sup> tier supplier will also reap the rewards of this stability. This phenomenon should, in theory, optimise the entire supply chain through all tiers by reducing pipeline inventory to an absolute minimum.

South Africa, because of the lack of funding justification for our low volumes, does not have the advanced technology to create as stable a sequence adherence as in first world countries. It's not to say that the only reason for lack of stability is technology related, but it does have a huge impact. The OEM's still have more of an advantage than the lower tier suppliers because of its subsidiary support from the holding company. Some suppliers also experience these advantages. For the most however, the lack in technology has a large influence in becoming and sustaining competitiveness. The focus should be to enhance South Africa's suppliers' standards and thereby greatly improve stability at OEM's through the use of technology.

#### g) Operational conditions

Although not an obvious aspect to consider when comparing South African conditions to other worldwide manufacturers, the physical methods of executing operational activities is indeed different. The most extensively used operational tool in South Africa is the forklift. It is heavily depended upon to get goods from A to B. Although reliable, the operation of the vehicle is not always precise and as careful as would be the case in Europe; so when considering the use of the forklift to execute certain handling operations, the training of the forklift driver is an extremely important factor. Also, the fitment of the part to the car is just as important, so when designing the system, the capabilities of the fitter must be included in design. A satisfied workforce is imperative is a productive one.

#### h) Classification of a Tier-One Supplier

As mentioned earlier, the South African definition of a tier-one supplier is not the same as that in more advanced countries. The lack in expertise, technology and support calls for a need to understand this different role so that supply planning can take place under the correct premises. The following aspects should be considered when developing the Tier-One Supplier.

- Lower supplier networks are unstable and risky in terms of reliability, quality and timing.
- Lack of funding from parent companies to upgrade technology levels
- Dependant on OEM for funding and development
- Volumes are low and therefore machinery costs are high
- Labour intensive production versus mechanised production from companies abroad
- In general, quality standards are not as high as with international counterparts
- Education levels of suppliers are very practical based – not managerial and visionary.
- Operators (labourers) are not as highly educated as those overseas. This has a huge impact on the implementation of new processes – training is a fundamental aspect that must not be overlooked.

### 4.3 Conclusion

From the experience gained through the industry case study, a number of factors pertaining to Supply Planning in Europe were found to be different in the South African automotive industry. This chapter has outlined the most significant ones to serve as the basis for the formulation of a Supply Planning Methodology for South Africa.

## Chapter Five

### **CASE STUDY: PROJECT INTRODUCTION**

## 5.1 Introduction

In order to demonstrate the significant impact that the supply planner can have on supply chain integration in South Africa, a study that encompasses all aspects of developing the supply chain within the automotive industry was set in motion. The contents of this chapter will comprise of all business, technical, political and supply chain issues that would normally arise when embarking on such a project. The environment in which this project was done, as well as its credibility will be addressed first. The remainder of the chapter will cover all background information.

## 5.2 BMW as an Industry Example

'The BMW group is the most highly regarded company in Europe. This is the result of the latest, annually updated survey of 10,000 top managers from 345 international companies by the renowned US economic magazine "Fortune".' [20] In the "Fortune" ranking of global car manufacturers, the BMW Group is behind Toyota in second place.

BMW has always been known as a top quality vehicle brand with its associated stigma of prestige and luxury. Of course, this kind of image is earned and not merely acquired by accident. A good output is the result of a good input. BMW aims not only to satisfy, but also to exceed customer expectations by continuously striving towards an optimised network of activities.

Every company has one overriding motivation: to make money. The only way to do this is to produce a quality product that is has the right promotion, is in the right place at the right time and is priced competitively. If these aspects are achieved, the customer will be satisfied. The only way to obtain this result in any company is to minimise total system costs. This is realised when logistic activities are optimally integrated amongst each of the supply chain members. Each supply chain member has a preceding supplier and a consequent customer it serves. It therefore is in the interest of every company, whether it's a first tier supplier or an Own Equipment Manufacturer, to strive towards 'looking at the bigger picture' and integrating their supply chains. This is the key to survival in a continuously changing world.

### 5.2.1 Local role as an OEM

The local role of BMW and other OEM's in South Africa is to enforce a steady improvement of their processes in order to remain competitive – globally. This is not an easy task in a developing country that lacks many of the resources and technology that first world countries have. Our geographical location is an obstacle in itself when considering how many parts have to be imported for the production of a vehicle. This, together with our low manufacturing

volumes, creates an inevitably complex network of supply chains. South Africa's OEM's are on the highest level of development when considering the lower tiers of the automotive supply chain. This is the result of many external factors that are mostly unavoidable. However, the factors that are controllable and changeable lie in the hands of the OEM's and in this case, specifically BMW. The expertise that BMW SA own – both as a result of their German affiliation and especially their entourage of quality people and processes, gives them the potentiality to develop their first tier which in turn could propagate further development of the lower tiers.

## 5.2.2 Local quality performance

When one mentions local quality, many envision a standard that is specific to developing countries which South Africa has always been associated with. However, considering BMW's reputation, it comes as no surprise that BMW (SA) Plant Rosslyn received a US quality award in June 2002. The plant was the gold recipient of the JD Power Initial Quality Study Award based on the responses from an estimated 65 000 owners and lessees of new 2002 model cars and trucks. Because the Rosslyn plant was grouped together with European manufacturers, it was measured against the standards of these plants. In terms of the award, the local operation of the German group has been ranked as the superior plant among European manufacturing facilities.

This type of recognition demonstrates the level at which BMW SA operates. This world-class achievement does not happen over night. Sophisticated systems, dedicated people with a common vision, and continuous improvement are the fuel for their success. It for all these reasons that BMW SA can serve as a worthy candidate in attempting to achieve the aim of this dissertation.

## 5.3 The Supply Planning Project Scope

BMW is currently in the planning phase of developing all the processes needed to support a successful launch of the new three series BMW, herein after referred to as the E90 model. This planning phase of such a complex and substantial nature, is a great vantage point for initiating any changes and so the scope of this project lies within the planning, design and development phases. The Supply Planner takes the lead in forming a project team and embarking on optimising current processes and procedures for the supply of parts to the assembly plant.

### 5.3.1 Background

The focus of the project at hand lies in the development of a pilot supplier. This supplier currently delivers its part family – the Floor Carpets – on a JIT based supply method. The parts are delivered to BMW's in-house sequencing centre where it is stored until needed for fitment.

Before the part can be delivered to the line, it has to be sequenced in the order given at the so-called Status 5300, which is when the body of the car as per customer order is dropped onto the line for the start of assembly.

Owing to internal system changes at BMW, the planning of the E90 has to accommodate these changes to ensure that the proposed philosophies of this new system are met and that production commences without any delays. These new philosophies will be dealt with very briefly so as not to overlook its importance.

### 5.3.2 Environment: The 10 day car

BMW is in the process of implementing a Customer Oriented Sales and Production Process. It aims to optimise the processes from customer ordering through production, distribution, to vehicle hand-over to increase customer satisfaction with regards to individuality, on-time delivery and lead-time. The major driving forces for the implementation of such a system are outlined by the fact that there is:

- An obvious need to remain competitive amongst challenging worldwide trends:
  - Edging out of market (surplus capacity)
  - Shorter model life cycles; less volume per model (model rate of return)
  - Change of customer demand (exclusivity, individuality, service)
  - Broadening of offers (diversification)
  - World wide production and logistical alliances
  - New production concepts (supplier as assembly partner)
  - Declining market prices
- A necessity not to be left behind by larger manufacturers.
- A desire to lead the sector by having the BEST possible reputation with the customers.

This concept was seen as one of the methods to meet these aims and, owing to its successful launch in other BMW plants worldwide, it can be viewed as one of the leading competitive edges in such a difficult market.

### 5.3.3 Customer oriented sales and production process

This new process re-engineers the BMW production and sales system with the following vision: "Each customer is to receive his or her individual vehicle on a firm date, ideally the date that the customer has asked for."

Higher-level objectives of this process are:

- 100% delivery punctuality – to the actual day
- full flexibility to accommodate changes in customer's wishes within the body version until 4 days before the start of assembly
- throughput time of a maximum of 2 days from the start of assembly to F2 or 6 days from status 5000 (formation of daily packages) to F2

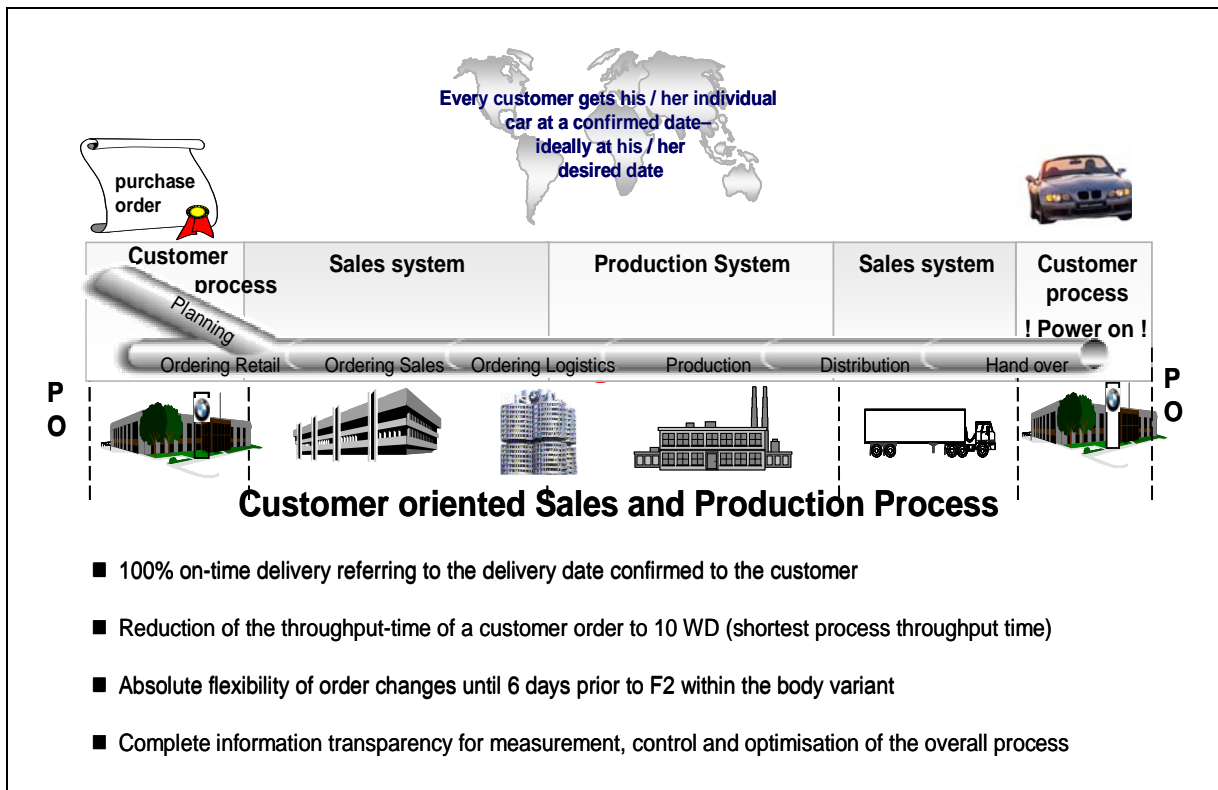
With specific reference to the BMW production system, this means:

- Late allocation of order: customer's order are allocated to bare body shell when assembly starts, painted bodies are treated effectively as an outsourced part (change from "push" to "pull" principle)
- Finalizing the daily (production) package sent to suppliers 4 days before start of assembly. This gives the supplier a fixed horizon in which to optimise their production processes.

Figure 5.3-1 below depicts the system approach that this process addresses – from customer order placement to customer delivery.



Figure 5.3-1: Customer Oriented Sales and Production Process



Source: BMW Group, KOVP Presentation, February 2003

Now that the fundamental elements of the environment in which this case study takes place has been defined, the actual project to be undertaken by the Supply Planner can be discussed.

## Chapter Six

### **CASE STUDY: PROJECT APPROACH**

## 6.1 Introduction

The aim of this project was to perform the role of a Supply Planner in order to develop a new method of execution for such future projects in the Automotive Industry. Its potential worth has already been established, providing the necessary motivation for playing this role. The project was chosen for several reasons. Firstly, it revolves around the current trend of transforming a JIT supplier into a JIS one, which is the first of its kind in South Africa; secondly, its complex set of constraints both at the OEM and at the supplier will provide a broad perspective when developing a new approach. It must be stressed, however, that not all aspects of Supply Planning can be encompassed in one project but all factors encountered during the project that was undertaken – both soft and hard – will serve as the input for the development of a practical framework for Supply Planning.

## 6.2 Project Description

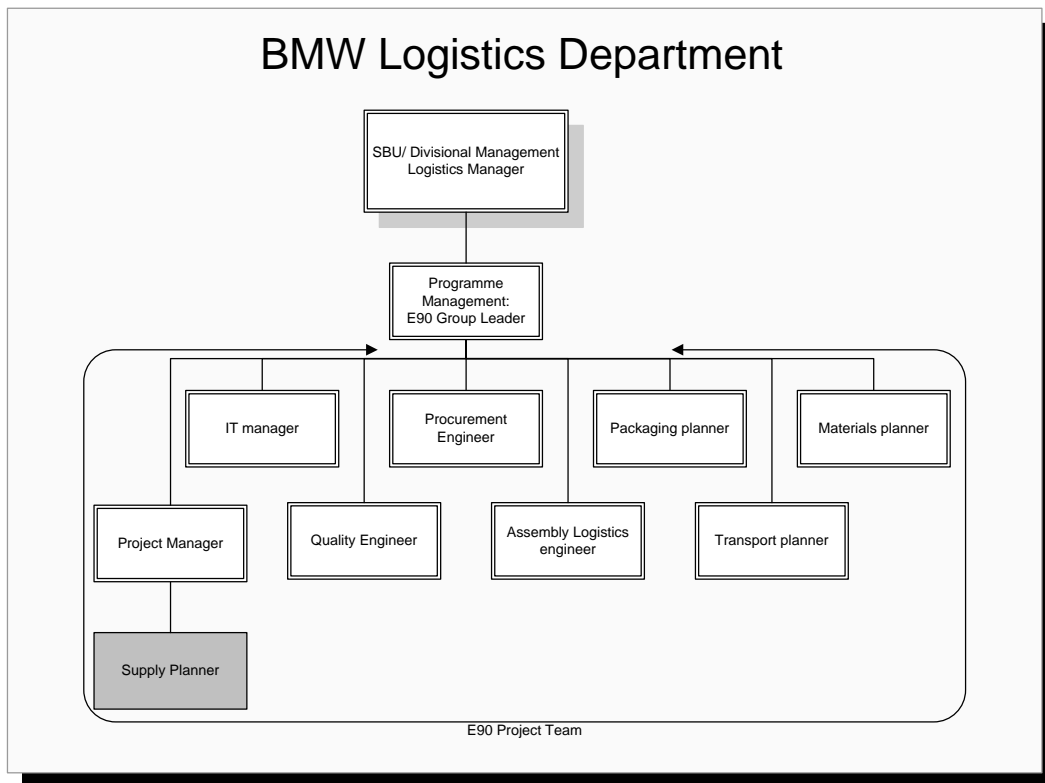
An investigation into the development of a pilot supplier for the new three series (E90) is the basis for this project. There is a constant drive for the BMW Group to reduce supply chain costs and improve current supply method processes. The current planning phase for the E90 is the ideal period in which to innovate, improve and develop current methods so as to create flexibility and optimise the future series production.

The supplier under review is that of the floor carpets. Based in Ga-Rankuwa, the supplier produces in batches and delivers directly to the BMW sequencing centre on-site. At the start of assembly, the parts for that particular customer-ordered vehicle are initiated with a “call-off” to the relevant suppliers (in this case to the sequencing centre). The part is then required to be ready for fitment after a certain time lapse according to the order of part assembly. The shorter the time window from start of assembly to fitment point, the more critical the part is. Owing to the worldwide trends of lean manufacturing in every way, the method of this particular supply concept had to be questioned and scrutinized.

### 6.2.1 Project stakeholders

The BMW stakeholders in this project lie within the departments as shown below.

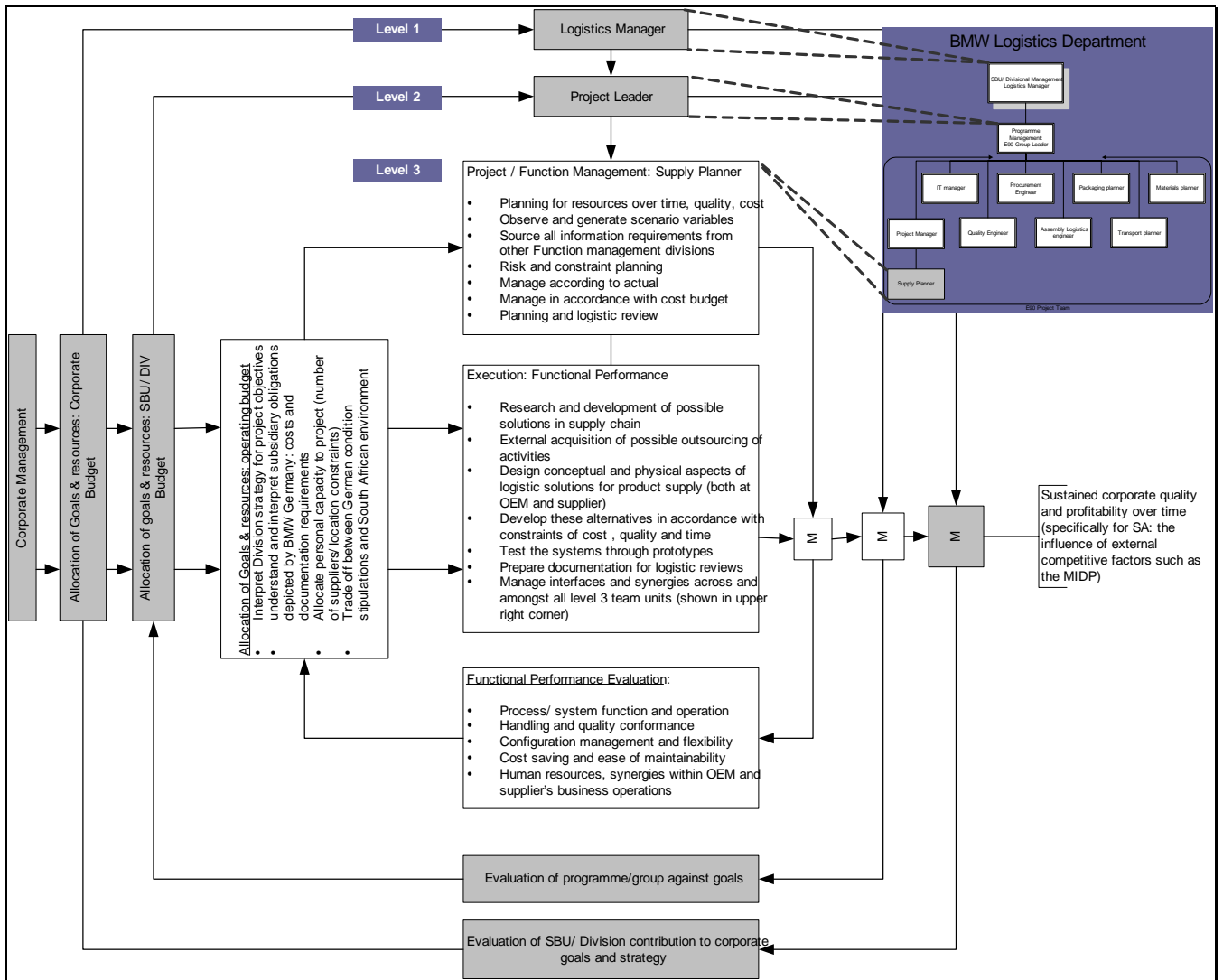
Figure 6.2-1: BMW Logistic Department Organogram



Below is a cybernetic model of the supply planner's role within this organisation. This gives an indication of how the project will be executed using the inputs from each of the departments shown above. Other stakeholders not shown include the following:

- the customer (end user of the vehicle and/ or the order placer)
- the supplier (tier 1) and indirectly the supply chain of the entire procurement process
- BMW Germany (wholly owned subsidiary thereof)
- All labourers involved in each of the supply chain logistic activities

Figure 6.2-2: Cybernetic Model of Supply Planner's Role within BMW (inputs, processes and outputs)



### 6.2.2 Problem statement

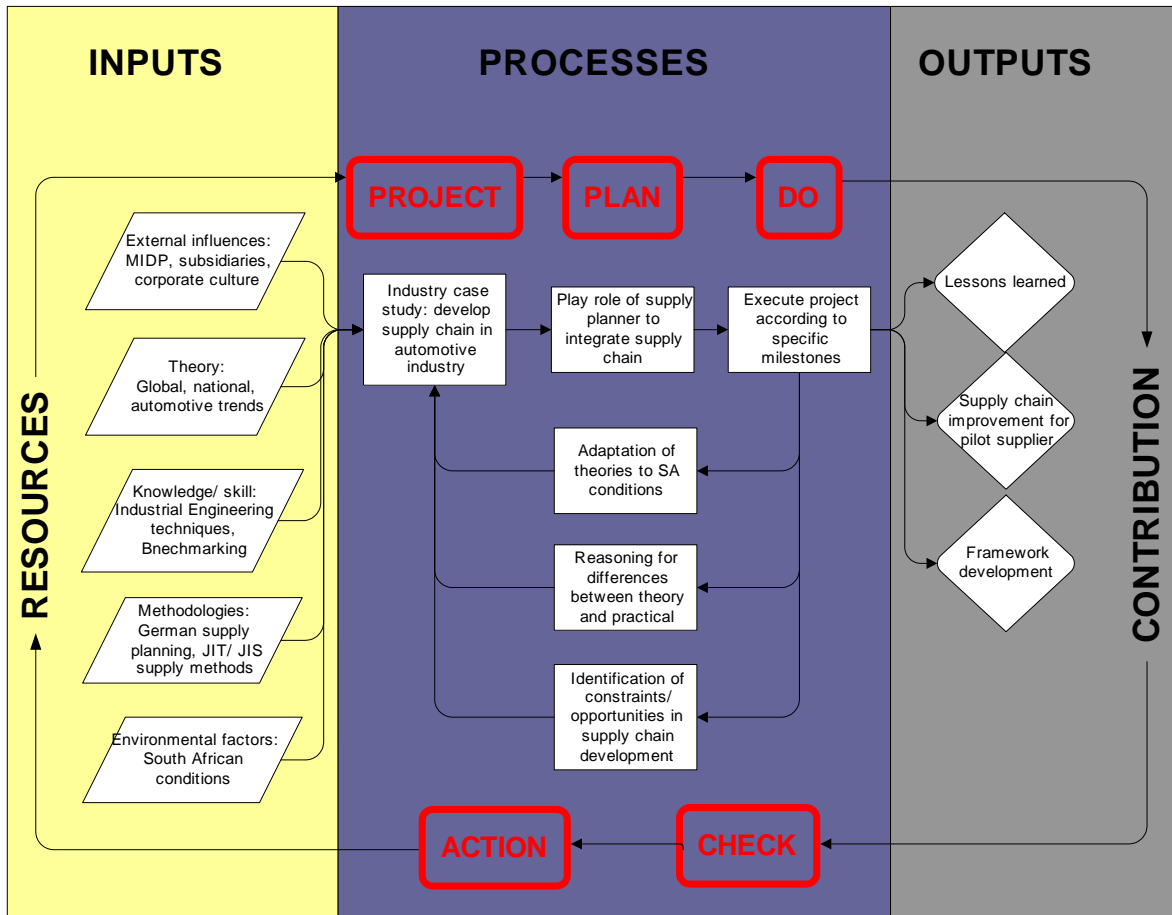
From the information above, it becomes clear that there is a business case to develop and improve this particular supply chain. In order to keep in line with the current trends of streamlining the supply chain, the investigation into reducing steps within this pipeline is the sole project aim.

Playing the role of the “Supply Planner” to investigate this supply chain development, the role, tasks and functions will be carried out in accordance with the generality of the supply planning methodology as discussed earlier. The scope of the project is to investigate, develop and implement an improved supply chain method of supply so as to reduce total system costs between the tier 1 supplier and the OEM (BMW plant Rosslyn). All stakeholders that have a direct and indirect involvement in the development of this supply method will have to be involved in the project’s progress in order to remain aligned during the volatile phase of the total vehicle project. This will be just one of the functions that the Supply Planner will have to take heed of.

### 6.2.3 Project approach

The diagram in Figure 6.2-3 shows the iterative approach that will be followed in conjunction with the methods of supply planning in the automotive industry. Its iterative technique represents the nature of the ever-changing planning phase as well as the reality of everyday business operations – changing. A more detailed outline of the approach that will be followed to execute this project is shown in Appendix A.

Figure 6.2-3: Cybernetic Approach to Project Execution

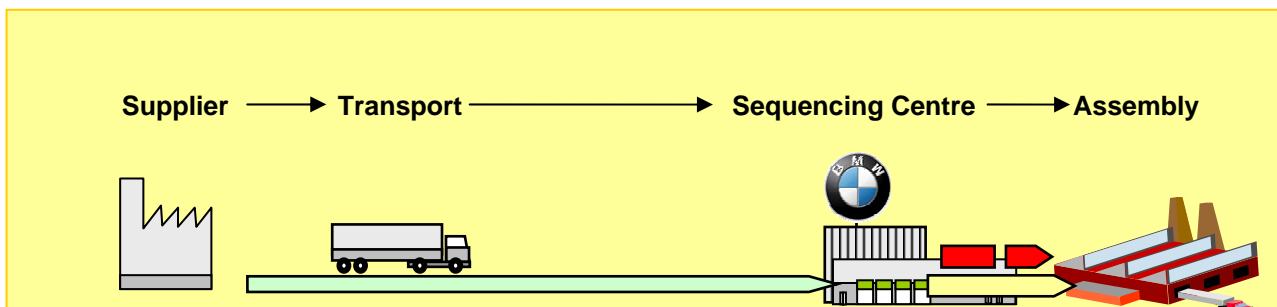


### 6.3 Problem and Requirements Analysis Phase

This phase will deal with the analysis of the current logistical functions within the supply chain. All problems and opportunities will be identified in order to define the way forward.

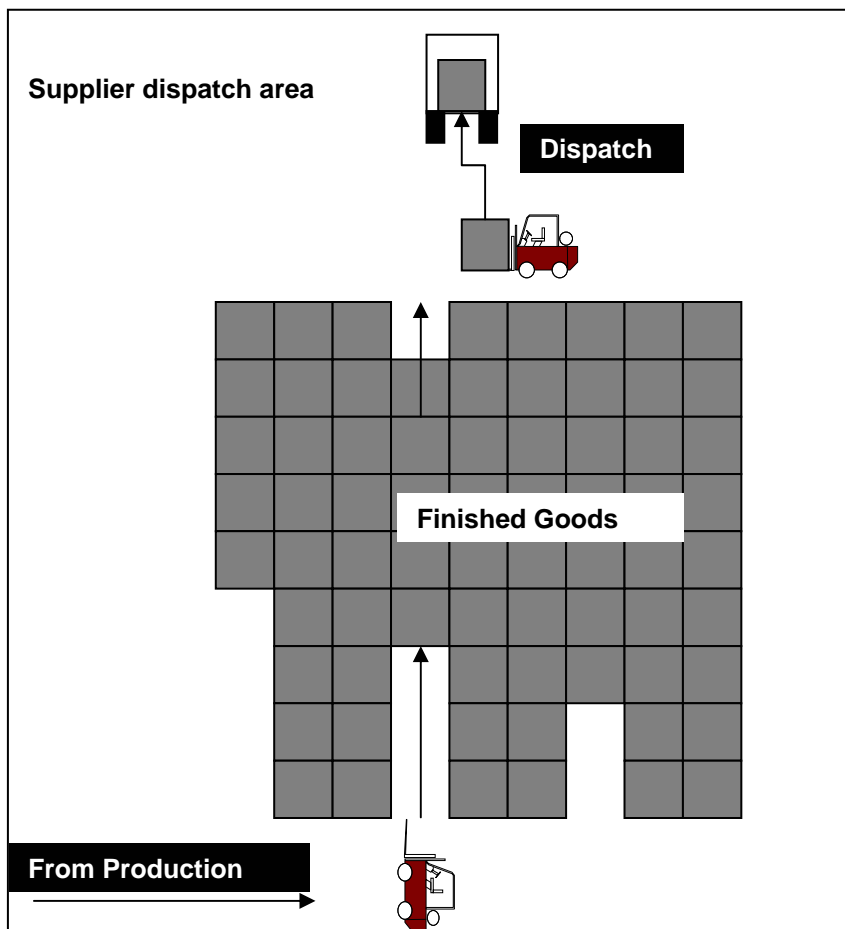
A brief overview of the current supply method is shown in Figure 6.3-1.

Figure 6.3-1: Current JIT Supply Method



The supplier produces the carpets in batches. Because of the high machinery costs at the supplier, they work on a 3-shift system so as to optimise resource utilization. The carpets are packed directly onto a stillage at the final production process (water-jet). Once full, the stillage is transported via forklift to the finished goods section where they are double stacked in nine parallel rows. To keep with the FIFO (First-in-first-out) principle, the carpet stillages are pushed forwards with the forklift so that the new load can be loaded from the front. The simple diagram below depicts this scenario.

**Figure 6.3-2: Supplier Storage and Dispatch Process**



The truck, once fully loaded with 8 stillages, travels to the BMW plant approximately 25km away. The truck is offloaded at the sequencing centre where the carpets are stored for half of a day's shift or longer. The FIFO principle is not always adhered to here. Every 4 minutes, when a vehicle body is dropped onto the line for the start of assembly, the sequencing centre is notified. Because of the limited time from this call-off to the fitment point, only 8 carpet sets can be transferred from the delivery stillages to the sequencing stillages and towed to the line in time. Once at line side, the operator fetches the relevant carpet set, one by one, using a table



on wheels as the transfer mechanism and moves it to the assembly line. The carpet is then fitted to the vehicle in sequence.

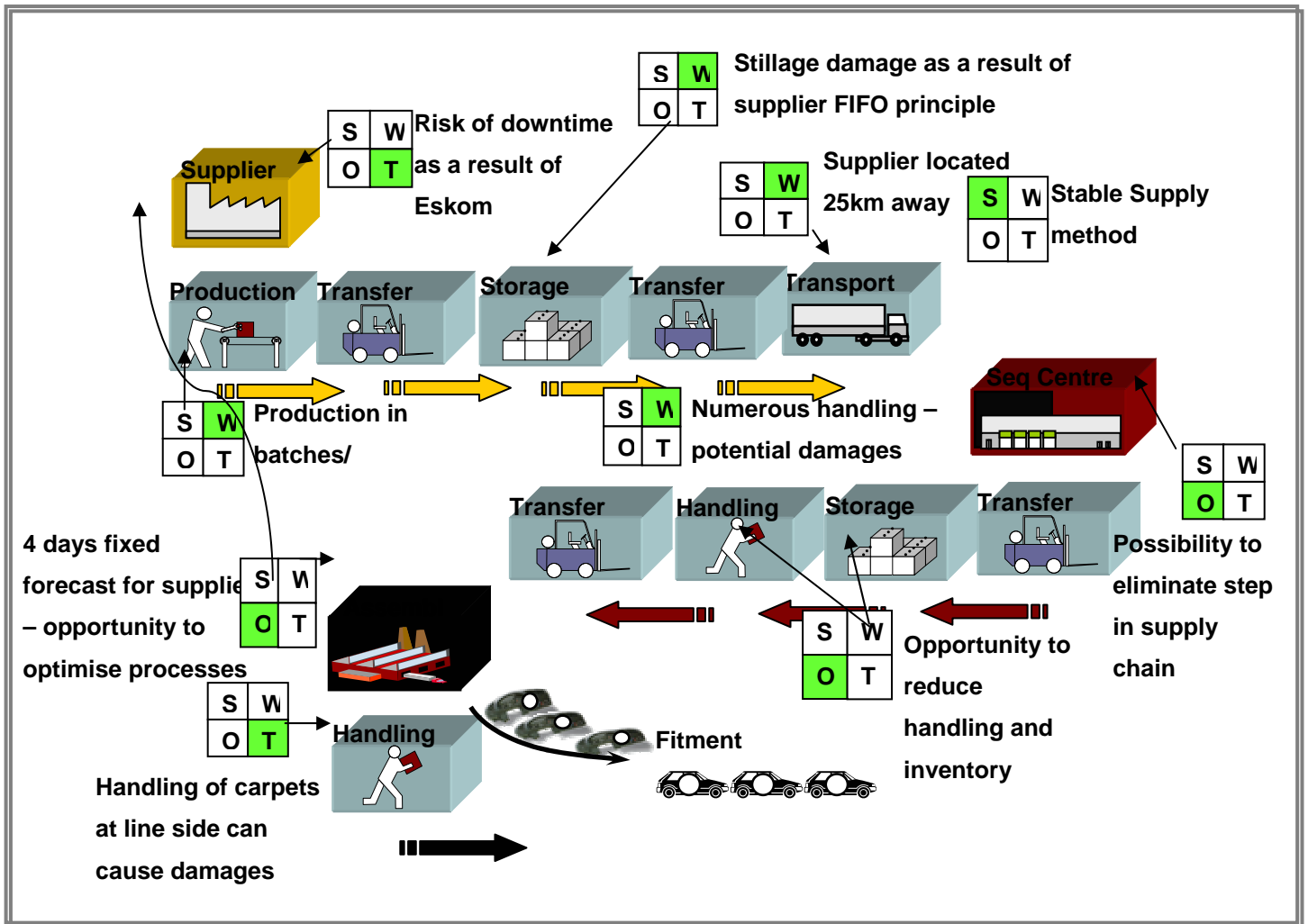
Although this method of supply serves the purpose of getting the required carpet set to the fitment point on time, there are numerous areas of improvement that could be realised. The SWOT analysis shown below depicts the strengths, weaknesses, opportunities and threats for this situation.

### 6.3.1 SWOT Analysis

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>▪ Current stable supply method</li> <li>▪ Stable production system at supplier</li> <li>▪ Optimised truck loads (distance from supplier)</li> <li>▪ Low risk of line stoppage owing to in-house stock holding</li> </ul>	<ul style="list-style-type: none"> <li>▪ Large number of steps in supply chain</li> <li>▪ Bulky, large part family</li> <li>▪ High number of variants</li> <li>▪ Supplier located 35km from plant</li> <li>▪ Fitment point of part is less than an hour from start of assembly – critical part</li> <li>▪ Large amount of stock on hand at supplier and at BMW</li> <li>▪ A sequenced delivery from assembly start information is not possible due to time constraint.</li> <li>▪ Part sensitivity to dust and damage</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>▪ New BMW customer oriented sales and production process will provide stability for supplier by sending a call-off over a fixed period of 4 days before assembly start <ul style="list-style-type: none"> <li>○ More flexibility for supplier</li> <li>○ Optimisation of batch sizes</li> <li>○ Improved forecasting for lower tiers</li> </ul> </li> <li>▪ Opportunity to change current JIT supply to a sequence supply based on information received 4 days prior to assembly start</li> <li>▪ Opportunity to still optimise truck loads because of 4 day horizon</li> </ul>	<ul style="list-style-type: none"> <li>▪ Risk of out of sequence parts at assembly start – need for emergency concept</li> <li>▪ Space on the line is minimal for buffer stock</li> <li>▪ Lower buffer stock will make truck turn-around time more critical</li> <li>▪ New call-off type to be sent to supplier – integration risk</li> <li>▪ Possible increase in delivery frequencies may increase in-plant traffic flow</li> </ul>

The Strengths, Opportunities, Weaknesses and Threats are summarized in the figure below. There are of course many more factors that contribute to this business case and as the investigation unfolds, these will be highlighted.

Figure 6.3-3: SWOT Overview of Current Supply Chain



### 6.4 Development Phase

In accordance with the generic project phases, the development phase should now take place. This means that a number of alternative solutions to the current should be developed and then evaluated in order to determine its economic feasibility. It must be noted that the development of alternatives for an OEM supply chain method can not be done in isolation of the method to be used at the Supplier – hence supply CHAIN method. The alternatives must therefore be

generated in conjunction with one another, given that both ends are capable of the proposed solution.

Considering the current Value Chain below, the value-adding activities are those shown below in black. All the other steps in the chain are superfluous and therefore should be minimized. This is the starting point for carrying out the JIT philosophy of removing redundant processes.

**Figure 6.4-1: Value Chain**



A number of possible solutions exist to improve the current situation, but the first step in being effective is to know what the global trends are in this particular field. From the research conducted, outsourcing is one of the most common ways of reducing costs and simultaneously improving the focus on core competencies. This technique could be used to transfer the sequencing activity to the supplier or to a logistics service provider. This in turn would mean that the supplier would move from a JIT-based supply to the OEM to a JIS-based supply method. Automotive trends are definitely moving towards more JIS supply based deliveries from suppliers placing more responsibility with the supplier and less with the OEM. OEM's are forcing suppliers to upgrade their processes and equip themselves to keep up with the OEM's world-class standards. This phenomenon is intended to filter through to the lower tiers and create a domino effect throughout the supply chain. Bearing this in mind, the alternatives must be aligned with fulfilling this larger plan of uplifting the Automotive Industry in South Africa.

Although outsourcing may not be the best solution for this particular situation, it must be investigated. Using the lessons learned from Baker (Paragraph 2.3.3), a rigid framework can be followed to ensure that the most important aspects associated with this technique are fully considered.

Irrespective of the techniques that will be used to develop this supply chain method, the premise that this entire investigation revolves around the transformation of a JIT supply method to a JIS one prevails. This in turn means that a large part of the investigation will probe into the outsourcing of the sequencing activity. For this reason a brief assessment of its feasibility must be dealt with.

Referring back to the approach of the project in Figure 6.2-3: Cybernetic Approach to Project Execution

, the inputs of supply chain best practises must not be disregarded. The lessons learned from those that have embarked on similar types of projects before are invaluable. A good

understanding of these practises is therefore indispensable. Before continuing with the investigation, it was deemed necessary to ensure that the important aspects of outsourcing are addressed and worked through.

From the main reasons for outsourcing outlined by Baker (Paragraph 2.3.3), the following are relevant for this project:

Reasons for outsourcing	Applicable	Not applicable
Reduce and control operating of overhead costs	Reduce handling: less resources required	
Improve company focus	Focus on assembly	
Access to capabilities of suppliers	Develop supplier	
Free resources for other purposes	Free space required for other parts in sequencing centre	
Avoid future capital requirement		Not relevant
Resources are not available internally		Resources are available
Function is difficult to manage or is out of control		Not out of control but not desired

Ensuring that all Baker's learned lessons are considered, each are dealt with below. Some will only become relevant at different stages of the project and will be re-addressed when necessary.

#### *Lesson 1: Understand your cost*

This lesson can only really be of relevance when the final alternative is decided upon as a result of a cost analysis of all the proposals. This will be an ongoing process of updating and re-calculation. All "hidden costs" such as maintenance, extra asset acquisition and subsequent loss of resource utilization will have to be accounted for.

#### *Lesson 2: Our drawings do not reflect what we want*

Care must be taken to ensure that requirements are accurately interpreted into specifications for the relevant drawings. This aspect will be considered if such a situation arises during the design and development phases

#### *Lesson 3: Understand what has been quoted*

When outsourcing a certain activity, many added costs are quoted for and many are not. A clear understanding of what has been quoted for is imperative for avoiding the wrong decision. When such quotes arise, this lesson will be considered carefully

*Lesson 4: How much outsourcing can you afford?*

In order to determine whether BMW can afford outsourcing, a detailed understanding of the costs of the current assets, resources and headcounts must be a given

*Lesson 5: Watch your raw material and the 'bridge build'*

This lesson is very relevant to a vehicle project because of the overlap of the new series production with the old. Compatibility of the two is vital in ensuring that there are no hiccups in the production process as well as the supply process. This becomes especially important when implementing the new system.

*Lesson 6: Supplier selection: Quantitative factors*

This lesson is crucial to the continuation of the project at hand. If the supplier is not capable of being developed and/ or not a viable future supplier, then the investigation may as well terminate immediately.

The following questions need to be answered in the evaluation of suppliers:

- Are they profitable? According to the procurement department, previous projects have been conducted with the supplier and were successful. As a result of this, the supplier has been a reliable and profitable partner
- History of price adjustments? Owing to the company's affiliation to its German holding company that also supplies to BMW Germany, cost parity is a pre-requisite and so there is no history of piece price increases.
- Facility percentage capacity? After assessing the supplier's premises, the allocation of BMW business is more than sufficient. They are also acquiring new machinery especially for BMW parts which will increase productivity and reduce set-up times.
- Delivery performance? There has been an excellent track record of on-time, reliable deliveries from the supplier.
- Quality performance? Almost every carpet that comes from the supplier meets the BMW quality standard. Approximately 0.05% of a year's production has been returned to the supplier because of some sort of defect.
- Warranty performance?

*Lesson 7: Supplier selection: Qualitative factors*

Qualitative factors are based on judgment, opinion or experience and are critical to supplier selection

- Is the supplier about to install a new computer system? No the supplier is not implementing a new system, however if the JIS route is followed, a new method of call-off to the supplier will have to be installed. This must be monitored to ensure that the system at BMW and at the supplier are compatible
- Is there a history of successful projects with the supplier? Yes. According to procurement, a large project to develop the supplier through upgrading their current machinery and processes was executed a few years back and it was successful. This is a good indication of the strong relationship that already exists.
- Distance from your location to the supplier can influence timeliness of delivery, etc. – this is an issue when the JIS supply method was investigated. Because of this very aspect, the preferred JIS supply method based on status 5300 information was aborted immediately. This led to the JIS-based on status 5000 sequence information – method of supply
- Does supplier have resources to complete the project? Although the supplier may not have all the necessary expertise, BMW can provide this aspect. The supplier does, however, have the labour and experience on his side. Their mother company in Germany is also a great advantage in lending a helping hand.
- How is suppliers' safety or environmental record? There have been indications that there are quality and safety problems at the supplier with regards to the manner in which the stillages are stored and pushed. This must be monitored to ensure that this factor does not hinder the progress of the project.

#### *Lesson 8: Performance Expectations*

Owing to the long term relationship that exists between the supplier and BMW, the supplier is well aware of the measurement system against which he will be measured. These will of course be agreed on again for the new series production.

#### *Lesson 9: Communicating Material Requirements*

Because the methods of call-offs and BOM requirements are already compatible with BMW's information systems, the communication of material requirements is fully understood.

#### *Lesson 10: Approach target costing cautiously*

This lesson is extremely important because there is a stipulation from BMW Germany that cost parity is adhered to no matter what. Although this clears up any negotiation issues that may arise, it also limits the means to negotiate the cost of the outsourcing. This could terminate the entire project. A way to develop the supplier so that the increased activity on his side does not increase his running costs is the way to a compromised solution.

## Chapter Seven

### **ALTERNATIVES: SUPPLY METHOD SOLUTIONS**

## 7.1 Development of Alternatives

As part of any investigation, a number of potential solutions have to be developed so that an improvement can be sought (if it exists). For simplicity purposes, the different alternatives will be dealt with in the following manner: each alternative will comprise of a combination of processes at the OEM and the Supplier. This means that a specific alternative for the OEM will have a subsequent set of premises for the processes required at the Supplier. This will eliminate any sub-optimal supply chain improvements. Each alternative thus fully describes the interdependency of the OEM and Supplier.

## 7.2 Alternative One: Supplier to Sequence on Stillages

Transferring the outsourcing activity to the supplier would have an impact on the entire supply chain. Assessment of the processes at BMW and at the supplier is essential in determining if it's a feasible way to go. The effect on all logistic activities for this new proposal must be considered.

In this alternative, the mere transfer of the sequencing activity to the supplier is investigated. In essence, this means that the cost of sequencing the carpets in-house must be more than if it was done directly at the supplier. All current premises (Do Nothing Alternative) would remain the same, except for the fact that the truck would not deliver to the sequencing centre but rather as close to the fitment point as possible. The proposed new supply routes are shown in appendix B. The next step would be to ascertain as to whether this route would be compatible with other logistical aspects that it interfaces with, for instance, in-plant traffic capacities, assembly space constraints, and if the current truck size is still able to manoeuvre in this offloading zone.

After investigating these particular aspects, the following considerations were brought to the fore;

1. Call-off Method: based on the premise that the current JIT method of supply will be replaced by a variation of a JIS supply method, an alteration of the call-off method must be considered. Currently, the supplier is notified according to a part-related call-off based on truck optimisation. This means that the material planners will only send for the next load once the piling time of the previous one has been consumed. For the JIS 5000 call-off, the supplier will be notified according to an order-related call-off based on the planned sequence – a delivery time is also sent to indicate the time frame in which the supplier has to get the required parts to the plant, in the specified sequence for fitment. In this way, the supplier can optimise his processes and batches sizes. This is a daily call-off with a fixed horizon. A new IT call-off system will have to be installed at the supplier and its compatibility with their internal information systems ascertained.



2. In-plant traffic: according to the model currently being built and used to simulate in-plant traffic flow, the new proposed route for the truck is favoured. This is due to the fact that the route for the current scenario is overloaded and the removal of such a truck is desired.
3. Assembly space: a JIS supply method implies that the point of offload should be as close to the fitment point as possible. After measuring the distance from the two possible offloading zones, the west entrance to the assembly plant would be the most desirable. For the E90, this zone would be occupied by 3 other part family deliveries. To determine whether the zone could accommodate the extra load, a truck schedule showing the number of truck deliveries per part family per day as well as the estimated time that the particular truck would stay in the zone, was drawn up. This proved that the zone does have the capacity to accommodate an extra set of deliveries per day. This of course is based on a truckload of 40 sets per delivery as per the current status. Based on the calculation however, the zone will be almost 95% to capacity in terms of time in the zone. If more than one truck arrives simultaneously or after another that offloads in front of the waiting truck, a number of timing problem could arise. This issue led to the investigation of offloading the carpet truck in the Body Shop instead of the Logistical Aisle. There already was a request on place for two other part families to use a section of Body Shop for their offloading. This space, however, is located on the opposite end. Nevertheless, the advantages for relieving the traffic in this particular zone were too great to ignore. The request was formally placed with the relevant persons. Its outcome will depend on a number of factors, which could delay the decision process.
4. Truck size: because of the smaller area in which the truck would now have to turn in comparison to the current offloading zone, there was a concern as to whether the 12 metre truck's turning circle would be small enough. To determine whether the current 12-metre truck would still be able to offload in this new zone, a practical turning exercise was carried out. Upon completion thereof, it was clear that the 12-metre was not suitable. However, a 10-metre truck with 8.5m loading capacity could turn with ease. This meant that the loading quantity would also be affected. This was the next constraint that needed urgent attention.
5. Truck loading: in conjunction with the truck consolidator, a maximum load of 6 stillages could be loaded onto the truck if the same loading concept was used. The quantity per delivery would therefore equal 30 instead of the previous 40. This in turn implies that more deliveries per day would be required. The fact that the load consumption would be less than the turnaround time for truck to replenish the load, would mean that more than 1 truck would be required in the system to avoid line stoppage. This situation is shown in Appendix B. This seemingly minor change in load quantity changes the business case drastically. The "total system optimisation" concept must not be overlooked. If for argument's sake, handling is reduced and consequently handling costs are reduced, an

increase in the transport costs as a result of the loading constraint increases the total system costs, then the business case is lost and another alternative should be found. When referring back to the in-plant traffic implications based on a 40 set loading quantity, the load of 30 will result in more frequent deliveries and may possibly over-constrain the delivery zone. The capacity calculation becomes no longer valid.

6. Inventory: the amount of buffer stock is dependant on a number of factors:
  - i. Distance of supplier from plant
  - ii. Amount of time from start of assembly to fitment point
  - iii. Truck load quantity
  - iv. Delivery frequency
  - v. Amount of line side space available
  - vi. Stability of assembly sequence adherence (backlog)
  - vii. Stability of supplier's process (direct and indirect)
  
7. Packaging: based on the premises for this alternative, the design of the stillage remains the same as per E46. 5 Carpet sets per stillage delivered by the supplier will be used. Since the stillages will be delivered directly to the line, there will be no need for the sequencing centre stillages. However, looking at the handling process that will be required to re-sequence the carpets in the event of the following occurrences:
  - i. The planned sequence at status 5000 (4 days before start of production) and the actual sequence at status 5300 (start of assembly) are different. This percentage difference will interpret to the number of carpets that will be out of sequence and require handling.
  - ii. Blocked orders: if another supplier can not deliver their parts in time for assembly, the parts for that entire vehicle will be set aside and re-entered into the sequence once the part becomes available.
  - iii. If there are unforeseen problems in the paint shop and the predicted bodies do not get painted, the parts will have to be sidetracked until re-entry.

Although it is predicted that these situations will only arise on an occasional basis, it can not be overlooked. When looking at the design of the stillage and the bulkiness of the carpet set, it becomes clear that this re-sequencing procedure will be difficult and susceptible to handling damages. This calls for an alternate mode of packaging and/ or process.

8. Supplier process: As mentioned earlier, the supplier produces the carpets in batches in accordance with the stipulations set by BMW. The three shift work-time model at the supplier is due to the high machinery costs. There is no possibility of producing the carpets in sequence and so the sequencing activity will always be an extra step in the chain. The proposal of having the supplier do the sequencing as opposed to BMW doing it in-house would imply the following:
  - i. The supplier, still producing in batches would load the carpets onto the stillages as current (at the last step in the production process) and transfer it to the dispatch area via a forklift. Their FIFO principle calls for much concern, however, because the damage to the stillages as a result of the forklift “pushing” the double stacked carpets is costing a great deal of money per year. There have also been concerns from the quality and safety initiatives to look at alternate ways to the current.
  - ii. According to the sequence information received at status 5000 (4 days prior to start of assembly), the supplier will select the relevant carpets and load them onto stillages (same as storage stillages).
9. Quality: from the statistics obtained internally, most of the defective, reworked, rejected and damaged carpets were as a result of internal procedures and not from the supplier. For this reason, it becomes clear that the problem lies in the double handling of the product and so it may be safer to transfer this activity to the supplier.
10. Handling: as mentioned earlier, there are too many handling processes that are not adding value to this supply chain. The sequencing activity can not however be avoided and as a result of the batch-type production at the supplier, the sequencing can not be incorporated into the actual manufacturing process – an additional step it must be. A handling operation that can accommodate this step with ease must be found.

Table 7.2-1: Alternative One Solution Summary

below gives a summarized view of the current situation versus Alternative One. The accompanying comments indicate the opportunities and shortfalls that the alternative may present. These must be dealt with when generating new alternatives

Table 7.2-1: Alternative One Solution Summary

Logistic activity	Current Situation	Alternative One	Comment
Call-off	<ul style="list-style-type: none"> <li>▪ JIT part-related with truck optimisation</li> </ul>	<ul style="list-style-type: none"> <li>▪ JIS order-related with sequence information and required time in plant</li> </ul>	New IT system must be set up to accommodate these changes
In-plant traffic	<ul style="list-style-type: none"> <li>▪ Current off-load is within capacity but less traffic is desired along that route</li> </ul>	<ul style="list-style-type: none"> <li>▪ The new supply route (closer to fitment point) is more desirable according to the traffic simulation model.</li> <li>▪ Delivery zone may be constrained owing to other deliveries in same area by 3 other part families</li> </ul>	A truck schedule to ensure that there are no bottlenecks in the delivery zone must be drawn up
Assembly space	<ul style="list-style-type: none"> <li>▪ Limited line-side space (logistical aisle)</li> <li>▪ Headcount and forklift/tow motor assigned to T-4 Department</li> <li>▪ Sequencing centre is space strained for E90</li> </ul>	<ul style="list-style-type: none"> <li>▪ JIS supply will require the full use of the allocated line side space in the logistical aisle</li> <li>▪ The need for extra space in the body shop would alleviate space constraints and increase traffic capacity</li> </ul>	Investigation into obtaining space in the body shop for offloading and possibly line side buffer storage.
Transport: Truck size and loading	<ul style="list-style-type: none"> <li>▪ A 12 metre truck</li> <li>▪ Truck load of 40 carpet sets per load</li> <li>▪ 1 truck required in system</li> <li>▪ 5 deliveries per day</li> </ul>	<ul style="list-style-type: none"> <li>▪ A 10 metre truck</li> <li>▪ Truck load of 30 carpet sets per load</li> <li>▪ 2 trucks required in system</li> <li>▪ 8 deliveries per day</li> </ul>	Truck optimisation is a necessity owing to per trip payment scheme, buffer implications and in-plant traffic flow
Inventory	<ul style="list-style-type: none"> <li>▪ A buffer time of 9 hours is held in the sequencing centre at BMW</li> <li>▪ A 3,5 days stock of finished goods is held at the supplier</li> </ul>	<ul style="list-style-type: none"> <li>▪ For JIS, there must be a buffer time that will bridge the gap between the consumption of the load and the truck turnaround time. This will be the minimum buffer that should be available at line side</li> </ul>	The amount of buffer required must be aligned with assembly to ensure that the required space is available.

Logistic activity	Current Situation	Alternative One	Comment
Packaging	<ul style="list-style-type: none"> <li>▪ Delivery stillages from supplier to sequencing centre – 5 per stillage</li> <li>▪ 1 part number per stillage from supplier</li> <li>▪ sequenced carpets are transferred onto different stillages – 8 per stillage – tow motored to line side</li> <li>▪ a 1:1 ratio of empties pick-up to full-offload</li> <li>▪ currently 350 stillages in system</li> <li>▪ high maintenance of stillages due to supplier FIFO principle (damages to steel stillages)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Delivery stillages from supplier to line side – 5 per stillage</li> <li>▪ Parts are sequenced according to status 5000 (4 days before actual start of assembly)</li> <li>▪ a 1:1 ratio of empties pick-up to full-offload</li> <li>▪ 350 stillages in system</li> </ul>	<p>Stillage design proposed to remain as per E46. Any out of sequence parts will have to be removed at line side.</p> <p>A solution to the damages of stillages as a result of supplier process must be investigated.</p>
Quality	<ul style="list-style-type: none"> <li>▪ Approximately 0.5% defective carpets over one calendar year – 97% of which were as a result of in-house damage</li> <li>▪ Supplier quality is of a high standard</li> </ul>	<ul style="list-style-type: none"> <li>▪ By transferring the sequencing to the supplier, in-house damages can be reduced to 0%</li> </ul>	
Handling	<ul style="list-style-type: none"> <li>▪ Double handling as a result of sequencing batched produced carpets</li> <li>▪ Handling of the carpets in-house is causing the carpet damage</li> </ul>	<ul style="list-style-type: none"> <li>▪ Double handling will be merely be transferred to the supplier instead of in-house</li> </ul>	An investigation into optimising the handling for sequencing must be done.
Supplier processes	<ul style="list-style-type: none"> <li>▪ Supplier produces in batches</li> <li>▪ Finished goods are housed in the dispatch area and stacked double high</li> <li>▪ Forklift pushes stillages along floor to adhere to FIFO principle</li> </ul>	<ul style="list-style-type: none"> <li>▪ Supplier process to remain the same as current</li> </ul>	Quality and safety regulations are concerned about the supplier's dispatch method. A more optimised process is desired.

### 7.2.1 Findings

Alternative One provided more insight into the level of detail that this project should cover. By proposing one alternative, another unforeseen constraint arises which is dealt with in the following alternative. This iterative process is the key to ensuring that all facets of the project are included and accounted for. The constraints that were encountered from the development of Alternative One can be summarized as follows:

1. Truck load is not optimal
2. Body shop space is critical to alleviating delivery zone traffic and space constraints
3. Stillage design is not optimal for sequencing activity (at line side and at supplier)
4. Handling must be minimized.

Again, referring back to the cybernetic model in Figure 6.2-3: Cybernetic Approach to Project Execution

, solutions should be sourced from best practises. To address the above constraints and find a possible solution, it is necessary to identify a similar set of circumstances on a global scale and benchmark the process. Owing to the fortunate opportunity of having access to worldwide resources in the automotive industry, a suitably apt benchmark of the Regensburg carpet supply concept was found. It was decided that this process would be the starting point for improving the current situation.

### 7.3 Benchmarking of the Supply Method in BMW Regensburg Plant

The supply process at this plant is different from that of Rosslyn's. The use of stillages is completely omitted in this process through the use of rail and hanger system. The carpets sets (front and rear) hang vertically from a steel hanger that is attached to a roof supported rail and crane system, along which it slides. The system is in place at both the supplier and the assembly plant – both erected by a common contractor for compatibility purposes. The system at the supplier is fully automated – storing and distributing up to 650 carpet sets per day to the BMW plant. The carpets, once produced, are punched and hung on the “hanger” which is attached to the rail. The carpets are automatically taken to the dispatch area, which is one level above production. When the call-off from BMW is received, the carpets are automatically tracked and “fetched” from their locations in the ordered sequenced and brought to the loading area where it is slid directly into the truck, which has a corresponding rail. The truck is loaded from the rear with approximately 30 sets per load. The supplier is located 3km from the plant and so approximately 20 deliveries per day are required.

When the truck arrives at the Regensburg BMW plant, the truck reverses and aligns with the rail system ready for offloading. The carpets are slid off the truck automatically and “stored”

temporarily on a divergent rail. The empty hangers are slid along the incoming divergent rail and into the truck once the sets are fully offloaded. The truck therefore can leave for the next pick-up within 15 minutes. When assembly calls for the required carpet sets, a forklift, equipped with a modified stillage (with a rail), “fetches” a load of 6-8 carpets from the storage area. The stillage with the rail upon which the carpet hang, and collects them by having them slide into the stillage. The forklift then transfers the carpets to the line side rail by sliding them off again. The carpets are moved according to the tact time of the plant and lowered to man-height for ease of detachment when needed for fitment.

The system, although initially having a few teething problems, is currently running smoothly and without glitch at both the supplier and the plant. It is for this reason that the benchmark is a viable option for improving the current system at BMW Rosslyn in South Africa.

Owing to differing conditions that exist in South Africa in comparison to Germany, a number of changes need to take place in order for it to be a feasible option. These differences will be brought to the fore during the development process and again in the following chapter.

#### **7.4 Adapting the Benchmarked Activity**

Based on the Regensburg concept, the following proposal was brought forward. The reasoning behind the decisions made is shown hereafter and will be highlighted in detail in the following chapter.

Before looking at the total supply chain system– from the supplier to BMW – a look at the processes on the BMW's side will be dealt with first. In order to gain more insight into how the technicalities of the rail system should work a number of digital photos as well as a video clip was obtained from the German plant. From these visuals, an adapted alternative was generated to accommodate South African constraints and conditions.

The first major constraint was the fact that a JIS 5300 supply method as done in Regensburg, would be impossible at Rosslyn. The fact that the carpets are fitted a mere 48 minutes after assembly start and the supplier situated 35 minutes away from the plant, meant that this type of supply was not an option. An option into moving the location of the supplier to as close to the OEM as possible was investigated. Since the supplier is wholly owned by its German holding company, and the move was not in the interests of their strategic vision for the South African company, the motion was denied. The carpets would therefore have to be supplied on a JIS 5000 basis.

A brief summary of the unresolved constraints that were encountered after the first alternative are shown below:

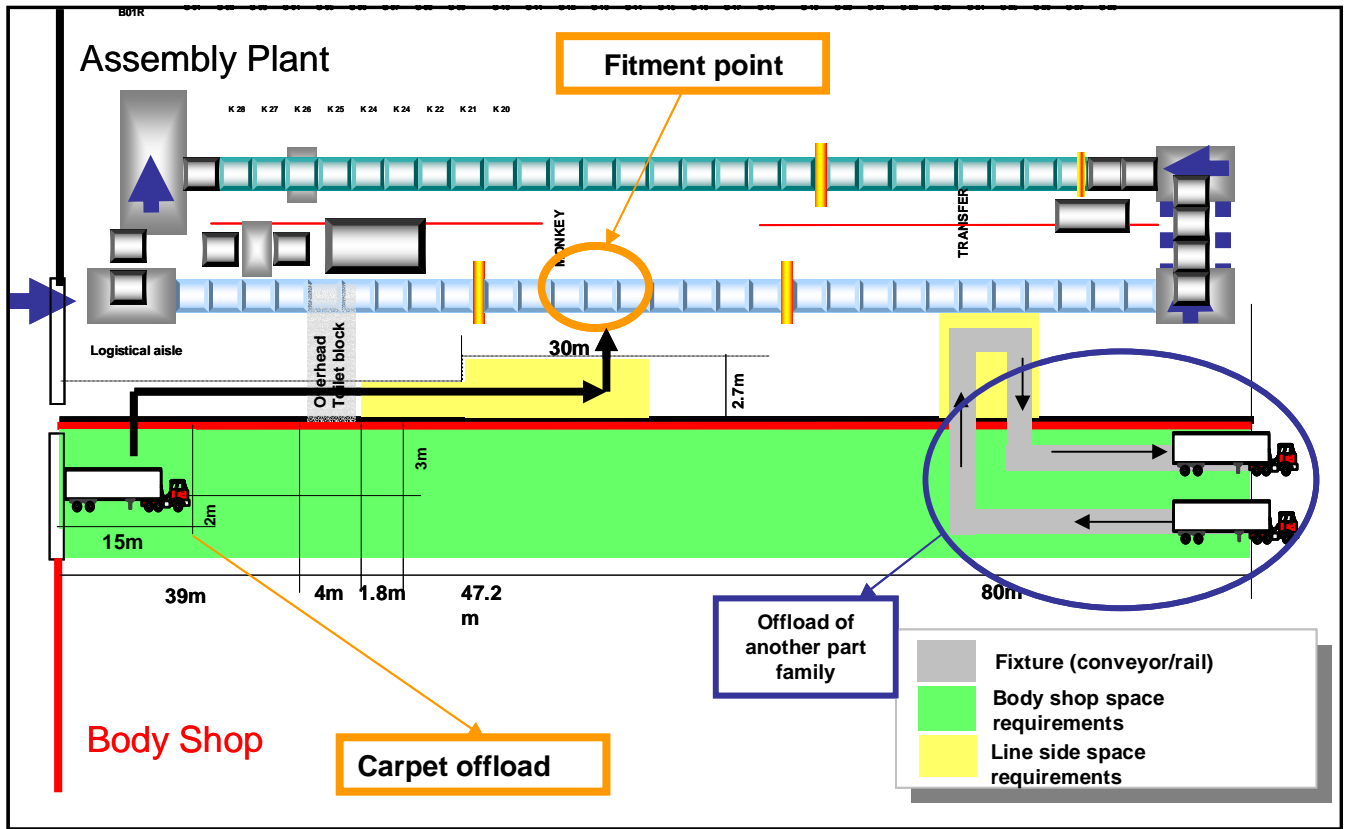
- Truck load is not optimal
- Body shop space is critical to alleviating delivery zone traffic and space constraints
- Stillage design is not optimal for sequencing activity (at line side and at supplier)
- Handling must be minimized.

By adapting the benchmarked activity to suit our local conditions, the following premises for the logistical aspects of the supply chain were compiled:

1. Call-off Method: the call-off method remains the same as per alternative one – JIS 5000 with planned sequence information.
2. In-plant traffic: the status on the current planning for the in-plant traffic reveals that the proposed route in Alternative one is still desired and so will be used as the premise for this alternative.
3. Assembly space: the request into obtaining the desired space in body shop for the offloading of the carpets has been under way and after a lengthy number of meetings and formal applications, the authorities agreed to award not only the space needed for a truck to offload, but the entire aisle alongside the logistical aisle. There are however restrictions. Firstly, the space will only become available after the start of production in 2005 and secondly, if fixtures are erected in that space, a contingency plan has to be in place that plans the removal of these fixtures by the year 2012. This is due to internal constraints within body shop production processes. Figure 7.4-1 gives an indication of the area that is required in the plant.



Figure 7.4-1: Space Requirements for Carpet Offload



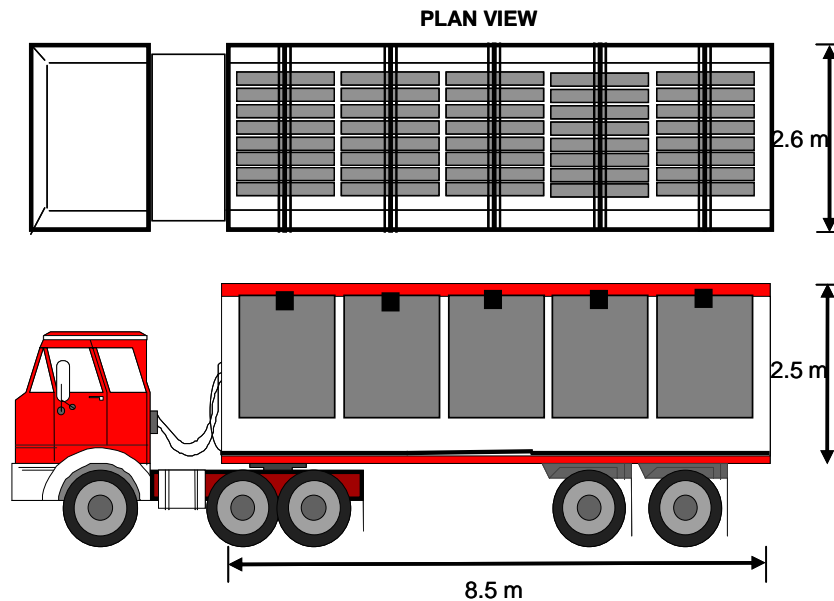
The area shown in green is the aisle that has been granted for logistical use in the September after the start of production in 2005. There was also an idea to convert the aisle into a thoroughfare for the trucks. By introducing a one-way traffic flow instead of the current two-way through fare, the in-plant traffic can be alleviated. This, however, is not an easy task. Ventilation systems to redirect exhaust fumes from the trucks need to be in place and comply with the health and safety regulations.

4. Truck size: the truck size and load from the previous alternative proved to be one of the most influential factors in determining the way forward. With a sub-optimal load of 30 sets, the JIS supply method at status 5000 deems an unviable option. The truck load must therefore be equal to that of the current 40 set per trip. Not only is this the most optimal amount for the breathing variance between the line side buffer and consumption of the delivered load, but also the most economical owing to the newly introduced “per trip” costing strategy instead of the previous “per day” charge of a truck.

The aim therefore is to fit 40 sets into a truck that has a loading capacity of 8.5 metres x 2,6 metres, instead of the previous 12m truckload. After numerous iterations in

attempting to load this bulky part on rail affixed to a truck in the most optimal manner, a final proposition was found that met all these requirements. The diagram below illustrates this scenario. The truck will be loaded from the side. Five rows of 8 carpet sets will be used which meets the minimum requirement of 40 sets per load.

**Figure 7.4-2: Truck Loading Configuration**



5. Inventory: The JIS principle calls for a minimization of waste – one of which is excess inventory. The current stock of 9 hours that is housed in the sequencing centre can be reduced to a maximum of 3 hours at BMW. The supplier, now having the advantage of having a fixed four day forecast can also reduce his current finished goods stock from 4 days to a maximum of 3 days. Although a buffer of less than 3 days is desired, one can not overlook the supplier's internal constraints. Owing to the fact that the lower level suppliers are situated overseas and the parts need to be imported by the 1<sup>st</sup> tier supplier, a longer set of lead times exist which in turn means that more buffer stock is required. The geographical position of most of the lower tier suppliers calls for a mandatory analysis of possible risks that exist in the supply chain for the 1<sup>st</sup> tier and of course the OEM. When embarking on developing the supplier to coincide with the OEM's plans of developing the supply chain, a total system approach is imperative for its success.
6. Packaging: as highlighted in the previous alternative, the packaging concept needed attention. Not only is there a steady track record of high maintenance costs for stillage damage but the current stillage design does not cater for ease of sequencing which now

plays a prominent role in this alternative investigation. The rail system provides an opportunity to almost completely eliminate the need for stillages.

7. Handling and Quality: information revealed from the benchmark, showed that the damages as a result of handling were greatly reduced once the rail system was fully operational. This is due to the fact that the carpets are merely pushed along the rail via the attached hanger and roller mechanism and never physically touched on the carpet itself. In this way, the possibility of damaging this sensitive part is minimized.
8. Supplier process: as already mentioned, the processes at the supplier have great potential for improvement. A number of alternatives were generated for the supplier. These all had to be aligned with the processes at BMW and therefore any constraints encountered at the one would have an impact on the proposed approach at the other and vice versa. The design and development processes therefore had to be done in parallel and through a joint effort. The alternatives for the supplier will be dealt with later on in the chapter.

Now that the relevant logistical aspects of this new benchmarked process have been dealt with, a closer look at the operational and infrastructure requirements can be done.

## 7.5 Alternative Two A: Manual Rail System (OEM's Process)

The modified truck (with 5 rows of rails) manoeuvres into the designated loading bay in body shop as shown in Figure 7.4-2. Once stationary, a forklift fetches the first row of carpets in the truck using a transfer stillage. This stillage, similar to the device used at the Regensburg plant, is affixed with a corresponding rail that aligns with the rail inside the truck. The carpets are then slid into the stillage and the forklift transfers the carpets onto the line side rail, where they hang freely. The forklift driver then moves to the rail near the fitment point and collects the empty hangers in the same manner. The forklift then moves to the truck, offloads the empties along the vacant rail row and then proceeds to collect the adjacent set of carpets in the truck. This cycle is continued until the truck is re-loaded with the empty hangers on a 1:1 ratio.

The carpets at the line side are hung in order of the status 5000 sequence. If this planned sequence differs from the actual sequence at status 5300, the carpets will have to be re-sequenced. The T-shaped rail serves this purpose. If a carpet is out of sequence as a result of instances such as blocked orders, cumulative backlog or unprecedented part delivery failure from any one supplier, the part will have to be side-tracked and put back into sequence when required. A set of 6 carpet sets – arranged according to the status 5300 sequence – are slid into another modified wheeled stillage at the end of the line side rail. This stillage, also affixed with a rail, is rolled to fitment area where it is aligned with the corresponding rail. The carpets

are manually slid off the stillage and fitted to the car. The wheeled stillage is rolled back to its original position where it awaits the next set of status 5300 carpets to be loaded.

Although the proposed process does not seem to reduce the number of steps, the actual carpet is not physically handled during these steps. For this reason, it is an improvement on the current process, which is far more labour intensive and susceptible to damage. It is now important to integrate the supplier's processes with that of BMW's so that sub-optimisation can be avoided.

## 7.6 The Supplier's Processes

In light of the alternative above, it must be stressed that the process improvement proposal at BMW could not be formulated in isolation. The development of the supplier's process is fundamental to the success of the entire system. An already existing close relationship with the supplier aided in mutual cooperation of developing their process. In keeping with the best practises of Regensburg as a guideline, the supplier process in Germany was also earmarked as the way forward for our local supplier. The differing conditions that are part of the South African environment induced the need for an adapted system.

The first step in the process was to assess the current production systems at the supplier. The actual manufacturing of the carpet is not a very complex procedure. However, because of the high cost of the machinery, the parts are produced in batches. The final step in the manufacturing process is the water-jet procedure. It is here that the finished carpets are placed in a stillage and then transferred to the dispatch area via forklift.

In an attempt to optimise this process in terms of installing a rail system that would be compatible with that of BMW, a number of alternatives were generated to find the most advantageous. One of the major constraints that were encountered in attempting to develop the supplier, was that "cost parity" on the part of the supplier is not negotiable. In other words, an increase in the piece price is disallowed in terms of the BMW Group Policies. A way of outsourcing the sequencing activity to the supplier and not increasing their running costs was the task at hand. This meant that the number of steps in their processes required to get the carpets to BMW in the desired order, must be minimised or even eliminated. Not an easy undertaking.

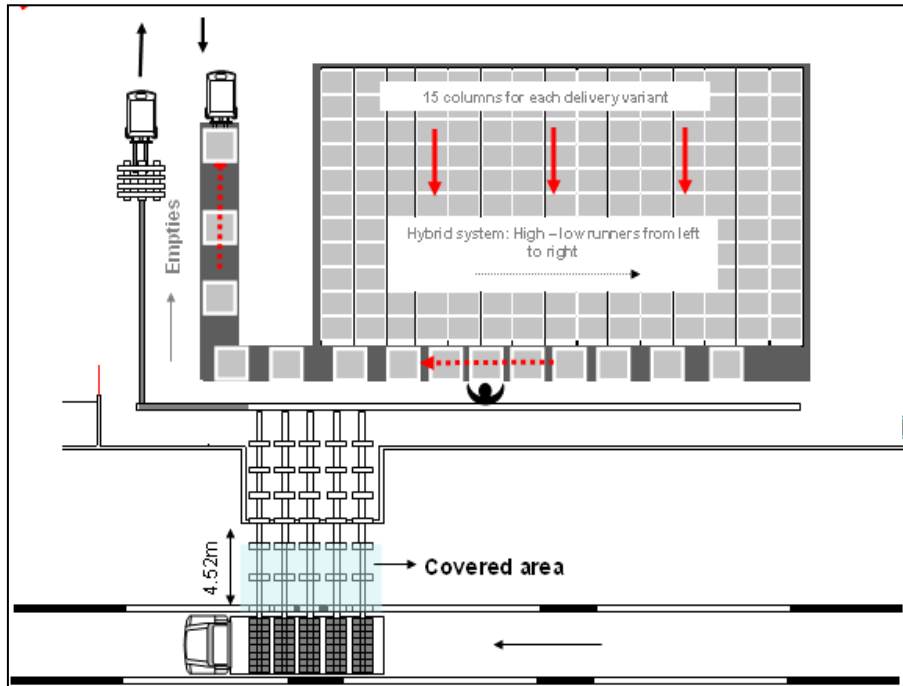
The process at the supplier in Germany is fully automated – from end of production to truck loading. Their volumes are approximately 650 carpets per day as opposed to the maximum of 250 per day in South Africa for BMW. This has huge implications in justifying the cause for implementing a fully automated system. Not only will the amortization period be lengthy, but the resource utilization will be insufficient. On the other hand, a system that would still require the

use of labour and material handling recourses and still require additional investment cost would not be a worthwhile option.

## 7.7 Alternative Two B: Manual Rail System (Supplier Process)

The first alternative concentrated mainly on the problematic dispatch area where the FIFO principle was kept using an undesirable technique of pushing the double-stacked stillage along the floor via a forklift. The damage to the stillages as well as its potential safety threat to employees called for a distinct need for change. One of the major concerns was of course the double stacking of the stillages. From a personal point of view, there seemed to be sufficient floor space to have their required stock of 3 days stacked only one high in the same designated area for finished goods. After calculating the amount of floor space required to accommodate this number of carpets in a singular stacking manner, and comparing this figure to the amount of usable space that the supplier had for BMW storage, it was clear that there was indeed enough room. Although this new view of their dispatch process took a while to accept, it was nonetheless proved to be the way forward in solving the FIFO principle adherence without breaching any health and safety regulations. This opened the door to new opportunities in initialising new methods. Also, the supplier pointed out the possibilities of altering parts of the building to accommodate some changes if necessary; these new possibilities stimulated further ideas in terms of their facility layout structure. Currently, the flow of the finished goods was from left to right. The option to re-position the truck loading bay to the side of the building brought on the initiative to change the direction of material flow too. A north-south direction would be able to accommodate more columns and fewer rows of carpets, which would be ideal in arranging one variant per row for ease of sequence picking. For these reasons, this type of flow would be the basis for new proposals.

Below is a diagram of one of the first alternatives that were generated. Cognisance of BMW's present alternative was taken. The loading of the truck had to be in line with the proposed way of offloading the truck at BMW. If this aspect was satisfied, the generation of innovative solutions at the supplier would not have to be restricted. This alternative suggests that the supplier still houses the carpets in a stillage as is currently done. However, the stillages are no longer pushed along the floor using the forklift, but rather placed on a slight gravity feed roller bed conveyor that slides the stillages to the opposite end of dispatch, where the carpets can be picked for sequencing. A single rail would be erected across the rows of stillages in an attempt to simplify the picking process for the sequencing operation. This rail would then feed directly into the truck as shown.

**Figure 7.7-1: Roller Bed/ Rail System at Supplier**

A number of constraints were encountered once this alternative was introduced to the team.

- The supplier's internal costs would not be reduced but in fact increased owing to the extra sequencing activity. An additional head would be required on a full-time basis.
- The flow of empty hangers from the truck to the rail would be problematic in terms of a one-way flow. Carpets could therefore not be sequenced in advanced and would have to wait for the truck's return to obtain the hangers required for sequencing.
- The initial goal of minimizing or even eliminating stillages in the system is nowhere near achieved in this alternative. The amount of stillages as well as hangers required in this system is actually more than the current scenario's requirements.
- The number of steps in the value chain is increased due to the different systems at BMW and the supplier.

These constraints will have to be considered when generating subsequent alternatives. A summary of the alternatives generated for both BMW and the supplier and is given in Table 7.7-1 and Table 7.7-2 respectively.

Table 7.7-1: Alternative Two A: OEM Solution Summary

Alternative Two A: OEM Processes			
Logistic activity	Current	Alternative Two A: BMW Processes	Comment
Call-off	<ul style="list-style-type: none"> <li>▪ JIT part-related with truck optimisation</li> </ul>	<ul style="list-style-type: none"> <li>▪ JIS order-related with sequence information at status 5000 and required time in plant</li> </ul>	New IT system must be set up to accommodate these changes
In-plant traffic	<ul style="list-style-type: none"> <li>▪ Current off-load is within capacity but less traffic is desired along that route</li> </ul>	<ul style="list-style-type: none"> <li>▪ The supply route as per alternative 1 is used</li> <li>▪ The truck will offload in body shop area once it becomes available in September 2005 (after start of production). The truck will offload beside the logistical aisle until this time</li> </ul>	The area in Body Shop will only be available in September 2005. the decision to convert the aisle into a through fare is still pending
Assembly space	<ul style="list-style-type: none"> <li>▪ Limited line-side space (logistical aisle)</li> <li>▪ Headcount and forklift/tow motor assigned to T-4 Department</li> <li>▪ Sequencing centre is space strained for E90</li> </ul>	<ul style="list-style-type: none"> <li>▪ The amount of space required for the line side rail is approximately 80 square metres.</li> <li>▪ The offloading space in body shop can also be used for other part family deliveries and so will aid in alleviating the congestion within that zone.</li> </ul>	The amount of space required for alternative 2 is less than the current.
Transport: Truck size and loading	<ul style="list-style-type: none"> <li>▪ A 12 metre truck</li> <li>▪ Truck load of 40 carpet sets per load</li> <li>▪ 1 truck required in system</li> <li>▪ 5 deliveries per day</li> </ul>	<ul style="list-style-type: none"> <li>▪ A 10 metre truck</li> <li>▪ Truck load of 40 carpet sets per load – 5 rows of 8 carpets hang on rails within truck</li> <li>▪ 1 truck required in system</li> <li>▪ 5 deliveries per day</li> </ul>	The truck load of 40 carpets is achieved in this alternative which in turn minimizes the transport costs (trucks are charged per trip and not per day as previously).

Inventory	<ul style="list-style-type: none"> <li>▪ A buffer time of 9 hours is held in the sequencing centre at BMW</li> <li>▪ A 3,5 days stock of finished goods is held at the supplier</li> </ul>	<ul style="list-style-type: none"> <li>▪ A buffer of approximately 3 hours will be kept at BMW to allow for the breathing gap between the truck deliveries and consumption of the load.</li> </ul>	This amount of buffer can be accommodated on the length of the line side rail. A further truck load can be hung on the rail at fitment.
Packaging	<ul style="list-style-type: none"> <li>▪ Delivery stillages from supplier to sequencing centre – 5 per stillage</li> <li>▪ 1 part number per stillage from supplier</li> <li>▪ sequenced carpets are transferred onto different stillages – 8 per stillage – tow motored to line side</li> <li>▪ a 1:1 ratio of empties pick-up to full-offload</li> <li>▪ currently 350 stillages in system</li> <li>▪ high maintenance of stillages due to supplier FIFO principle (damages to steel stillages)</li> </ul>	<ul style="list-style-type: none"> <li>▪ There will be approximately 20 modified stillages in the entire system to allow for transfer of the carpets from one rail to another within the BMW plant.</li> <li>▪ A rail erected at line side and near the fitment point will be required. A section of the rail will have a T-formation to allow for side tracking and re-sequencing of carpets to status 5300.</li> </ul>	The rail system, benchmarked from the process at Regensburg, will reduce handling, potential damages and require less effort to get the carpets to the fitment point.
Quality	<ul style="list-style-type: none"> <li>▪ Approximately 0.5% defective carpets over one calendar year – 97% of which were as a result of in-house damage</li> <li>▪ Supplier quality is of a high standard</li> </ul>	<ul style="list-style-type: none"> <li>▪ By transferring the sequencing to the supplier, in-house damages can be reduced to 0%</li> </ul>	
Handling	<ul style="list-style-type: none"> <li>▪ Double handling as a result of sequencing batched produced carpets</li> <li>▪ Handling of the carpets in-house is causing the carpet damage</li> </ul>	<ul style="list-style-type: none"> <li>▪ Handling will be greatly reduced through this rail system. Carpets need only to be pushed along and not physically detached from the rail until fitment.</li> </ul>	



Table 7.7-2: Alternative Two B: Supplier Solution Summary

Alternative Two B: Supplier Processes			
Logistic activity	Current	Alternative Two B: Supplier Processes	Comment
Supplier processes	<ul style="list-style-type: none"> <li>▪ Supplier produces in batches</li> <li>▪ Finished goods are housed in the dispatch area and stacked double high</li> <li>▪ Forklift pushes stillages along floor to adhere to FIFO principle</li> <li>▪ The supplier removes the respective carpets from the stillages and into another according to the required sequence</li> </ul>	<ul style="list-style-type: none"> <li>▪ The supplier produces in batches</li> <li>▪ Finished goods are housed in the dispatch area where they are single stacked and moved along a roller bed.</li> <li>▪ The parts are picked from the stillages and hung on the hangers that are attached to a rail. This rail feeds directly into the truck once a load is accumulated.</li> <li>▪ Once the stillages are empty, they are rolled back towards production</li> <li>▪ The empty hangers are released onto the rail upon the truck's return.</li> </ul>	<p>There will still be a large amount of stillages in the system.</p> <p>The flow of empty hangers along the same rail as the sequenced carpets, inhibits the possibility to sequence in advance of the truck arrival. This may influence the truck turnaround time considerably.</p>

Although the volumes of BMW SA do not favour the automation of this type of process – from offload to fitment point, the possibility can not be ignored. If there is a saving in running costs per year and this saving can substantiate the initial investment costs, it may prove to be a viable option.

### **7.8 Alternative Three A: Automated/ Semi-Automated Rail System (BMW Process)**

In this alternative, the truck docks in the body shop area as before and aligns with the fixed rail system (5 corresponding rows that align with that of the truck's). The carpets are moved along the roof-supported rail and crane system through the body shop and then into the logistical aisle. The reason for this configuration is due to the height restriction of the ablution block in the middle of the logistical aisle. In the ideal case, the rail would have had a direct route without any undesirable curvatures. Nonetheless, the functionality of the system should not be compromised. In an attempt to reduce costs in having a fully automated system, the re-sequencing activity would be operated on a manual basis. A platform upon which a head could climb in order to reach the relevant carpets would be in place. Once sequenced to status 5300, the carpets then automatically move through a lifting station and down to fitment. The empty hangers move back to the truck in much the same way but along a separate rail that converges to the incoming rail. This would mean that empties may only return to the truck once this part of the rail is vacant. It was pointed out that the truck turnaround time could be affected by this queuing system. This alternative is illustrated in the figure below.



## 7.9 Alternative Three B: Automated/ Semi-automated Rail System (Supplier Process)

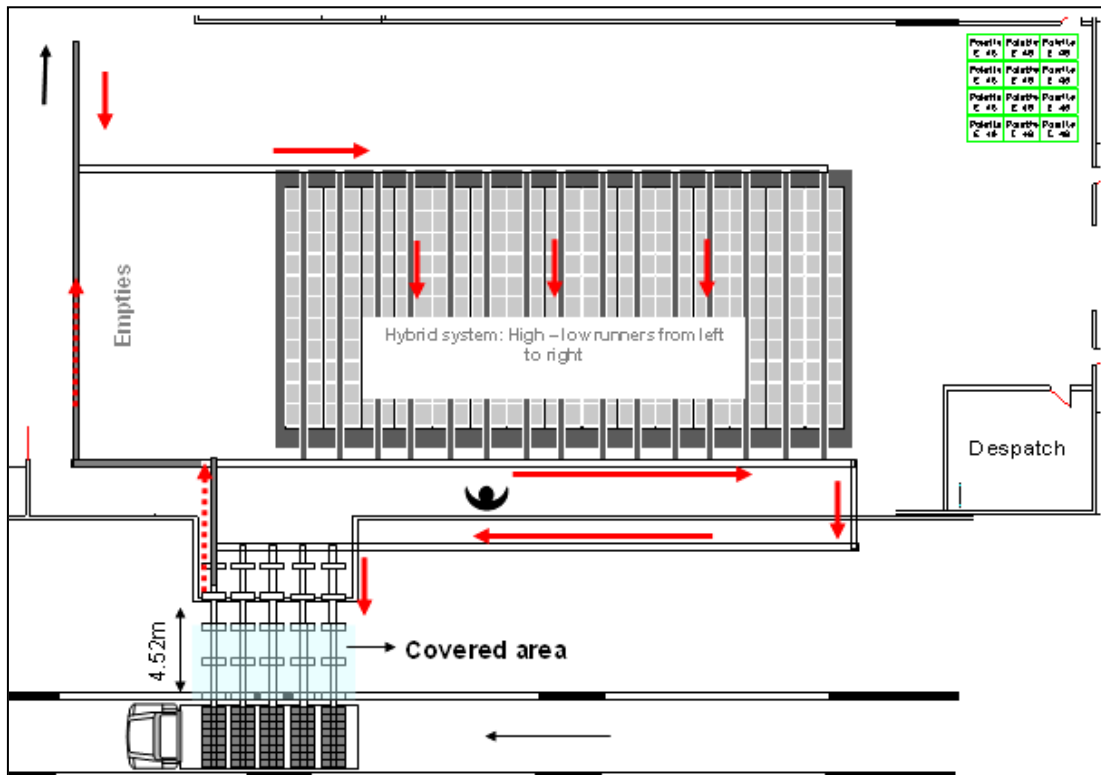
After the presentation of the first alternative and number of variations thereof, a consensus was reached as to the way forward. Owing to the cost parity constraint, it was clear that any development at the supplier should reduce their annual running costs and not increase it, even though the extra step of sequencing would have to be done. This meant that either the forklift usage should be eliminated/reduced and/or less labour would be required.

In technical terms, this implied that if BMW was going the rail route, then so too should the supplier in the quest for uniformity and compatibility. A full rail system – from the end of production to the point of truck loading – was the basis for the next alternative.

As shown in the diagram below, the rail begins at the final step of production and runs through to the dispatch area where it diverges into a number of rows – each dedicated to a particular variant for the new E90 model. The flow, as stated earlier, will run from north to south instead of the previous west to east. This allows for more rows of rails to be erected whilst still providing enough space for the storage of other automaker's finished goods.

At the south end, the rails converge into one again where the relevant variants are picked from the parallel rows and slid into the perpendicular one. This rail then feeds directly into the truck as shown. A separate rail for the empty hangers runs from the truck back to the end of production. The return of the empty hangers therefore does not interfere with the loading of the sequenced carpets. The system was initially quoted on a fully automated basis, but after assessing the costs and its rationale, a more refined alternative was suggested. Instead of full automation, the system would be motorized in some parts and manual in others. The main aim was to balance the amount of resources required to operate the system manually versus the cost of automating that section. After several iterations, a final proposal was brought forward. The costs were reduced dramatically and no extra resources were required for its operation. In fact, the use of the forklift that was previously dedicated to the BMW goods could now be used for other activities. Figure 7.9-1 gives an illustration of this proposed Automated System at the Supplier.

Figure 7.9-1: Automated System at Supplier



To recap on the newly formed alternatives, overviews in tabular form are shown below.

Table 7.9-1: Alternative Three A: OEM Solution Summary

Alternative Three A: OEM Processes			
Logistic activity	Current	Alternative Three A: BMW Processes	Comment
Call-off	<ul style="list-style-type: none"> <li>▪ JIT part-related with truck optimisation</li> </ul>	<ul style="list-style-type: none"> <li>▪ JIS order-related with sequence information at status 5000 and required time in plant</li> </ul>	New IT system must be set up to accommodate these changes
In-plant traffic	<ul style="list-style-type: none"> <li>▪ Current off-load is within capacity but less traffic is desired along that route</li> </ul>	<ul style="list-style-type: none"> <li>▪ The supply route as per alternative 1 is used</li> <li>▪ The truck will offload in body shop area once it becomes available in September 2005 (after start of production).</li> <li>▪ The truck will have to align with the fixed rail in this area</li> </ul>	The area in Body Shop will only be available in September 2005. Because of this, the rail system structure can only be erected after the start of production. A contingency plan will have to be in place to find an alternative way of delivering the carpets to the fitment point
Assembly space	<ul style="list-style-type: none"> <li>▪ Limited line-side space (logistical aisle)</li> <li>▪ Headcount and forklift/tow motor assigned to T-4 Department</li> <li>▪ Sequencing centre is space strained for E90</li> </ul>	<ul style="list-style-type: none"> <li>▪ The amount of space required for the rail fixture in body shop and in the logistical aisle is approximately 300 square metres.</li> </ul>	The offloading space in body shop can not be used for other truck deliveries because the rail fixture will be located there.
Transport: Truck size and loading	<ul style="list-style-type: none"> <li>▪ A 12 metre truck</li> <li>▪ Truck load of 40 carpet sets per load</li> <li>▪ 1 truck required in system</li> <li>▪ 5 deliveries per day</li> </ul>	<ul style="list-style-type: none"> <li>▪ A 10 metre truck</li> <li>▪ Truck load of 40 carpet sets per load – 5 rows of 8 carpets hang on rails within truck</li> <li>▪ 1 truck required in system</li> <li>▪ 5 deliveries per day</li> </ul>	The truck load of 40 carpets is achieved in this alternative which in turn minimizes the transport costs (trucks are charged per trip and not per day as previously).
Inventory	<ul style="list-style-type: none"> <li>▪ A buffer time of 9 hours is held in the sequencing centre at BMW</li> <li>▪ A 3,5 days stock of finished goods is held at the supplier</li> </ul>	<ul style="list-style-type: none"> <li>▪ A buffer of approximately 3 hours will be kept at BMW to allow for the breathing gap between the truck deliveries and consumption of the load.</li> </ul>	This amount of buffer can be accommodated on the length of the entire rail. This means that excess stock can be kept in-plant if necessary. However, this contradicts the JIS principle of lean production.

Logistic activity	Current	Alternative Three A: BMW Processes	Comment
Packaging	<ul style="list-style-type: none"> <li>▪ Delivery stillages from supplier to sequencing centre – 5 per stillage</li> <li>▪ 1 part number per stillage from supplier</li> <li>▪ Sequenced carpets are transferred onto different stillages – 8 per stillage – tow motored to line side</li> <li>▪ A 1:1 ratio of empties pick-up to full-offload</li> <li>▪ currently 350 stillages in system</li> <li>▪ High maintenance of stillages due to supplier FIFO principle (damages to steel stillages)</li> </ul>	<ul style="list-style-type: none"> <li>▪ There will be no need for any stillages at BMW for this automated alternative</li> </ul>	This automated rail system, will reduce handling, potential damages and require less effort to get the carpets to the fitment point, even more than alternative 2.
Quality	<ul style="list-style-type: none"> <li>▪ Approximately 0.5% defective carpets over one calendar year – 97% of which were as a result of in-house damage</li> <li>▪ Supplier quality is of a high standard</li> </ul>	<ul style="list-style-type: none"> <li>▪ By transferring the sequencing to the supplier, in-house damages can be reduced to 0%</li> </ul>	
Handling	<ul style="list-style-type: none"> <li>▪ Double handling as a result of sequencing batched produced carpets</li> <li>▪ Handling of the carpets in-house is causing the carpet damage</li> </ul>	<ul style="list-style-type: none"> <li>▪ The carpets need not be handled at all except in the case of re-sequencing.</li> </ul>	This alternative proposes the least amount of handling

Table 7.9-2: Alternative Three B: Supplier Solution Summary

Alternative Three B: Supplier Processes			
Logistic activity	Current	Alternative Three: Supplier Processes	Comment
Supplier processes	<ul style="list-style-type: none"> <li>▪ Supplier produces in batches</li> <li>▪ Finished goods are housed in the dispatch area and stacked double high</li> <li>▪ Forklift pushes stillages along floor to adhere to FIFO principle</li> <li>▪ The supplier removes the respective carpets from the stillages and into another according to the required sequence</li> </ul>	<ul style="list-style-type: none"> <li>▪ The supplier produces in batches</li> <li>▪ Finished goods are hung directly onto empty hangers affixed to the rail.</li> <li>▪ The carpets are automatically moved to the dispatch area in batches and stop at the allocated rail into which it must slide. The batch is then removed from the motor and pushed into the relevant row.</li> <li>▪ At the end of the rows, the carpets are picked into the required sequence by pushing them manually into the perpendicular rail.</li> <li>▪ The carpets are then moved along to the truck for loading.</li> <li>▪ The empty hangers are released onto a separate rail that leads back to production.</li> </ul>	There will be no need for stillages at the supplier – only for excess storage purposes.

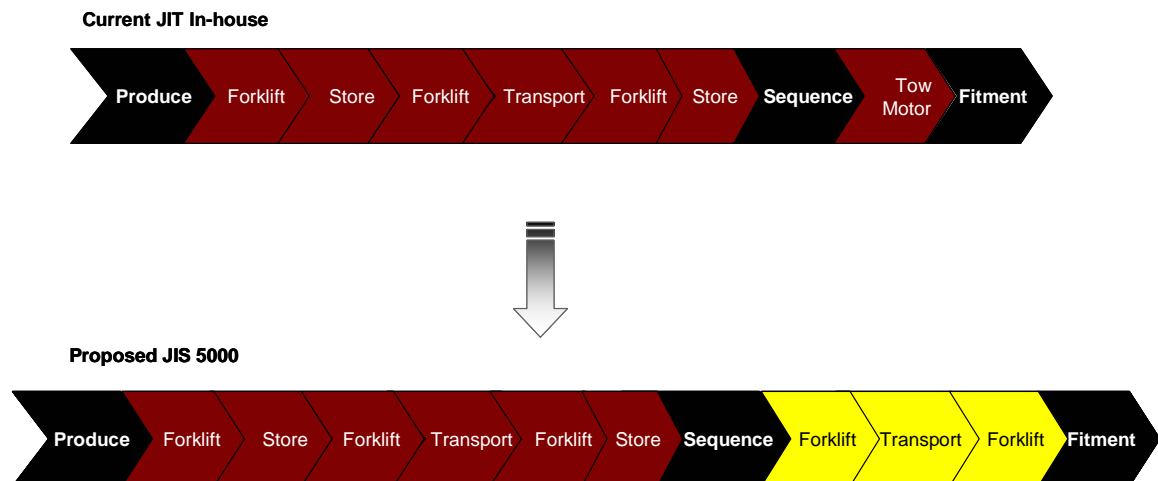
Before a decision can be made as to which alternative is the best possible solution, another sphere of outsourcing has to be investigated: the use of a Logistic Service Provider (LSP) to sequence the carpets. A few options exist for the way in which the LSP could perform this activity. These options, however, have to accommodate both the processes at BMW and that of the supplier. The operations at the LSP will therefore depend heavily on the methods that will be implemented at both ends. For simplicity purposes, only two of the many proposals worked on with the LSP will be dealt with. Those that were discarded were done so as a result of operational and technical problems that were encountered.



### 7.10 Alternative Four: Stillage Sequence by a Logistical Service Provider

The first and most simple approach to outsourcing this sequencing activity was to merely keep to the current status of JIT production but have the LSP fetch the batched stillages from the supplier, do the sequencing as is currently done in-house and then deliver directly to the line. From the diagram below, the impact on the value chain can be seen. The number of steps has increased somewhat. Although this LSP is situated only 3km from the BMW plant, a JIS delivery according to status 5300, which would be ideal, is still not feasible. Not only is the amount of time needed insufficient, but the cost of approximately 30 deliveries per day that would be required to sustain this supply method, would be far too expensive. The in-plant traffic simulation also confirmed that this amount of deliveries in the planned offloading zone would be way above the capacity limits. Therefore the service provider would merely be doing what BMW does, but at their premises.

Figure 7.10-1: LSP Value Chain



Of course, the decision as to whether this scenario is the best possible solution in comparison to all the others suggested will depend on the comparative cost calculation. This will be dealt with in the decision analysis phase.

### 7.11 Alternative Five: Rail System Sequence by a Logistical Service Provider

Owing to the different alternatives that were generated for the BMW and supplier processes, another method of outsourcing the sequencing via an LSP had to be explored. When looking at the system as a whole, an LSP would not be of any use if a rail system was erected at the supplier for the purpose of sequencing. It therefore stands to reason that no investment at the supplier should take place if the sequencing was to be outsourced completely. A possible improvement in their current storage technique may still be desirable – perhaps the installation of a racking system that would allow for the easy location of specific carpets and according to the FIFO rule. This however,

would not be of concern to the OEM, but rather to the supplier's need for internal procedural improvements. What is a concern for the OEM, is the reduction in their supply costs. If the LSP can accomplish this need, then it is in the best interests of BMW to change the current operations. This means that the next, most viable alternative would be to supply the carpets to BMW on the proposed rail system. The most economical version of the rail system, the manual rail/forklift, will be used as the premise.

The LSP proposed to do the following:

1. Have the stillages delivered to their premises at Rosslyn. The same load, truck and delivery frequency as current will be used
2. A 1,5 day buffer stock will be kept at the LSP
3. The carpets will be picked from the stillages according to the status 5000 information received from the supplier (which was initially sent from BMW via EDI)
4. The carpets will be hung onto a hangers attached to a central rail that has to be erected in accordance with the BMW rail system requirements for compatibility purposes.
5. The carpets will then be slid into the modified truck as per alternative 2
6. The truck will transport the carpets into the BMW plant and offload as per alternative 2 (BMW processes).

## 7.12 Summary of Alternative Solutions

Although only the main alternatives for investigating the sequencing of carpets at the supplier and at a Logistical Service Provider have been presented, numerous variations thereof were also generated and discussed with the project team. The nature of a planning phase in a vehicle project is one of constant change. Any new information received from any of the interfaces with which the supply planner interacts, must be addressed and re-assessed as to how it may or may not affect the current planning status. This means that a certain alternative may change due to external influences that arise from other spheres of the project and not necessarily as a result of operational or technical problems as is normally the case. If a constraint arises during a certain planning stage and is subsequently solved, care must be taken to ensure that another constraint does not develop as a result of that new solution. Table 7.12-2 shows a summary of the alternative solutions that have been developed and analysed during this project.

Table 7.12-1: Summary of Alternatives

Alternative	OEM Supply Method	Supplier Supply Method
<b>Supplier Sequence</b>		
<b>One</b>	<b>A</b>	<b>B</b>
	Receiving of sequenced parts on stillages directly to line side.	Supplier to pick parts from batches housed in stillages and sequences them onto different stillages. These are delivered to OEM
<b>Two</b>	<b>A</b>	<b>B</b>
	Manual Rail System at OEM: forklift to offload hanging carpets from truck rail onto line side rail situated near fitment point.	Manual Rail System: stillages are placed on roller bed in dispatch (single stack). Parts are picked from rows onto hangers attached to rail that leads directly to truck rails
<b>Three</b>	<b>A</b>	<b>B</b>
	Semi-automated rail system at OEM: the truck aligns with the fixed rail at offload point. Carpets are hoisted up and brought overhead to lifting station, where the carpets are lowered for fitment of the part by the operator.	Semi-automated rail system at Supplier: a rail system is erected from the last production process, through dispatch directly to truck rail. Each variant has a dedicated row. This is to accommodate the batch production at the supplier. The system is motorised, but not automated due to low volumes.
<b>Logistical Service Provider Sequence</b>		
<b>Four</b>	LSP stillage sequence: carpets are fetched from supplier in batches and sequenced onto stillages at LSP premises. These are then delivered to OEM as per Alternative one	LSP to fetch carpets from supplier. Supplier production in batches need not be altered in any way.
<b>Five</b>	LSP rail sequence: assuming that the OEM has a rail system in place, the LSP must sequence the carpets onto rails inside the truck. A small rail system must be erected at LSP premises to accommodate this. The same supply method as per Alternative Four applies.	The Supplier's processes remain unchanged (as per Alternative Four)

The solutions within some of these alternatives are interchangeable. For instance, the supplier's process for Alternative Three can be used in conjunction with the OEM's and LSP processes for Alternatives Two, Three and Five. Each of these combinations had to be investigated in terms of costs in order to find the most favourable solution. Before a decision can be made, the relationship amongst all the alternatives must be defined. The matrix below illustrates these relationships. This is the basis of the next section that deals with the Decision Analysis phase.

Table 7.12-2: Relationship Table

Option	One	Two A	Two B	Three A	Three B	Four	Five	Action
1	0	0	0	0	0	0	0	Do Nothing
2	1	0	0	0	0	0	0	Accept One
3	0	1	1	0	0	0	0	Accept Two A and Two B
4	0	1	0	0	1	0	0	Accept Two A and Three B
5	0	0	0	1	1	0	0	Accept Three A and Three B
6	0	0	1	1	0	0	0	Accept Three A and Two B
7	0	0	0	0	0	1	0	Accept 4 and current Supplier + OEM Processes
8	0	1	0	0	0	0	1	Accept 5 and Two A with current Supplier Process
9	0	0	0	1	0	0	1	Accept 5, Three A with Current Supplier process

### 7.13 Decision Analysis

Based on the alternatives shown in

Table 7.12-1: Summary of **Alternatives**

, a cost analysis was developed for each of the possible combinations. The current supply method (Alternative 0) was used as the basis for differential comparison.

The starting point in attempting to determine the costs of the various alternatives is to first calculate the cost of the current process. Referring back to Baker (Section 2.3.3), without understanding your own cost, you are unable to determine whether the outsourced activity is more cost effective. Logistical costs are not easy to come by and since no formal costing of the sequencing activities that occur in-plant have been documented, a satellite project was established to focus on capturing accurate cost factors and figures upon which all future cost analyses could be based. Using this as one of the inputs into this cost analysis, a greater understanding of which activities and processes were costly and which were negligible, was determined. Although the analysis was carried out throughout the project, only a fully comprehensive and complete calculation could be brought forward once all the relevant quotations were finalised. Below is a break down of the method that was used to calculate the costs that will be used for decision-making. The best solution will be based on the least cost alternative.

The first step in developing this cost analysis was to capture the Material Handling costs, Space Costs and the Cost Factors. These standard costs serve as the basis for the detail logistical calculations. It must be noted that the actual figures are not available to the public domain and so a snapshot of these calculations is shown in the appendices.

Using these standard costs as input, the Detail Logistical Costs could be calculated. The following cost elements were included:

- Container costs
- Maintenance Costs
- Inventory carrying costs
- Handling costs (including sequencing costs)
- Space costs
- Transport costs
- Depreciation costs
- Cost of defects
- Investment costs (per alternative)

Again, a snapshot view of these calculations is shown in the appendices.

All these calculations were verified according to the BMW Group standards and internal funding rules. Once this detailed cost analysis was completed, a summarised version hereof was formulated to compare differential costs amongst the alternatives.

The detailed logistical cost analysis is used to create the worksheet shown in the appendices. All the costs for the alternatives are summarized and compared against the “Do Nothing” alternative. Only the differential costs are of importance in determining the best candidate solution.

Using the Alternative 0 as the standard, the various ROI's are calculated to compare either the reduction in overall costs or the increase thereof. All the worksheets are interrelated and so, the ROI for each alternative is automatically generated from the above information. The results are shown in the appendices and in essence, reveals the best possible candidate with regards to cost savings. Since all the ROI's were calculated using Alternative 0 (Do Nothing) as the standard, a positive ROI indicates that the candidate proves to be a more viable supply method. T

he degree of improvement shown via the ROI percentage is the yardstick against which the candidates are measured. A summary of these results in accordance with the alternatives presented in Table 7.12-2, are shown below.

**Table 7.13-1: Summary of Options**

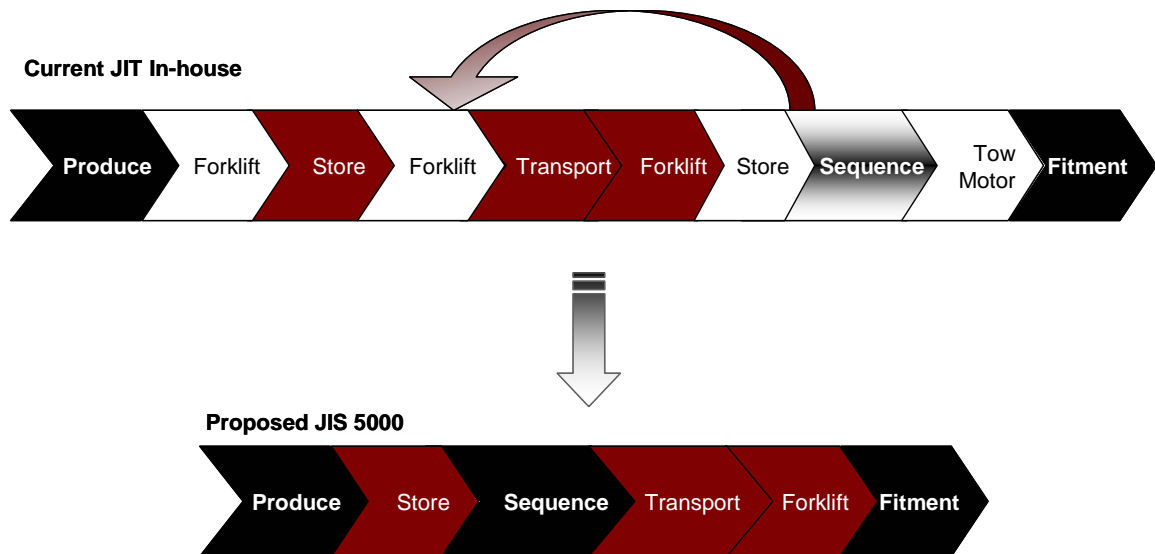
Options	OEM Supply Method	ROI	Supplier Supply Method
Supplier Sequence			
<b>2</b>	Receiving of sequenced parts on stillages directly to line side.	<b>34.2%</b>	Supplier to pick parts from batches housed in stillages and sequences them onto different stillages. These are delivered to OEM
<b>4</b>	Manual Rail System at OEM: forklift to offload hanging carpets from truck rail onto line side rail situated near fitment point.	<b>52.6%</b>	Manual Rail System: stillages are placed on roller bed in dispatch (single stack). Parts are picked from rows onto hangers attached to rail that leads directly to truck rails
<b>5</b>	Semi-automated rail system at OEM: the truck aligns with the fixed rail at offload point. Carpets are hoisted up and brought overhead to lifting station, where the carpets are lowered for fitment of the part by the operator.	<b>20.2%</b>	Semi-automated rail system at Supplier: a rail system is erected from the last production process, through dispatch directly to truck rail. Each variant has a dedicated row. This is to accommodate the batch production at the supplier. The system is motorised, but not automated due to low volumes.

Logistical Service Provider Sequence			
<b>7</b>	LSP stillage sequence: carpets are fetched from supplier in batches and sequenced onto stillages at LSP premises. These are then delivered to OEM as per Alternative one	<b>-2.3%</b>	LSP to fetch carpets from supplier. Supplier production in batches need not be altered in any way.
<b>8</b>	LSP rail sequence: assuming that the OEM has a rail system in place, the LSP must sequence the carpets onto rails inside the truck. A small rail system must be erected at LSP premises to accommodate this. The same supply method as per Alternative Four applies.	<b>-9%</b>	The Supplier's processes remain unchanged (as per Alternative Four)

After much iteration involving all potential solutions, the ROI calculations revealed that the best possible candidate was *Alternative Two A for the BMW Processes* and *Alternative Three B for the Supplier Processes*. In other words the supplier will have the motorised rail system in place - i.e. no stillages are required in the system – and the carpets are loaded directly onto the modified truck as described. The carpets are then transported to BMW via the newly proposed route near to the fitment point (in the body shop space) and offloaded by the forklift using the modified stillage with rail. The carpets are then slid onto the line side rail and finally moved to the fitment point when the sequence according to status 5300 is known.

The value chain for this supply method is shown in Figure 7.13-1 below, comparing it to the current value chain. There are definite improvements in not only the supply steps, but also the financial benefits.

**Figure 7.13-1: Value Chain for Final Solution**



The proposed solution was also the most favoured amongst the team members for the following reasons:

1. The Body Shop space will only be available 5 months after start of production. This constraint made the semi-automated alternative a less favourable option owing to the fact that the rail fixture, planned to be erected in this space, can not be built within the timing boundaries. The manual system, however, is not affected by this constraint, as the fixture is located in the logistical aisle. The truck is also able to offload alongside the logistical aisle until the space in body shop becomes available.
2. According to lessons learned from the Regensburg project, the manual based system is also the preferred option. This is due to the potential problems that may arise with the loading and offloading of the truck with the automated alternative. There was a concern regarding the truck turnaround time. With the automated alternative, the truck would have to wait a lot longer than was initially thought. The length of the rail and the speed of the offloading and loading may result in the need for two trucks instead of the one as was planned. With the manual based system, the forklift dictates the truck turnaround time and because the queuing of the empties is not dependant on the incoming carpet load from the truck, only one truck is required in the system.
3. The motorized system at the supplier proved to be a unanimous favourite. This reverts back to the initial goal of developing the supplier – to outsource the sequencing activity whilst remaining cost neutral. The only way that this can be achieved is through the proposed semi-automated system as previously described. From the calculations, it is clear that the savings on running costs justifies the initial expenditure.
4. The single stacking of the carpets has contributed a great deal to the FIFO principle and the need for a forklift has been eliminated.



5. The stillages have been eliminated from the entire supply chain as was planned at the outset of the investigation.

## 7.14 Conclusion

This investigation involving the transformation of a supplier from a Just-in-time to a Just-In-Sequence supply method has proved feasible in terms of cost, time and quality. The final proposed solution involves the installation of a motorised rail system at the supplier and a rail/forklift system at the OEM. Although a significant capital investment is required, the annual handling, maintenance, quality, costs, etc. are reduced substantially as reflected in the positive ROI.

It must be stressed that the final decision is not yet made. Although an improvement of the current process has been found and all team members are supporting the change, there is a possibility that the “Do Nothing” alternative may prevail. This is due to some external factors that were recently encountered. The fact that other German suppliers of the same part family may be establishing a satellite factory in Rosslyn, may result in a change of the current supplier for future series production. Therefore the justification of developing the current supplier who is located 35 minutes away from the assembly plant may be in question. Another problem may occur if a separate decision to localise the part is approved. This would require a large outlay in capital costs and would therefore take precedence over this proposal.

The decision will be made before the next planning phase so that construction and implementation plans can be put in place.

The next chapter focuses on the development of a Method/ Approach for Supply Planning in South Africa. The approach, development and execution of this Supply Planning Method are explained. Its success will be based on the verification of its use on this Industry Case Study.

## Chapter Eight

### **SUPPLY PLANNING METHODOLOGY**

## 8.1 Introduction

This chapter is dedicated to the development of an approach for the execution of Supply Planning in the Automotive Industry. A detail description of the Supply Planning Methodology (SPM) is attached in the appendices and the explanation thereof is dealt with in the paragraphs that follow.

Based on the industry case study that was undertaken at BMW South Africa, a number of premises must be highlighted so as to limit the potentially enormous scope of Supply Planning. This methodology is based on a specific type of supply chain problem that has a large potential for improvement, namely:

- the supplier is currently supplying on a JIT basis with in-house sequencing done at the OEM,
- the supplier produces in batches,
- the current trends of transforming supply methods to a Just-In-Sequence supply is the underlying philosophy, and
- the testing, construction and implementation phases fall outside the scope of this planning methodology.

## 8.2 Overview

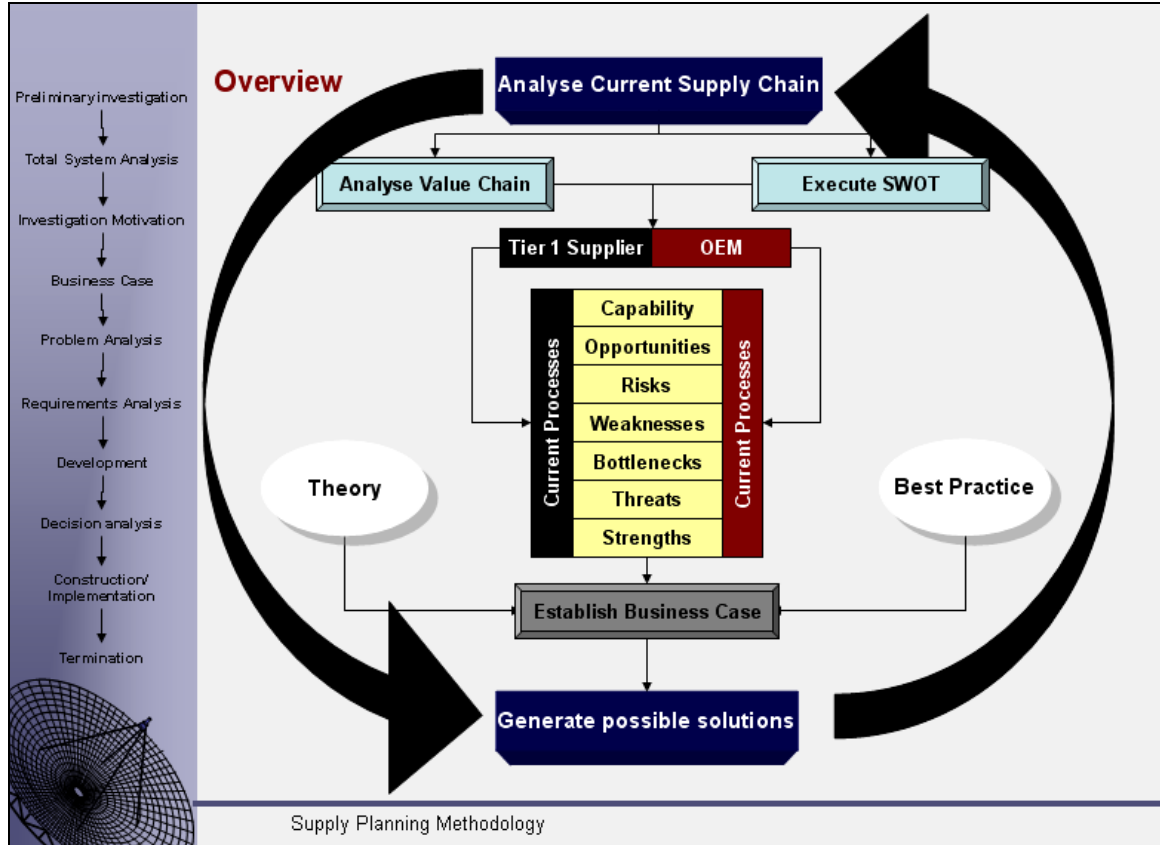
Figure 8.2-1 below provides an overview of the tasks that the Supply Planner should perform in order to develop the supply chain. In keeping with the generic project planning phases, additional tasks have been highlighted to ensure that certain specific requirements are met. Issues such as the development of a business case are imperative for progressing positively in such an automotive project. The supply planner must be aware of these tasks and follow the chronological order of these events. This will prevent the reactive cycle that was experienced during the industry case study. Without clearly defined steps of progress, one will tend to omit certain aspects that may result in sub-optimal planning.

Adding to the overview of this methodology, the figure shows how these phases are translated into high-level activities that encompass all the necessary activities that need to be executed in order to:

- Identify all problems, risks and opportunities at both the supplier and the OEM.
- Use external input in the form of research and best practices to aid in finding appropriate solutions.
- Take heed of internal business procedures so that the project is not stalled as a result of its neglect.

- An approach as to how problems may be solved in a logical manner and in the most economical way.

Figure 8.2-1: Overview of the Supply Planning Methodology



### 8.3 Approach to developing the supply chain

In accordance with the overview, each phase of the supply chain development will be elaborated on. The first phase, the Preliminary Investigation, is crucial to the projects goal. It is here that the supply chain (between the tier-one supplier and the OEM) be analysed in TOTALITY. This means that the OEM's processes can not be viewed in isolation of the Supplier's and vice versa.

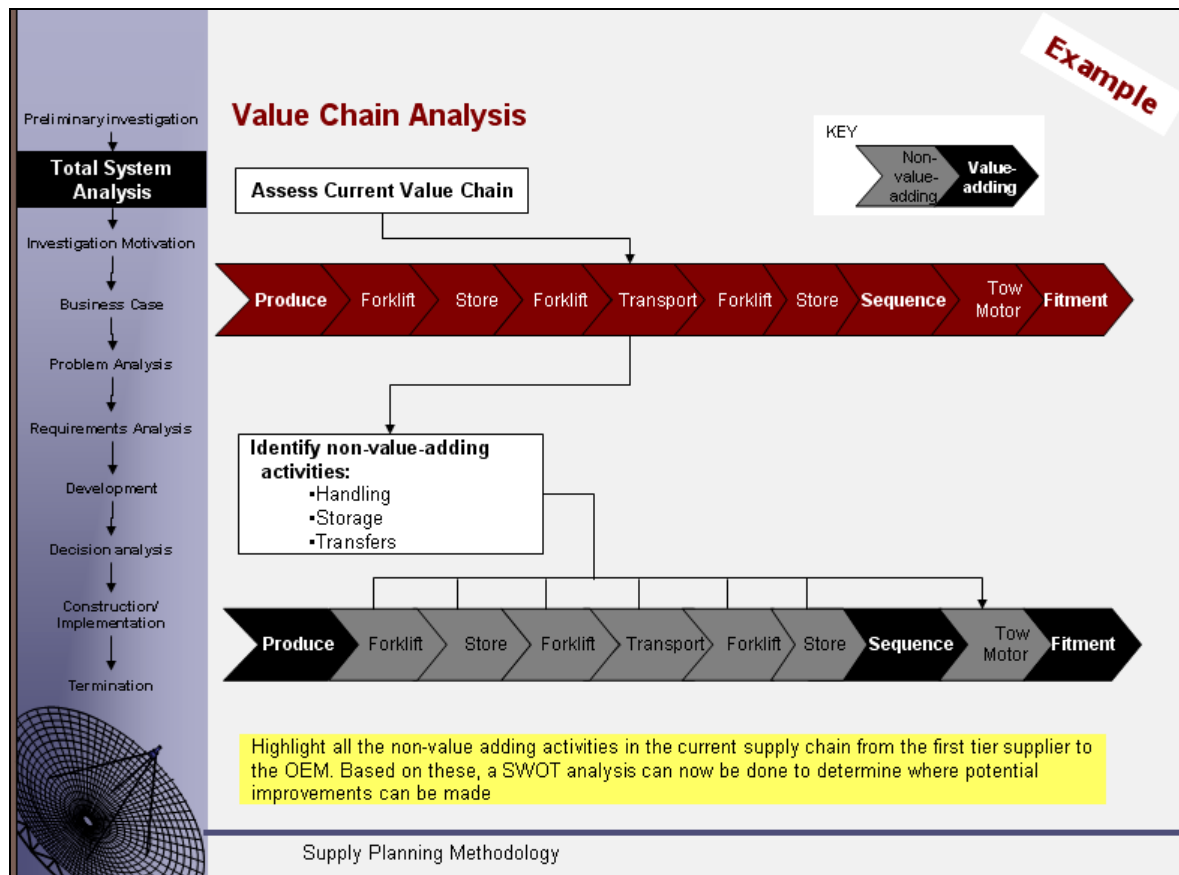
To achieve this viewpoint, the Supply Planner should analyse the supply chain through a number of activities. From the experience gained through the industry case study, the following are the most effective:

1. Value Chain Analysis
2. SWOT Analysis
3. Analysis of current best practises and supply chain trends

## 8.4 Value Chain Analysis

The total supply chain between the tier one supplier and the OEM must be analysed. All activities that do not add value should be highlighted. This is where the potential lies for improvement and optimisation of the supply chain. If these redundant activities can be eliminated, the supply chain can become leaner and in turn may result in cost reductions. The fact that this analysis covers the entire supply chain, it prevents sub-optimisation between tier one and the OEM. An example of this type of analysis is shown in diagram below. It is based on Porter's Value Chain.

Figure 8.4-1: Value Chain Analysis



## 8.5 SWOT Analysis

This simple, yet effective analysis provides an in-depth view of all the strengths, weaknesses, opportunities and threats that exist in the supply chain between tier one and the OEM. The Strengths and weaknesses show how the supply chain is affected internally (within the processes). The opportunities and threats are indicative of external influences. Another example of this activity is in the Appendices.

## 8.6 Trends and Best Practises

A vital part in attempting to optimise the supply chain in any environment is to transform current processes in accordance with worldwide trends and/ or best practises. Although this aspect is important in this type of activity, it is often overlooked and made to seem unimportant amongst business's everyday activities. Organisations have unique ways of carrying out these types of investigations and because of internal standard processes, innovation is sometimes suppressed. The Supply Planner must incorporate this aspect into his/her investigative process so that up-to-date trends are put into action and world class levels are achieved at a the pace of first world countries. An example and action plan of this activity will be shown in the upcoming phases.

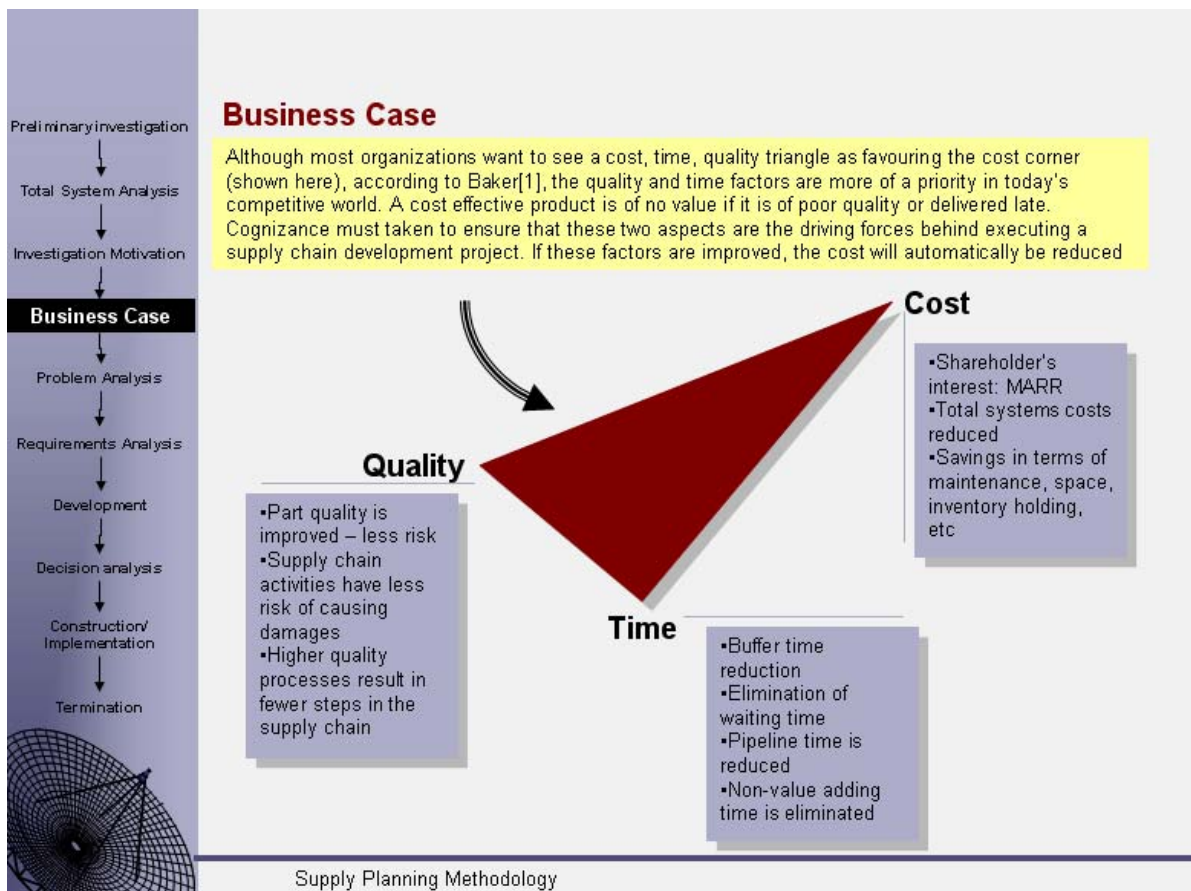
Once the total system has been analysed through the carrying out of the above-mentioned activities, a look at the project feasibility in terms of company policies must be taken. If system stakeholders, owners, and users of a system are not satisfied that the project will be beneficial to them, the project will be rendered useless. Requirements for such an investigation are company specific, but in most instances the "Cost, Time and Quality" triangle is what the owners want to see. According to Baker [6], the quality and time factors are more of a priority in today's competitive world. A cost effective products is of no value if it is of poor quality or delivered late. Cognisance must be taken to ensure that theses two aspects are the driving forces behind executing a supply chain development project. If these factors are improved, the cost will automatically be reduced.

When attempting to motivate the investigation of improving the supply chain processes, all stakeholders must support the project fully from the onset. Stakeholders comprise of all the system's users, owners, benefactors, victims and sponsors. The owners of the system want to see the business case in terms of:

- Cost
- Time
- Quality

Figure 8.6-1below shows some of the detail behind these three drivers.

Figure 8.6-1: Business Case Justification



The other system stakeholders such as users and victims have to be convinced that possible changes will be to their benefit. Personal relations are important in gaining support. Don't underestimate their influence in driving the project's success.

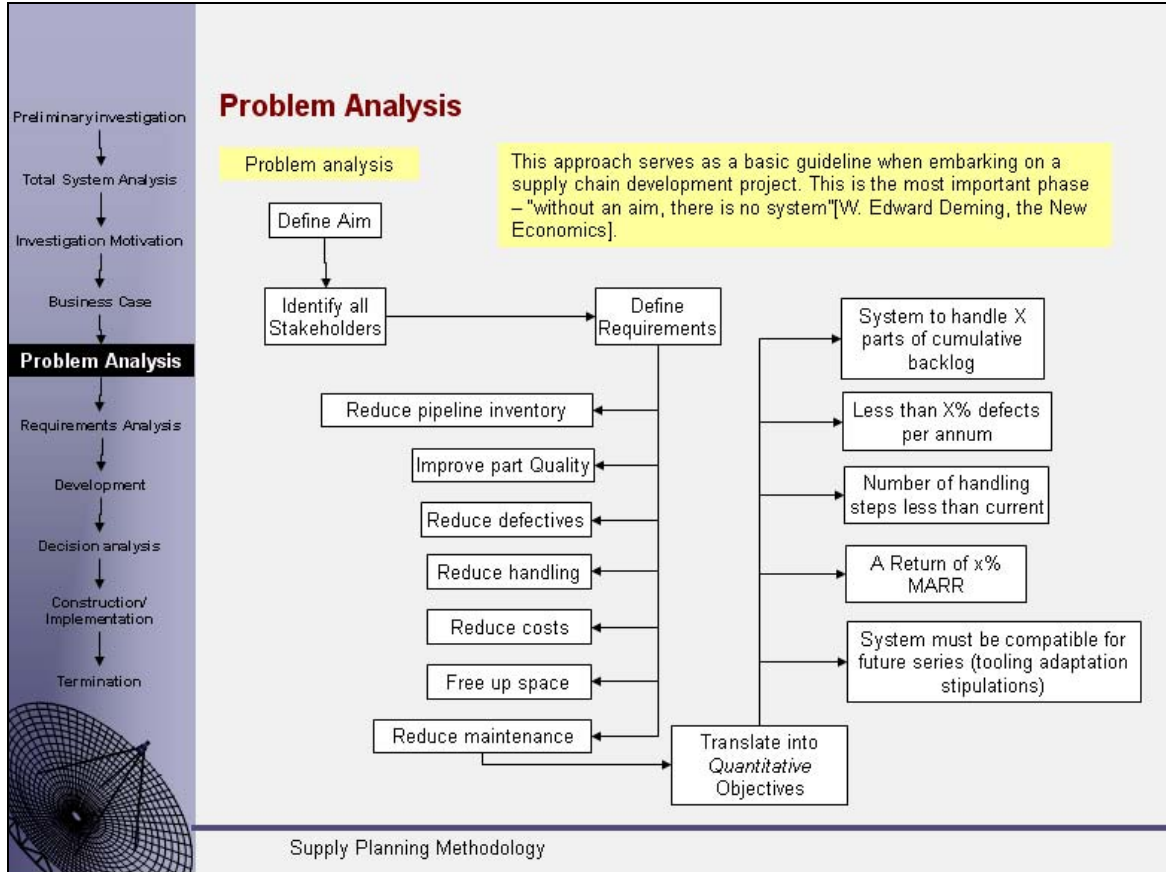
Now that the Preliminary Investigation, Total System Analysis and Business Case phases are complete and the project's feasibility is sound, the rest of the general project phases can be carried out in more detail. The Problem Analysis Phase is next. In essence, this is the most crucial phase in setting the aims of the project. "Without an aim, there is no system," [21].

## 8.7 Problem Analysis Phase

The first and foremost task is to clearly define the aim of the project. Is the aim to improve quality or is it to minimise handling? It could of course be both, but through personal experience, there should be one or two major driving forces for such an investigation. Once this has been defined, all stakeholders must be identified and formally informed of the project's aim, intentions and desired outcome. Each stakeholder, especially the users, must fully understand their role in the project and each must know what their contributions and responsibilities should be. The project's

requirements must be determined and translated into *quantitative* objectives so that specific measurements can be put in place to measure the project's progress and outcomes. [25] This approach, shown in the figure below, serves as a basic guideline when embarking on a supply chain development project.

**Figure 8.7-1: Problem Analysis Guideline**



## 8.8 Requirements Analysis Phase

The next step in the process is to determine all system requirements. This means that a full assessment of the supplier and the OEM must be conducted and analysed.

## 8.9 Supplier Assessment

According to Baker [Paragraph 2.3.3], if the supplier is not capable of what is required from them, an alternative solution need to be found or the supplier must be changed. All potential risks must be identified in all facets of the supplier's business to ensure that the project's aims are in line with the supplier's competence. A guideline as to how this can be done is shown in the appendices. The following areas of risk must be identified:



- Lower Tier problems
- External supply chain problems
- External political, legal and environmental factors
- Historical information with regards to supply chain problems between tier one and the OEM

A closer look at the production process of the supplier is necessary. The most desirable aspect of any production process is flexibility. In turn, this means that ideal suppliers are capable of producing at the same rate and sequence of the OEM – a phenomenon commonly referred to as “synchronous, simultaneous manufacturing”. This means that the supplier produces according to an order-related “call-off” received from the OEM at the point that that specific vehicle body is dropped onto the assembly line. The supplier therefore has the capability to produce a part at the same or faster rate of the OEM and still deliver the part to the fitment point in time. This is the so-called “Just-In-Sequence” supply method. A number of processes need to be in place for this type of manufacturing to be achieved. For instance, the distance of the supplier’s location to the OEM assembly plant may be the major factor in refraining from opting for this type of supply method. Many variations of JIS exist in the supply of automotive parts to the assembly line. In South Africa, a large number of tier one suppliers are not able to produce in this fashion. A number of reasons for this inflexibility are not limited to but include the following:

- Long set-up times
- High machinery costs
- Bottlenecks in the production processes
- Location of supplier is too far from OEM
- Low number of variants
- Unstable sub-suppliers
- Fitment point of part is too close to start of assembly
- High transport costs (cost per trip)

The next step in this assessment is to fully understand the supplier’s production process. This not only aids in obtaining the information that will be required for the formulation of the supply concepts which must be done by the supply planner, but also reveals any possible bottlenecks, supply problems, quality problems, etc. A basic framework for this activity is shown in the appendices.

The aim of this supplier assessment is to ascertain whether the supplier is capable of being developed and if so, what are the areas that need to be focused on. Because such an assessment is not that easy to measure, a traffic light measurement system, as used by the BMW Group for most other assessments, should be used. This assessment is based on the rating of the relevant criteria according to red, yellow, green. Based on this, an overall red light

will indicate that the supplier is too unstable for the project and therefore an alternative solution should be investigated.

### **8.10 OEM Current Supply Method Assessment**

Ensuring that the TOTAL supply chain is analysed, the assessment of the OEM and Supplier can not be done in isolation of one another. The same assessment process as done for the supplier's production process should be done for the OEM's processes. All aspects of the OEM's processes, viz. receiving, storage, sequencing, line supply and reverse logistics must be considered. Based on the supplier's assessment, the OEM's processes must be aligned with those of the supplier. Once all the information is gathered, a clearer picture of the total systems' capability is achieved.

### **8.11 Development, Design and Decision Phases**

The planning phases of a series project are very unstable in terms of fixed premises. The status of the project factors such as number of variants, in-plant structural changes, legislation issues, etc all influences the planning of the supply chain. All project factors need to be considered on a regular and constant basis so that the supply planning is based on correct assumptions. It may be that a change in one project factor may affect the entire investigation and make the project infeasible, which would result in its termination.

Owing to the fact that project planning is an iterative process, the development, design and decision phases should not be seen as separate exercises, but rather a combination of processes in order to reach the desired goals.

In reference to the Appendix: Execution Method, the process flow of how to attempt developing the supply chain is shown. Based on the initial premises brought forward, it attempts to provide a generic framework for finding appropriate solutions, whilst simultaneously incorporating all soft factors that are part of supply planning. These factors include but are not limited to the consideration of project factors, regular meetings, and organisational formalities.

Before one embarks on developing alternative solutions to the current supply chain processes, it must be noted that most project policies and procedures of OEM's insist that at least three alternatives be investigated. Based on the premise that the supplier is currently producing in batches and supplying the OEM just in time to the in-house sequencing centre, the following alternatives should be investigated:

1. Alternative 0: "Do Nothing" – keep as current
2. Alternative 1: "Supplier Sequencing" – benchmarked process

3. Alternative 2: “Logistic Service Provider sequencing” – functional outsourcing

Note that alternatives “1” and “2” can comprise of more than one variation – each with differing cost proposals. Alternative 1 and 2 must be economically favourable in comparison with Alternative 0. If not, the “Do Nothing” alternative will prevail.

## 8.12 Supply Planning Execution Method

In accordance with the Domino effect mentioned in Chapter One, if the OEM processes are optimised, the lower tiers will also be optimised, given that the supplier is capable and has the necessary aid to be developed accordingly. The execution method therefore begins at the OEM.

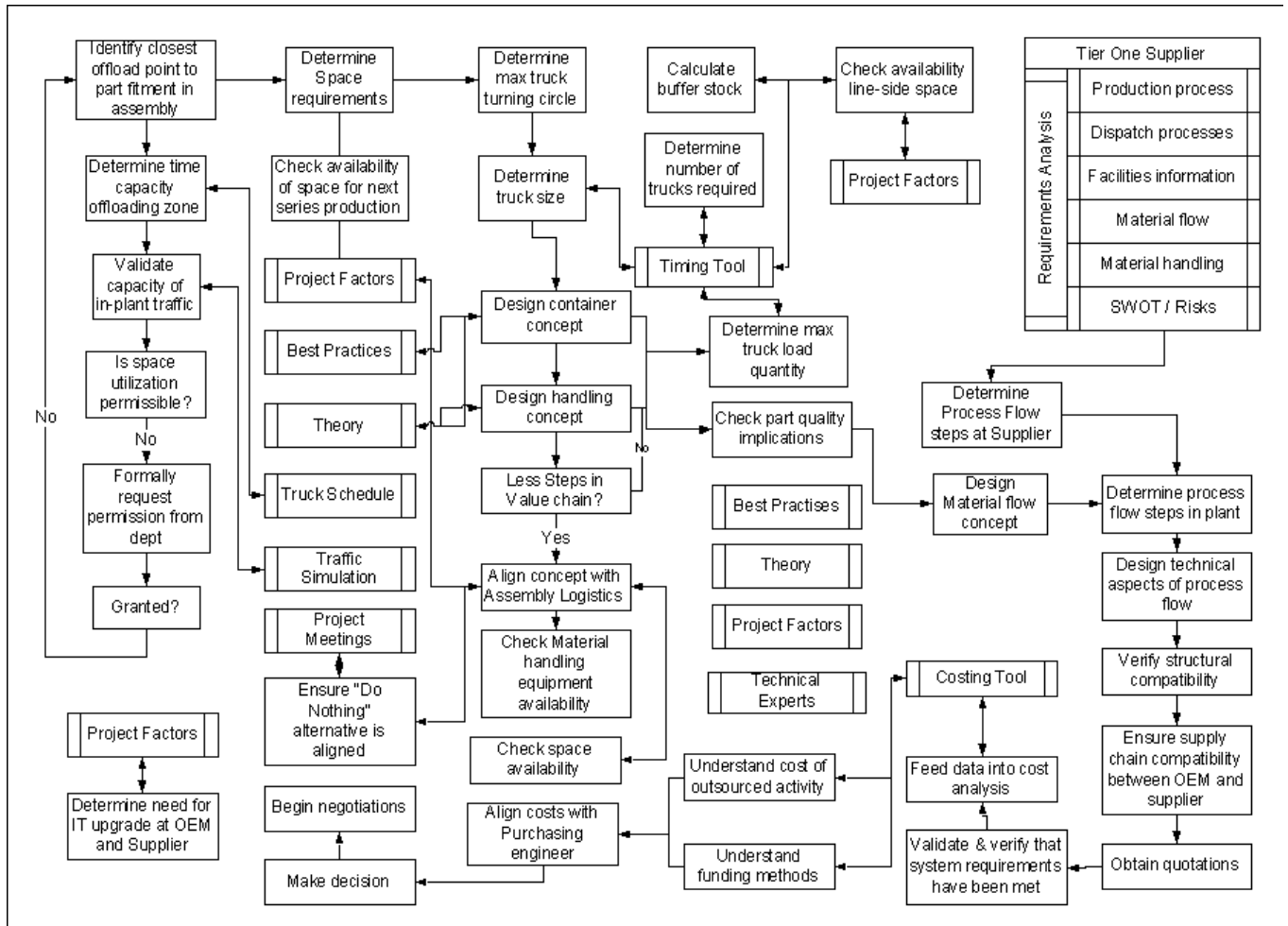
Keeping in mind that the aim of the project in this instance is to transform a JIT supply method to a JIS one, the basic principles of streamlining the supply chain is the underlying philosophy of this method. Its flow is cross-functional and incorporates all aspects with regards to the project status, supplier influences, arising constraints, etc. it is an iterative approach but aims to cover each supply chain aspect in detail.

Starting at the offloading point of the part to the OEM, the investigation of each activity of supply chain logistics – container loading, truck configuration, buffer times, pipeline inventory, in-plant traffic, structural aspect – are all carried out with the purpose of achieving total system optimisation.

Figure 8.12-1: Supply Planning Execution Methodology

shows the flow of events that should take place when carrying out this phase. The various input processes shown in black blocks will be discussed briefly in the following paragraphs.

Figure 8.12-1: Supply Planning Execution Methodology



### 8.12.1 Timing Tool

This basic tool was developed to calculate timing issues such as:

- Buffer time required at line side
- Truck turnaround time
- Emergency action plans based on this information
- Number of truck required in the system

The tool is excel based and requires the user to input the relevant times into the provided cells – from the truck loading at the supplier to the offloading of the part at the fitment point at the OEM. It then calculates the number of trucks that will be required in the system as well as the amount of buffer in plant to balance the supply time with the consumption time of the truck load.

### 8.12.2 External Project factors

In a large project such as a new series vehicle introduction, the status of the project changes on a regular basis. For South Africa, it is especially important to constantly monitor that status of the planning premises upon which the supply methods are based. The parent companies of the SA OEM's dictate this status and so the channels of communication should be clear and monitored carefully. An external constraint that may arise from the vehicle project could make the entire investigation null and void. Project factors are one the main reasons for going through an iterative process of generating alternatives. A single concept can be altered more than a dozen times.

For this Supply Planning Methodology, project factors include the following:

- Project status
  - Timing plans
- OEM plant
  - In-plant restructuring – its effects on investigation
  - In-plant traffic status – alignment of new delivery concept
  - Facility/ structural changes – interference/ opportunity for new supply method
- Product status
  - Number of variants – increase or decrease will affect supply method
  - Container design – its affect on loading quantity, truck configuration, handling equipment, etc
  - Part sensitivity –requirements for special packaging; affects on transportation to the line; operator clothing requirements, etc
  - Part measurements – its effect on container sizes, line side space requirements, etc.

- External factors
  - Other supplier developments – a possibility of a different supplier for future series production may discourage the erection of fixtures in the current supplier's premises
  - Currency fluctuations – may reduce or increase volumes for the plant which will influence planning premises
  - Government taxation – influence on part localisation, etc
  - Product theft – could change supply concept in order to prevent proliferation
  - Environmental issues – disposable packaging restrictions, etc
  - Cost parity policies – may prevent the option of requesting an on-cost from the supplier to perform an additional task for the sake of a new supply method.

### 8.13 Project meetings

Although this may seem like a normal part of running a project, the supply planner has the responsibility to *integrate* the project activities and it is through regular, formal meetings that this will be achieved. The Supply Planner must formulate an Integrated Project Team (IPT) as shown in the appendices. Gathering each and every IPT member for each and every meeting is not an easy task. Surrender to the fact that some members will rarely attend and that is it up to the Supply Planner to somehow ensure that all matters are aligned and formally passed through the acceptance of minutes. The importance of minutes is generally overlooked, however, it's the only way to formally progress through the project and gain more co-operation from team members. It also ensures that verbal statements are written down and changes can then only be made through formal channels.

One of the lessons learned from the industry case study that was conducted at BMW South Africa, was the fact that the "Do Nothing" alternative was not stressed enough. Because the investigation was a lengthy one, some team members assumed the status would automatically change to the proposed alternatives. This created many problems when the status eventually did not change and the "Do Nothing" alternative was requested to prevail. Due to the misconception of the project status, the "Do Nothing" alternative was not feasible anymore and another alternative had to be generated. It therefore can not be stressed enough, that the Supply Planner, although responsible for winning each members support, should re-iterate that the investigation is just that and not a status change until formally decided upon.

### 8.14 Costing tool

A costing tool was developed during the investigation performed at BMW South Africa. A detailed costing framework was non-existent and therefore had to be developed from scratch. From personal experience, it is vital that before such a costing analysis is done, the Supply Planner must know the company procedures with regards to accounting practices, costing formulae,

templates, acceptable rates of return, etc. If these procedures and processes are not adhered to, the decision making process will be stalled or aborted.

The framework for this costing tool begins with the calculation of standard space, material handling and cost factor calculations. These will serve as the input to the comparison of the various alternatives. For each alternative, a number of calculations must be made – depreciation of assets, initial investment costs, container costs, handling costs per alternative, etc – these all must be calculated in accordance with GAAP (General Accepted Accounting Practise). For each alternative, the ROI's (Return on Investment) must be calculated and graphed. The "Alternative 0: Do Nothing" must be used as the comparison basis. The alternative with the highest ROI will be the most favourable.

### 8.15 Determine Best Practises

This activity should become an inherent part of Supply Planning. It is during the initial planning phase of a vehicle project that the team? is most innovative. Once the project has progressed beyond the initial phase into the growth phase, it becomes more difficult to introduce new concepts and make changes to the planning status. The Supply Planner must take advantage of this situation and research supply chain processes that are similar to the one at hand.

When embarking on a benchmarking activity, it is best to obtain documentation of this process as well as visual aids in the form of videos and or photo clips (if the activity is not easily accessible). If possible, it would be extremely beneficial to talk to the technical expert who developed the process. Although this is not always possible, some form of intellectual should be available for perusal. Find out all the pitfalls, teething problems and technical difficulties that were encountered when implementing such a system. Other issues such as unanticipated bottlenecks, production problems, and worker's viewpoints should also be investigated to ensure that the Supply Planner is fully aware of how the system will function.

Understanding the specific environment and identifying the differences between the standard and the current situation will enable the Supply Planner to adapt the relevant processes to fit in with the specific constraints and conditions in the South African environment.

There are several types of benchmarking – process, functional, internal, external and international. It must be noted that the activity that is benchmarked in South Africa will be unique to one that is operational elsewhere in the world. Cognisance must be taken hereof when adapting the benchmarked activity to South African conditions. These conditions, as highlighted in Chapter Six, include but are not limited to the following:

- Transport: South African suppliers use one of three transportation methods – air, road and sea – the two latter being the most common. A large number of parts are imported and

therefore have long lead times, which creates more pipeline inventory and increases risk. Other issues such as truck accidents, highjackings, heists, etc must be considered when developing the supply chain. If the supplier is located some distance away, an emergency concept for air freighting parts in has to be in place so that the assembly line does not stop. European transport systems are far more reliable and accessible. Most of the suppliers are located in-land and therefore the shipping or air freighting of parts is a rare occurrence.

- Volumes: South African volumes are nowhere near as high as those in Europe, the Far East and the Americas. This aspect has a huge impact on the feasibility of investment in machinery, equipment and automation. If the benchmarked process abroad is automated and was a cost-reduction exercise, it may not mean that the same automated system will prove feasible under South African conditions with lower volumes. The Supply Planner may have to adapt the process to become a labour-intensive operation but just as efficient with less investment.
- Tier-one Supplier: the classification of a Tier-one supplier in South Africa is extremely different than that abroad. The expertise, technological know-how, level of mechanisation and operator qualification levels are more inferior to our counterparts. These aspects must not be overlooked when developing the supply chain between the OEM and the tier-one. A developmental exercise of this nature in South Africa would require considerably more support and expertise from the OEM's than those in first-world countries.
- Production Processes: processes at the supplier and OEM will have a large impact on the adaptation of the benchmarked process. If the supplier has any internal constraints that restrict them from producing parts in a certain manner (in sequence for instance), then the supply method between them and the OEM will have to accommodate it. Again, the importance of TOTAL system optimisation can not be stressed enough.
- Packaging: there are many aspects to consider when designing the packaging for a part family. Part dimensions, sensitivity, transport method, travel distance and supply method (be it JIT, JIS, bulk, etc), all play a part in the design of the containers. South Africa has a different set of conditions as opposed to Europe and other countries abroad. Issues such as highjackings, substandard roads and truck height restrictions must be taken into consideration when planning the packaging concept.

Other aspects to consider include the following:

- IT processes at the supplier and its compatibility to the OEM systems
- Part quality issues – what are the causes and plan the prevention thereof
- The potential theft of parts may influence the type of supply, transport and container concepts



- Handling of the part must be brought to a minimum – the value chain analysis will expose any non-value adding activities that can be eliminated.

The supply concept can now be designed whilst considering the above and all other factors shown in the “Execution Method”.

## 8.16 Implementation of Researched Trends

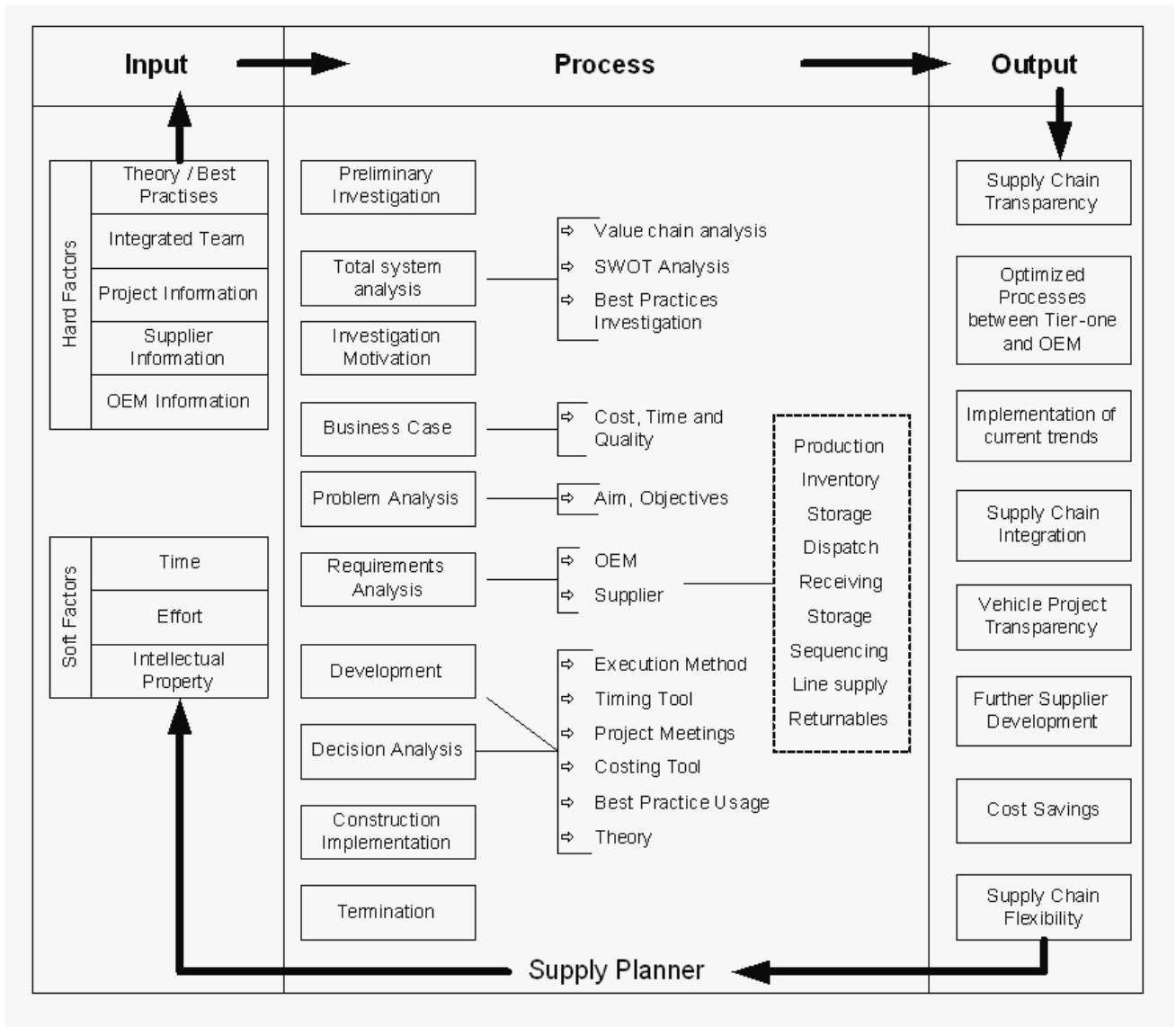
This section attempts to outline a method of incorporating current trends into the design of the new supply concept. Based on the research of current automotive supply chain trends, the Supply Planner should investigate the feasibility of implementing such processes. The underlying philosophy here is to uplift the Automotive Industry to world-class standards, and by implementing processes that are up to date and of leading standards world-wide, the South African industry can take a closer step to becoming more globally competitive.

The flow diagram shown in the appendices shows how current trends, such as “Outsourcing”, can be used to develop the supply chain, given that certain assumptions exist for this methodology. In reference to Timothy Baker [23], a number of aspects need to be considered when outsourcing an activity to a third party. A basic flow diagram was formulated to illustrate the steps that should be followed when embarking on such an investigation.

## 8.17 Conclusion

The Supply Planning Methodology detailed in this chapter attempts to demonstrate the way in which the planner should carry out his/her role of developing the Supply Chain in the Automotive Industry. It assumes that the role and function of the Supply Planner is understood and is based on certain assumptions regarding the project that is undertaken. The approach shows how all the theoretical aspects that need to be considered are interlinked and what their impact will be on one another if changed. Both soft and hard factors of a vehicle supply chain project are considered – its importance could not be overlooked. The figure below gives an overall summary of the Supply Planning Methodology.

Figure 8.17-1: Summary of Supply Planning Methodology



The last step in the process of formulating a new methodology is to verify that it works under the specified premises outlined in this dissertation. The last chapter is dedicated to this activity. Because an industry case study has already been executed, a comparison between the way in which the project was carried out and the way that the project could have been executed according to this methodology will be done.

## Chapter Nine

### **SUPPLY PLANNING FRAMEWORK VERIFICATION**

## 9.1 Introduction

For a methodology to be of any worth, it must be shown to work in the proposed environment. This chapter takes a look at how the framework could have been beneficial to the industry case study that was explained in Chapter Five and Six. The chapter is structured according to the flow of the Supply Planning Methodology as explained in Chapter Eight. Each lesson learned from the case study has been determined by comparing the actual work done with the proposed Supply Planning Methodology.

## 9.2 Framework Evaluation

In an attempt to validate the methodology that has been brought forward, the table below gives an overview of the lessons learned from the manner in which the industry case study was executed and the way in which the methodology proposes it should be executed. Only high-level issues are addressed for the sake of simplicity.

Table 9.2-1: Evaluation of the Supply Planning Method

Project Phase	Industry Case Study	Supply Planning Methodology	Lesson Learned
Preliminary investigation	An integrated project team was formed to ensure that all facets of the supply chain were accounted for before embarking on the relevant project. Some stakeholders were not properly identified and so were omitted from the initial project meetings	The method prompts the Supply Planner to identify ALL Stakeholders that are directly and indirectly involved in the project. Each member should be invited to meetings and should receive minutes accordingly.	Stakeholder identification – some players were not identified from the start of the investigation and only once the project was under way did they come forward with new information that changed the entire status of the project
Total System Analysis	SWOT – a weakness and threat to the Supply Chain was quality related. This was discovered through hear-say and not formally conducted. It therefore was depicted as the main reason for the investigation because of the criticalness of the part	The method states that a SWOT analysis be done on the supply Chain between the Tier one and OEM. Any findings should be from a reliable source that is formally presented.	The information regarding the quality problems were found to be inaccurate and if this was known at this stage of the project, the investigation would have taken on a new direction. Although not the only reason for the investigation, it played a large part in the formation of the business case and motivation.

Business Case	<p>Cost – at first, the costs were calculated in an informal manner. As amounts and quantities were obtained, the analysis was updated accordingly. At the time that the decision had to be made, a revision of the costs according to the OEM costing standards had to be done.</p> <p>Quality – incorrect information with regards to quality problems regarding the part family was the basis for the project's motivation. It was later discovered that the quality problems were minimal and not a sound reason for the investigation to take place. Because the business case was not formally brought forward to the relevant stakeholders in the early stages of the projects life, the investigation continued irrespectively.</p>	The Methodology gives an overview of the way in which the business case should be approached with regards to cost, time and quality. Shareholder interests are extremely important for a project's motivation.	<p>Cost - logistics costs for the plant were unclear and the initial cost analysis was rendered null and void due to incorrect figures, premises and standard costing procedures.</p> <p><b>According to the methodology, the project would have been terminated here. This would have prevented any further misconceptions</b></p>
Project Phase	Industry Case Study	Supply Planning Methodology	Lesson Learned
Problem Analysis	Project aim: this aspect shown in the method was not executed properly for this case study. This could have been another point where the quality aspects of the project could have been highlighted through the determination of quantitative objectives.	The Method states that all project aims should be written down and translated into quantitative objectives that are measurable. Only then can a clear aim be followed throughout the project's life.	Through the translation of requirements into quantitative objectives, a greater understanding of the project's intentions are made so that the focus is not lost

<p>Requirements Analysis</p>	<p>Requirements Analysis: the assessment of the supplier was conducted as per the lessons learned from Timothy Baker and proved to be a beneficial exercise for both the supplier and the OEM. A better understanding of what risks the supplier had, has and potentially would have under certain conditions was gained. This exercise also helped determine the supplier's level of capability. If the supplier was incapable of the requirements put forward by the OEM, the project may have been terminated immediately and an alternative investigated. A supplier assessment summary was adapted from the BMW Group method. A traffic light colour (red, yellow, green) is assigned to each criteria put forward; the colour represents the status of the planning of the specific criteria – in brief, the colour red represents critical issues, yellow is indicative of potential problems that currently exist but are in the process of being solved, and green means that there are no problems that are foreseen.</p>	<p>The analysis depicted in the methodology is similar to what was executed in the industry case study. It proved to be successful and therefore served as the input for the Supply Planning Methodology</p>	<p>The traffic light assessment creates a visual depiction of the risks that are at large and help to make decisions regarding the progression of the project. In respect of the industry case study, the assessment proved that the supplier had the necessary capabilities for the realisation of the JIS supply method.</p>
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Project Phase	Industry Case Study	Supply Planning Methodology	Lesson Learned
<p>Development and Decision Analysis</p>	<p>Execution Method: Space utilization was not formally granted, but continued on project. The status of the offloading zone was therefore changed without the necessary permission for the space to be utilized.</p>	<p>Formal requests and written permission should always be obtained before continuing on the project in that regard.</p>	<p>If formal permission was obtained, new developments from other parties would have been unable to materialise. This happened during the investigation and setback the progress considerably.</p>

	<p>Maximum truck size and turning circle was established after the first draft of alternative one. It was then later discovered that the appropriate truck size could accommodate less than the planned number of containers – the buffer time, loading quantities, consumption time, etc were all affected as a result of this aspect being overlooked</p>	<p>Determine max truck turning circle, then truck size – the buffer time, number of trucks, etc can then be determined.</p>	<p>Many meetings, time, confusion and effort could have been avoided if the sequence of events were done according to the Supply Planning Methodology.</p>
	<p>Design of technical aspects with regards to the process flow was done in isolation to the visuals and technical expert of the benchmarked activity.</p>	<p>Process at Supplier and OEM must be simultaneously designed in conjunction with Technical Experts and visual aids (photos, drawings, videos).</p>	<p>Some technical aspects that were overlooked proved to be critical to the system's success. These were only known by the key players who installed the benchmarked system at Regensburg. Some issues are not recorded and therefore are not known to the new planners</p>
	<p>Timing Tool: Buffers were calculated per part family in an ad hoc manner. This created some confusion when methods were compared amongst fellow supply planners – a standard process was required and so with the aid of historical information, a new simple tool was developed.</p>	<p>Timing Tool: the output of the timing tool serves as input for determination of number of trucks in system, buffer space required, truck size + load quantity, as well as buffer stock requirements.</p>	<p>Without a standard tool for calculating timing plans, misunderstandings, inaccuracies and inefficiencies will occur.</p>
	<p>Project Factors: a number of OEM Plant, External Factors and Product status changes within the vehicle project resulted in wasted time as a result of planning based on incorrect premises. The information was not captured in a timely manner.</p>	<p>The Methodology states that the relevant "Project Factors" should be monitored on a constant basis so that any changes thereof are known on a real time basis.</p>	<p>Although difficult to execute in every day business, constant monitoring will ensure that time spent on planning is not wasted on obsolete information.</p>



	<p>Project Meetings: These were conducted on a weekly as well as ad hoc basis in accordance with project status changes. All team members were invited; however, not all attended the meetings. Minutes were not always distributed which resulted in a number of problems – some team members that did not attend the meetings and therefore not informed of the proceedings, revealed new information that nullified the initial planning premises.</p>	<p>According to the methodology, FORMAL meetings should be set up on a regular basis and minutes distributed as soon as possible to ALL team members. If there are no queries, then the decisions made in the meetings stand and any changes will have to be formally requested.</p>	<p>This method eliminates the risk of team members changing planning premises in an untimely manner, resulting in inefficiencies and late planning milestones.</p>
	<p>Costing Tool: The initial cost analysis was not conducted according to a specific standard for the OEM. This was due to the fact that no formal procedures were in place and certain logistical costs had as yet never been calculated. The analysis was therefore based on certain premises and when the actual costs were made available, the initial calculations were invalid.</p> <p>Best Practises: The process that was followed in the case study was based on the theoretical research that was conducted beforehand. The specific activity undertaken, Benchmarking, was done according to the principles studied. Some difficulties were experienced in obtaining expert knowledge and visual aids of the benchmarked activity due to geographical problems.</p>	<p>The methodology states that all company accounting principles be understood and used in the cost analysis. Issues such as ROI, depreciation, inventory carrying costs, etc must be calculated according to the OEM standards so that uniformity is not lost and all parties (parent company included) have a common understanding</p> <p>The methodology's framework provides some guidance as to how to use current best practises (global) and adapt it to fit with South African conditions. It focuses on Benchmarking as the current best practise for investigating the improvement of the supply chain processes.</p>	<p>If there are standards for cost calculations already in place, then it is not necessary to re-invent the wheel and work in isolation as was initially done with the case study. However, through the experience gained, the proposed sequence shown in the methodology proves to be the most efficient and effective.</p> <p>The process followed in the case study was mainly based on the approaches previously studied and therefore served as most of the input for the Methodology Framework.</p>

### 9.3 Conclusion

The Supply Planning Methodology was formulated under specific assumptions / conditions associated with a typical vehicle project in South Africa. Its value for the Supply Planner can be seen by comparing the inefficiencies of planning in an ad hoc manner as was done in the industry case study with the structured approach of the proposed Methodology. Not only is there a significant improvement in time management, but the value of the solutions generated is of a higher calibre due to the incorporation of best practises. The sequenced activities in the flow of the methodology prompts the user to consider all aspects relevant to the project and refrain from isolating supply chain issues from one another. This prevents the possibility of sub-optimisation.

On the other hand, there are limitations associated with this methodology. Owing to the ever-changing, complex nature of a automotive supply planning project, the methodology may not have captured all aspects that need to be considered in a particular situation. It also is based on an industry case study at BMW South Africa and although generic, some business aspects that may be applicable to another OEM may not have been taken into account. The true value of the methodology can only be realised if the user (Supply Planner) reflects on to all the aspects highlighted therein.

## Chapter Ten

### **CONCLUSION**

From a holistic point of view, Supply Chain Integration should be one of the main objectives to improve competitiveness. Its underlying philosophies embrace all aspects of reducing costs, improving effectiveness and efficiencies and thereby sustaining competitiveness. For each type of organisation, there exists a different set of methods and / or techniques that aid in reaching these objectives – many of which are encompassed in generic “Lean Manufacturing” and Supply Chain Management principles.

From an Automotive Industry perspective, Supply Chain Management plays a fundamental role in streamlining the processes amongst all supply chain members – from the lowest tier, through to the OEM and finally the customer. Vehicle Supply Chain planning is a complex exercise. It is also the potential catalyst for Supply Integration, in a sense that the Supply Planner must interact with all spheres of the organisation – both suppliers and the OEMs. A large window of opportunity for significant cost reductions and Supply chain integration/improvement lies within the role of the Supply Planner. The aim of this dissertation was to explore this role through a detailed case study, a review of European methods and to formulate an adapted method for Supply Planning in the South African Automotive industry.

Prior to this exploration, extensive research was carried out in the fields of Logistics, Supply Chain Management and specifically the developments in the Automotive industry (both global and local). Some of the findings from the local research, revealed that the South African Automotive Industry, a significant contributor to the GDP, is under pressure to compete ‘fairly’ amongst its global competitors. The Motor Industry Development Programme that supports the export of vehicles, is due to terminate its programme in the year 2012. This in turn creates an urgency for the Automotive Industry to uplift its level of competitiveness and develop its Supply Chain Networks across the world.

The global trends, techniques and methods that were discovered throughout the research phase, uncovered far-reaching potential solutions and approaches for developing and integrating the Supply Chain. Using a particular Method for Supply Planning in the European Automotive Industry as the departure point, an investigation into its relevance for South African conditions was carried out. It became apparent that the role of the Supply Planner in Europe, is far more developed than in South Africa, where supply planning is often not as formalized or as well recognized as in Europe. However, after combining the principles and trends of Supply Chain Management with the European Supply Planning Method, it became apparent that this role has the potential to be the “enabler” of Supply Chain integration in the Automotive Industry.

Corporate success will increasingly be dictated by how well a company can control its supply base, create continuous performance improvement and identify and mitigate supply bottlenecks and liabilities [29]. New trends in the automotive industry are placing some extreme new requirements on supply chains. These include JIT or JIS where possible, integration of suppliers and controlled material supply in a short time with low inventories, while maintaining high delivery flexibility. As an active supply chain designer during the product/production development process, Supply Planners can effectively address these requirements and ensure integration of suppliers and safeguarding critical supply chains [30].

The next step was to embark on an industry case study in South Africa and “live” the role of the Supply Planner. By applying certain “Lean Manufacturing” and Supply Chain Management principles to a specific project, a new understanding of all these aspects could be found. BMW South Africa offered a unique opportunity for Supply Chain improvement. A pilot project for the transformation of a current Just-in-Time supplier to Just-In-Sequence supply was investigated. This project involved all aspects of Supply Chain analysis and application of Lean Manufacturing principles to aid in reducing costs and improving logistical processes.

It became clear that the role and functions described in the European Method are relevant to the South African environment. However, having been part of a large South African based vehicle project, yet with close contact with European partners, a number of differences in planning premises and scope needed to be addressed and adapted. A significant limitation in the Method was discovered in that it only described the “What” of Supply Planning and not the “How”. This was one of the major difficulties that was experienced by all the Supply Planners at BMW. It was this realization that brought on the need for an adapted Supply Planning Method with a more practical approach.

A generic approach to the development of a Supply Planning Method for the Automotive Industry in SA had to be adopted. The focus of the method was not on the detail of the industry case study, but rather on the processes, functions, methods and tools that Supply Planners should use when embarking on investigative projects.

The underlying philosophy behind this Method of Supply Planning, is the need for Supply Planners to research current trends on a global and national scale, adapt (innovate) them to South African conditions and implement them into supply chain processes. If this task is carried out for each project undertaken, up-to-date knowledge is guaranteed to be translated into the South African automotive industry.

The Supply Planning Framework was formulated under specific conditions and assumptions associated with a typical vehicle project in South Africa. Its value for the Supply Planner is illustrated by comparing the inefficiencies of planning in an ad hoc manner, as was done in an industry case study, with the structured approach of the proposed framework. Not only is there a significant improvement in time management, but also the value of the solutions generated is of a higher calibre due to the incorporation of best practises. The flow of the methodology prompts the user to consider all aspects relevant to the project and refrain from isolating supply chain issues from one another. This prevents the possibility of sub-optimisation.

On the other hand, there are limitations associated with this methodology. Owing to the ever-changing, complex nature of an automotive supply planning project, the methodology may not have captured all aspects that need to be considered in a particular situation. It is based on an industry case study at BMW South Africa and, although generic, some business aspects that may be applicable to another OEM may not have been taken into account. The true value of the methodology can only be realised if the user (Supply Planner) reflects on all the aspects incorporated.

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## Glossary of Terms

Call-off	Trigger for Delivery from Supplier
F1	Status point in Assembly
F2	Status point for end of Assembly
JIS	Just in Sequence Supply
JIT	Just in Time Supply
KOVP	Kundenorientierter Vertiebs- und Produktionsprozess / Customer Orientated Production and Supply Process
Mutually Exclusive	At most one project out of the group can be chosen
Independent	the choice of a project is conditional on the choice of one or more other projects
Contingent	The choice of a project is conditional on the choice of one or more other projects

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**Appendix A: Project Inputs, Activities and Outputs**

Phases	Inputs	Activities	Outputs
<b>Preliminary investigation</b>	Information obtained from: <ul style="list-style-type: none"> <li>▪ articles</li> <li>▪ books</li> <li>▪ conference material</li> <li>▪ logistic magazines</li> <li>▪ journals</li> </ul>	Research of up-to-date logistical concepts and Best Practises <ul style="list-style-type: none"> <li>▪ JIT (Just-in-time) and JIS (Just-in-sequence) concepts</li> <li>▪ National and international perspectives on supply chain management</li> </ul>	<u>Documentation:</u> <ul style="list-style-type: none"> <li>▪ citations from sources with personal interpretation thereof</li> </ul>
	Internal BMW information resources: <ul style="list-style-type: none"> <li>▪ Intranet</li> <li>▪ Internal documentation</li> </ul>	BMW philosophies relevant to research: <ul style="list-style-type: none"> <li>▪ KOVP (new 10 day car concept)</li> <li>▪ Supply planning roles</li> <li>▪ Current methods of supply to BMW SA and BMW Germany</li> </ul>	<u>Documentation:</u> <ul style="list-style-type: none"> <li>▪ presentations and official documentation (confidential information)</li> </ul>
<b>Problem Analysis</b>	Research findings <ul style="list-style-type: none"> <li>▪ Data capturing at BMW and suppliers</li> <li>▪ Supply chain analysis</li> <li>▪ Logistic function analysis</li> <li>▪ Further information gathering from all relevant team members to ascertain all associated problems and/or opportunities</li> </ul>	<ul style="list-style-type: none"> <li>▪ Data capturing and information gathering through meetings and documentation perusal</li> <li>▪ Interviews with relevant team members to determine potential problem</li> <li>▪ SWOT analysis</li> <li>▪ Impact on supply chain</li> <li>▪ Constraint identification throughout supply chain (Tier one to OEM)</li> </ul>	<u>Documentation:</u> <ul style="list-style-type: none"> <li>▪ current status defined</li> <li>▪ Minutes of meetings</li> <li>▪ Problem determination and focus areas for improvement</li> </ul>

*Appendices*

<p><b>Requirements analysis</b></p>	<p>Findings of research:</p> <ul style="list-style-type: none"> <li>▪ Current trends</li> <li>▪ Potential solutions</li> <li>▪ Supplier needs and constraints</li> </ul>	<ul style="list-style-type: none"> <li>▪ Identification of needs and opportunities for improvement with reference to the supply chain</li> <li>▪ Feasibility study for improvement opportunities (in terms of Supply chain improvement)</li> <li>▪ Current system assessment</li> </ul>	<p><u>Documentation:</u></p> <ul style="list-style-type: none"> <li>▪ Rough supply concept</li> <li>▪ Short supply concept</li> <li>▪ Constraints</li> <li>▪ Supply chain activities for current processes</li> <li>▪ Brief overview of current process at Supplier</li> </ul>
<p><b>Development</b></p>	<p>Tools to be utilized:</p> <p>Microsoft Powerpoint, Excel, Word, Visio, Project, Email, BMW intranet, Fraunhofer Intellectual Property and Internet</p>	<p>Vehicle for visual interpretation and understanding amongst all team members</p>	<p><u>Presentations:</u></p> <p>Weekly project and E90 supply planning meetings</p>
	<p>Resources required:</p> <p>Departments:</p> <ul style="list-style-type: none"> <li>▪ Assembly logistics</li> <li>▪ Product and process quality</li> <li>▪ Supplier quality control</li> <li>▪ Materials planning</li> <li>▪ Process IT</li> <li>▪ Procurement</li> <li>▪ Supply logistics</li> <li>▪ Process planning</li> <li>▪ Packaging</li> <li>▪ Traffic (internal to plant)</li> <li>▪ Transport (external)</li> <li>▪ Facilities Planning</li> <li>▪ Body shop</li> <li>▪ Supplier</li> </ul>	<ul style="list-style-type: none"> <li>▪ Consolidation of all relevant constraints, conditions, opportunities, threats, processes and procedures</li> </ul> <p>Use of research findings to determine possible solutions:</p> <ul style="list-style-type: none"> <li>▪ Benchmarking of possible solutions based on best practice in similar environment</li> <li>▪ Outsourcing considerations based on experienced findings from other sources</li> <li>▪ Domino effect on OEM and suppliers (own interpretation of top-down approach to supply chain in the automotive industry)</li> </ul>	<p><u>Documentation and visual aids</u></p> <p>Information and video clips on process being benchmarked in Germany</p>

*Appendices*

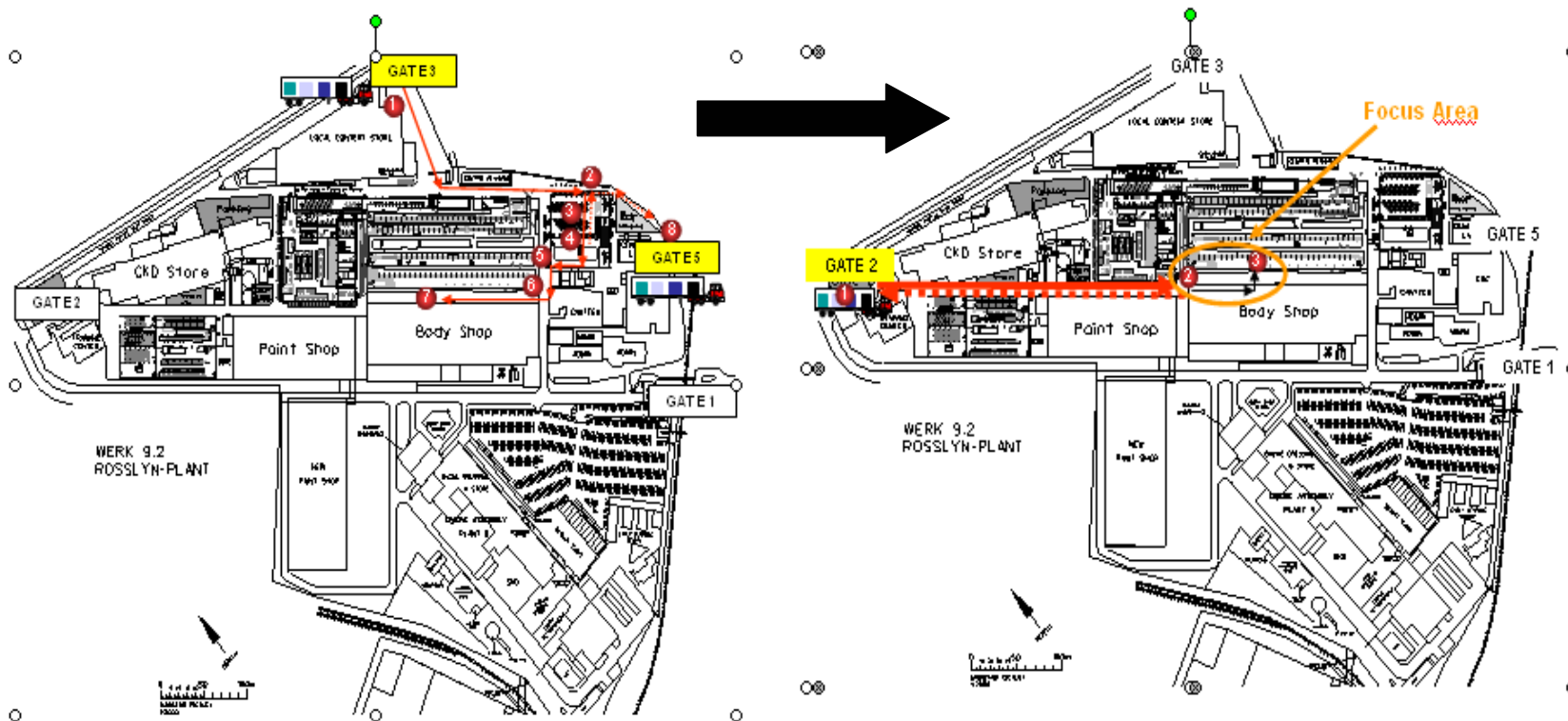
	Supply planning methodology from Germany (Fraunhofer Instituut / EBP consulting)	<ul style="list-style-type: none"> <li>▪ Use of “supply planning methodology” from Germany to serve as framework for personal role playing</li> <li>▪ Adaptation of method to SA conditions based on lessons learned</li> </ul>	<p><u>Documentation:</u></p> <p>Adaptation of framework for SA conditions – intended to serve as future guideline for future such transformations in our automotive industry</p>
	Information and data from above resources	<p>Generate alternatives for Just-in-sequence supply. This will encompass the following:</p> <ul style="list-style-type: none"> <li>▪ The supply chain between the tier one supplier and BMW</li> <li>▪ All BMW logistical activities: <ul style="list-style-type: none"> <li>○ Transport</li> <li>○ Containers/ packaging</li> <li>○ Process planning</li> <li>○ Buffer stock</li> <li>○ Assembly logistics</li> <li>○ Traffic scheduling</li> </ul> </li> <li>▪ The supplier’s process bottlenecks, dispatch configuration and FIFO principles</li> <li>▪ LSP (Logistic service provider) quotations for outsourcing of sequencing activity</li> <li>▪ Various quotations obtained from infrastructure company for proposed system requirements and specifications</li> </ul>	<p>Iterative documentation and presentation for validation and verification of alternatives amongst all team members involved. These alternatives will involve the following:</p> <ul style="list-style-type: none"> <li>▪ The changes in logistical processes within BMW</li> <li>▪ Effects on each activity within BMW</li> <li>▪ Effects of alternatives on tier one supplier in terms of their processes and constraints</li> <li>▪ The associated costs involved for both parties: holistic approach for supply chain costing</li> <li>▪ Logistical requirements required at the supplier for a transformation to a JIS supply</li> </ul>
<b>Decision analysis</b>	<ul style="list-style-type: none"> <li>▪ Current costs from all relevant departments associated with supply of part to the assembly line</li> <li>▪ German-based templates used for cost analyses and decision making</li> <li>▪ Engineering economy formulae</li> </ul>	<p>Thorough cost analysis of all alternatives in comparison to current situation:</p> <ul style="list-style-type: none"> <li>▪ Detailed and summarized costs for investment and running costs over the life of the new E90 BMW</li> <li>▪ ROI and comparison of alternatives based on costs calculated in accordance with engineering economy laws</li> </ul>	<p>Excel-based calculation worksheets to illustrate differential costs amongst alternatives</p>

*Appendices*

	External forces from Germany (BMW AG) and other negotiations outside the scope of this investigation at BMW SA	<p><u>Make-or-buy decision</u>: based on cost parity of piece price of supplier; investment costs at BMW and at Supplier and how the balance of responsibility will lie (Procurement negotiations)</p> <p>Flexibility for future series production as well as constraints associated with fixtures at BMW and at the supplier can influence decision making process</p>	<ul style="list-style-type: none"> <li>▪ Official documentation for negotiations</li> <li>▪ Presentation of concepts and cost justification to higher level circles in the BMW Group</li> </ul>
<b>Construction &amp; implementation</b>	Compatible specification from reliable contractor based on BMW and supplier requirements submitted	<ul style="list-style-type: none"> <li>▪ Pilot Prototype production of selected candidate</li> <li>▪ Implementation of new supply method using samples of stillages and infrastructure required</li> <li>▪ Sorting out of teething problems discovered during this initial prototype stage</li> </ul>	<p><u>Documentation</u></p> <p>High level procedural requirements and steps for implementation based on BMW timing plans for the series launch in 2005</p>
<b>Conclusion</b>		Lessons learned	Proposed guideline/ framework for development of future supplier candidates in the automotive industry



### Appendix B-1: Current versus Proposed New Offloading Route in-plant





### Appendix C-1: Standard Costs

#### Cost Factors

Calculation of cost factors for Bottom-Up-Approach

Calculation cost factors of MHE (data from 2002)

Item	fork truck	reach truck	tow motor
amount in all plant 9	60	37	13
Service total	714 167	358 813	126 440
Wear and tear total	859 146	129 674	129 674
Drivers error total	52 094	12 212	23 035
Fuel per unit	13 000	5 000	13 000
<b>average running cost per year</b>	<b>40 090</b>	<b>19 414</b>	<b>34 473</b>
Days of usage per year (2002)	239	239	239
Amount of lift/hour	2	2	2
Hours per shift	7.5	7.5	7.5
Number of running cost per person 4 (100% usage)	0.00311	0.00050	0.00212

Calculation of headcost cost factors (data from 2003)

Headcost of all hourly paid persons, including all costs, without overtime	104 345
Headcost of all hourly paid persons, including overtime and overtime	104 709
Working days per year (2003)	273
Hours per shift	7.5
<b>average personnel cost without overtime (100% productivity)</b>	<b>0.41621</b>

Calculation of area cost factor (2002, T-130)

All Area cost T-130 per year incl. cost accounting depreciation T-130 2002	5 391 880
Remaining area cost T-130 2002	3 254 680
Utilities	1125 900
Energy	1400 000
Water	43 340
Gas	169 040
Maintenance	55 500
462001 Buildings Maintenance	19 000
462002 Maintenance Electric	102 240
462025 Maintenance	237 260
Depreciation	2 027 340
Cost accounting	2 122 320
Sum of material T-130	2 122 320
Remaining area cost per square meter in T-130 per year incl.	352.2
Remaining area cost per square meter in T-130 per year	192.2

#### MHE Cost Calculation

MHE cost calculation

Calculation running cost of MHE

Item	fork truck	reach truck	tow motor	Cost center
amount in all plant 9	60	37	13	
Service total	714 167	358 813	126 440	T-95
Wear and tear total	859 146	129 674	129 674	T-95
Drivers error total	52 094	12 212	23 035	T-95
Fuel per unit	13 000	5 000	13 000	T-130/T-2/T-4
<b>average running cost per year</b>	<b>40 090</b>	<b>19 414</b>	<b>34 473</b>	

Calculation of average depreciation, based on finance information

Item	fork lift	reach truck	tow motor
amount of equipment already depreciated	48	26	10
amount of equipment still in depreciation	12	11	3
initial cost	200 000	220 000	180 000
depreciation	40 000	44 000	22 500
<b>average annual depreciation over all machines</b>	<b>8 000</b>	<b>13 081</b>	<b>5 192</b>

#### Space Costs

All Cost - Top-Down Logistic Cost Calculation E-46

Cost type	Detailed Cost (ZAR)	Receiving	Unloading	Shaking	Picking/ Merchandise	Sequencing	Kitting	Line Supply Logistic	Return Box and waste removal	Other	Sum
<b>Personnel cost</b>											
Sum Personnel cost	3 412 054	3 412 054	3 205 241	5 264 822	2 221 145	0	0 323 405	353 224	1 764 441		<b>29 337 151</b>
MHE cost	24 51	24 51	24 51	45 51	20 01	0 01	0 01	0 01	15 01		<b>250 0</b>
Personnel cost without assets	3 151 758	3 095 745	2 991 516	4 164 141	1 994 924	0	0 005 395	332 224	1 649 334		<b>24 116 111</b>
<b>MHE cost</b>											
Sum MHE cost incl. Aff	414 441	251 441	196 011	1 775 516	612 321	0	1 077 762	303 224			<b>3 225 622</b>
Sum MHE cost excl. Aff	904 972	327 072	322 441	404 224	222 972	0	1 220 005	269 441			<b>3 451 119</b>
amount of fork lift	4	5	2	2	4	0	22	0			<b>47</b>
amount of tow motor	0	0	0	0	0	0	0	0			<b>0</b>
amount of reach truck	0	0	0	0	0	0	0	0			<b>0</b>
<b>Area cost</b>											
Sum Area cost	192 004	102 174	1 028 501	96 451	10 461	0	34 522				<b>2 332 652</b>
area cost	77 611	77 611	77 611	77 611	77 611	77 611	77 611	77 611	77 611		<b>28 349</b>
<b>Other</b>											
Sum other cost											<b>1 528 000</b>
Other cost											<b>15 254 276</b>
asset management											<b>3 214 424</b>
other cost (not allowed)											<b>12 040 144</b>
<b>Sum excl. Aff</b>	<b>4 049 561</b>	<b>3 257 829</b>	<b>4 647 371</b>	<b>5 241 581</b>	<b>2 417 543</b>	<b>0</b>	<b>10 759 194</b>	<b>657 193</b>	<b>1 764 618</b>		<b>49 552 100</b>
<b>Sum incl. Aff</b>	<b>4 435 835</b>	<b>3 437 672</b>	<b>4 754 739</b>	<b>5 319 749</b>	<b>2 444 962</b>	<b>0</b>	<b>10 974 237</b>	<b>712 776</b>	<b>1 764 618</b>		<b>51 818 151</b>
<b>Transport cost</b>											
Sum fact. transport cost											<b>492 949 000</b>
Sum fact. transport cost											<b>524 727 151</b>

## Appendix C-2: Detail Logistical Cost Analysis

File Edit View Insert Format Tools Data Window Help

Cost Comparison

K36 =K35-H35

Logistics Cost analysis		Description of Alternative 1: JIS 5000: Rail Forklift system		Description of Alternative 2: JIS 5000: Rail Forklift system		Description of Alternative 3: JIS 5000 Forklift system		Description of Alternative 4: LSP: MHC quotation	
		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		R per vehicle	R/Year	R per vehicle	R/Year	R per vehicle	R/Year	R per vehicle	R/Year
1	Plant Family	Floor Care		Elevators		Elevators		Elevators	
2	Model	3		responsible planner		V.Stok		V.Stok	
3	PPC			Zin					
4	Barcode	EII		Bevestigingsaanbieder					
5									
6									
7									
8									
9									
10									
11									
12	<b>Curtz</b>	<b>Responsite</b>							
13	Transporteelsupplie	Einkoop	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	Transporteelsupplie	Transporteelsupplie (TC-3a)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	Transporteelsupplie	Transporteelsupplie (TC-3a)	444 728.00	444 728.00	423 756.00	423 756.00	423 756.00	444 728.00	444 728.00
16	<b>Totaal Transporteelsupplie</b>		<b>0.00</b>	<b>444 728.00</b>	<b>0.00</b>	<b>423 756.00</b>	<b>423 756.00</b>	<b>0.00</b>	<b>444 728.00</b>
17	Handlingsupplie	Einkoop	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Handlingsupplie	Transporteelsupplie (TC-3a)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	Handlingsupplie	Verrekeningsoplossing (TC-2a, TC-2b, TC-2c) (Bekendings) (Handlingsupplie (TC-4))	244 032.20	35 032.20	1 004.50	1 004.50	1 004.50	38 554.41	38 554.41
20	Handlingsupplie		244 032.20	35 032.20	1 004.50	1 004.50	1 004.50	38 554.41	38 554.41
21	<b>Totaal Handlingsupplie (incl. Spansingsupplie)</b>		<b>0.00</b>	<b>3 034 467.32</b>	<b>0.00</b>	<b>4 200 504.64</b>	<b>0.00</b>	<b>1 250 506.30</b>	<b>0.00</b>
22	Spansingsupplie	Einkoop	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Spansingsupplie	Transporteelsupplie (TC-3a)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	Spansingsupplie	Handlingsupplie (TC-3a)	35 032.20	37 103.93	37 103.93	37 103.93	37 103.93	37 103.93	37 103.93
25	<b>Totaal Spansingsupplie</b>		<b>0.00</b>	<b>35 032.20</b>	<b>37 103.93</b>	<b>37 103.93</b>	<b>37 103.93</b>	<b>37 103.93</b>	<b>37 103.93</b>
26	Maintenance	Transporteelsupplie (TC-3a)	297 500.00	297 500.00	297 500.00	297 500.00	297 500.00	297 500.00	297 500.00
27	Maintenance	Handlingsupplie (TC-3a)	455 279.59	455 279.59	255 279.29	255 279.29	255 279.29	524 942.06	524 942.06
28	<b>Maintenance</b>		<b>0.00</b>	<b>752 779.59</b>	<b>552 779.29</b>	<b>552 779.29</b>	<b>552 779.29</b>	<b>822 442.06</b>	<b>822 442.06</b>
29	OPS	Transporteelsupplie (TC-3a)	485 524.00	485 524.00	53 200.00	53 200.00	26 500.00	180 524.00	180 524.00
30	<b>OPS</b>		<b>0.00</b>	<b>538 724.00</b>	<b>53 200.00</b>	<b>26 500.00</b>	<b>26 500.00</b>	<b>180 524.00</b>	<b>180 524.00</b>
31	<b>Additional costs (e.g. value proposition)</b>		<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
32	<b>Definition: Transporteelsupplie is Bevestigingsoplossing (incl. Spansingsupplie) (TC-2, TC-2a, TC-2b, TC-2c)</b>		<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
33	<b>Totaal sum of curtz</b>		<b>0.00</b>	<b>4 556 795.25</b>	<b>0.00</b>	<b>2 251 774.61</b>	<b>0.00</b>	<b>2 457 171.77</b>	<b>0.00</b>
34	<b>Differential curtz (for favorable solution)</b>		<b>0.00</b>	<b>2 305 020.64</b>	<b>0.00</b>	<b>-2 305 020.64</b>	<b>0.00</b>	<b>205 397.16</b>	<b>0.00</b>
35									
36									
37									
38									
39									
40									
41	<b>Invest</b>	<b>Verrekeningsoplossing</b>							
42	Stratieseplan	Stratieseplan - Logistiek (TC-1)	0.00	400 000.00	400 000.00	2 500 000.00	400 000.00	400 000.00	400 000.00
43	Operasionele	Verrekeningsoplossing (TC-4)	200.00	1 974 000.00	200.00	1 200 000.00	200.00	1 420 000.00	1 420 000.00
44	Operasionele	Einkoop (TC-4)	0.00	10 000.00	0.00	10 000.00	0.00	10 000.00	10 000.00
45	<b>Totaal operasionele</b>		<b>2 000.00</b>	<b>1 984 000.00</b>	<b>200.00</b>	<b>1 210 000.00</b>	<b>200.00</b>	<b>1 430 000.00</b>	<b>1 430 000.00</b>
46	<b>Operasionele (handlingsupplie)</b>		<b>444 250.00</b>	<b>261 630.00</b>	<b>261 630.00</b>	<b>552 500.00</b>	<b>552 500.00</b>	<b>574 300.00</b>	<b>574 300.00</b>
47	<b>Totaal invest</b>		<b>421 250.00</b>	<b>2 005 630.00</b>	<b>2 005 630.00</b>	<b>4 274 274.00</b>	<b>4 402 240.00</b>	<b>4 402 240.00</b>	<b>4 402 240.00</b>
48	<b>Differential invest</b> (for favorable solution)		<b>1 115 351.00</b>	<b>-2 268 375.00</b>	<b>-2 268 375.00</b>	<b>2 268 375.00</b>	<b>133 975.00</b>	<b>133 975.00</b>	<b>133 975.00</b>
49	<b>Vehicle life cycle</b>		<b>252 350.00</b>						
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Alternative 0 = Standard

Cost overview Offload with rail system JIT in-house LSP Seq ROI JIS 5000 Rail & Forklift ROI JIS 5000

### Appendix C-3: Detail Logistical Cost Analysis

Supply Method	JIT In-house	JIS 5000 - Rail	JIS 5000 - Automated Exc	JIS 5000 - Manual
<b>Container costs</b>				
<b>Maintenance</b>				
<b>Spare parts</b>				
<b>Handling costs for equipment</b>				
<b>Inventory costs</b>				
<b>Additional inventory costs</b>				
<b>Repetitive costs per year</b>				
<b>Summary</b>				
<b>Total cost</b>				
<b>Total cost with rail system</b>				
<b>Total cost with manual system</b>				

# Appendix C-4: ROI Calculations

### ROI: Supply Method 1

Capital Investment Evaluation  
Project: E90 Carpet Supply

Investment Description: JIT in-house vs JIS 5000 with rail/ forklift system

Year:	1	2	3	4	5	6	7	8	Total
Expenditures / Investment	R'000	***	•	•	•	•	•	•	•
Capital Investment	R	***							****
Income / Savings	R'000	•	***	***	***	***	***	***	•
Annual cost savings	R		***	***	***	***	***	***	•
Net Cash Flow	R'000	•	***	***	***	***	***	***	•
Present Value (R'000) @ 10%	R'000	•	***	***	***	***	***	***	•
Cumulative Present Value	R'000	•	***	***	***	***	***	***	•
Discount Factor									
10.0%									
Internal Rate of Return (IRR)									
54.0%									
Net Present Value (R'000)									

### ROI: Supply Method 2

Capital Investment Evaluation  
Project: E90 Carpet Supply

Investment Description: JIT in-house vs JIS Fully automated rail system

Year:	1	2	3	4	5	6	7	8	Total
Expenditures / Investment	R'000	•	•	•	•	•	•	•	•
Capital Investment	R'000	•	•	•	•	•	•	•	•
Income / Savings	R'000	•	•	•	•	•	•	•	•
Annual cost savings	R	•	•	•	•	•	•	•	•
Net Cash Flow	R'000	•	•	•	•	•	•	•	•
Present Value (R'000) @ 10%	R'000	•	•	•	•	•	•	•	•
Cumulative Present Value	R'000	•	•	•	•	•	•	•	•
Discount Factor									
10.0%									
Internal Rate of Return (IRR)									
54.0%									
Net Present Value (R'000)									

### ROI: Supply Method 3

Capital Investment Evaluation  
Project: E90 Carpet Supply

Investment Description: JIT in-house vs LSP (Uti)

Year:	1	2	3	4	5	6	7	8	Total
Expenditures / Investment	R'000	•	•	•	•	•	•	•	•
Capital Investment	R'000	•	•	•	•	•	•	•	•
Income / Savings	R'000	•	•	•	•	•	•	•	•
Annual cost savings	R	•	•	•	•	•	•	•	•
Net Cash Flow	R'000	•	•	•	•	•	•	•	•
Present Value (R'000) @ 10%	R'000	•	•	•	•	•	•	•	•
Cumulative Present Value	R'000	•	•	•	•	•	•	•	•
Discount Factor									
10.0%									
Internal Rate of Return (IRR)									
54.0%									
Net Present Value (R'000)									

ROI JIS 5000 Rail & Fo


ROI JIS 5000 Rail & Forklift

# Appendix D: Supply Planning Methodology

## Developing the Supply Chain in the Automotive Industry

The approach to optimizing logistical processes

Supply Planning Methodology



## Supply Planning Methodology

### Assumptions

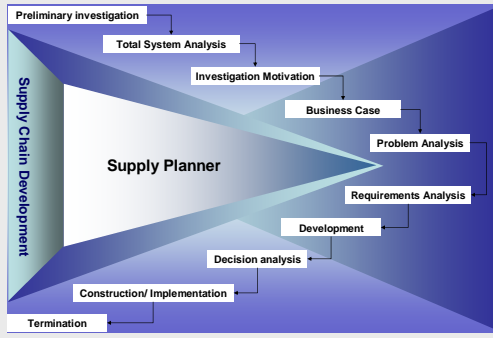
**i** This supply methodology is based on the following premises:

- The supplier is currently supplying on a JIT basis with in-house sequencing done at the OEM
- The Supplier produces in batches
- The current trends of transforming supply methods to a Just-in-sequence supply is the underlying philosophy
- The testing, construction and implementation phases fall outside the scope of this planning methodology

October 2003

## Supply Planning Methodology

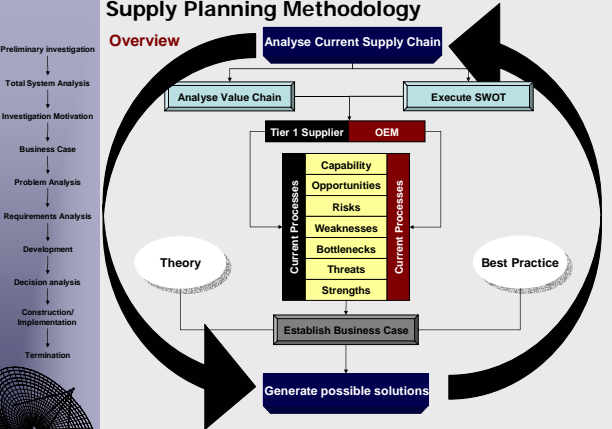
### Overview



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### Approach to developing supply chain:

Preliminary Investigation

The first step in developing the supply chain is to understand the current **total supply chain** method. Therefore, the following activities must be carried out to ensure that all facets of the supply chain are considered:

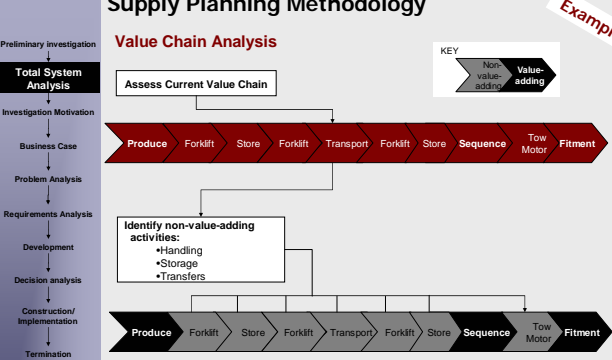
1. Analyse the supply chain through "Value Chain Analysis"
2. Determine all opportunities for improvements through an additional SWOT analysis exercise
3. Identify possible solutions/ improvements to the current supply chain through perusal of current trends and best practises:
  - Benchmarking
  - Outsourcing
  - Lean Production
  - JIS based supply methods
  - Responsibility shifts across the supply chain

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### Value Chain Analysis

**Example**



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#### SWOT Analysis: Supply Chain between Tier 1 to OEM

*Example*

	Positive	Negative
<b>Internal Factors</b>	<b>Strengths</b> <ul style="list-style-type: none"> <li>•Technological Skills</li> <li>•Distribution channels</li> <li>•Customer loyalty/ relationships</li> <li>•Production quality</li> <li>•Scale</li> <li>•Management</li> </ul>	<b>Weaknesses</b> <ul style="list-style-type: none"> <li>•Absence of important skills</li> <li>•Poor access to distribution</li> <li>•Low customer service</li> <li>•Unreliable product/service</li> <li>•Sub-scale</li> <li>•Management</li> </ul>
	<b>Opportunities</b> <ul style="list-style-type: none"> <li>•Changing customer tastes</li> <li>•Liberation of geographic markets</li> <li>•Technological advances</li> <li>•Changes in government politics</li> <li>•Lower personal taxes</li> <li>•New distribution channels</li> </ul>	<b>Threats</b> <ul style="list-style-type: none"> <li>•Changing customer tastes</li> <li>•Closing of geographic markets</li> <li>•Technological advances</li> <li>•Changes in government politics</li> <li>•Tax increases</li> <li>•New distribution channels</li> </ul>
<b>External Factors</b>		

As a basis, determine all the SWOTs both internally to the supplier and OEM, as well as the external environment in which the supply chain participates. This tool can also be used to assess each part of the logistical chain such as container management, transport, etc.

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#### Theory and Best Practices

Based on best practices and international trends in the Automotive industry, possible solutions can be found for transforming a South African supplier to a JIS-based supply method. These aspects must be incorporated in the development of the supply chain – in this way, the vision to uplift the automotive industry is possible.

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#### Business Case

Before any detailed investigations take place, ensure that there is sufficient motivation for the stakeholders to support the project fully.

Stakeholders, are all the system's users, owners, benefactors, victims and sponsors.

Owners of the system want to see the business case in terms of:

- Cost
- Time
- Quality

Without this motivation, the project may be terminated immediately.

Other system stakeholders such as users and victims have to be convinced that the possible change will be to their benefit. Personal relations is important in gaining support. Don't underestimate their influence in driving the project's success

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#### Business Case

Although most organizations want to see a cost, time, quality triangle as favouring the cost corner (shown here), according to Baker[1], the quality and time factors are more of a priority in today's competitive world. A cost effective product is of no value if it is of poor quality or delivered late. Cognizance must taken to ensure that these two aspects are the driving forces behind executing a supply chain development project. If these factors are improved, the cost will automatically be reduced

- Shareholder's interest: MARR
- Total systems costs reduced
- Savings in terms of maintenance, space, inventory holding, etc

- Part quality is improved – less risk
- Supply chain activities have less risk of causing damages
- Higher quality processes result in fewer steps in the supply chain

- Buffer time reduction
- Elimination of waiting time
- Pipeline time is reduced
- Non-value adding time is eliminated

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#### Problem Analysis

This approach serves as a basic guideline when embarking on a supply chain development project. This is the most important phase – "without an aim, there is no system"[W. Edward Deming, the New Economics].

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### Supply Planning Methodology

#### Requirements Analysis

Once the Business Case has been established and top management is supporting the further investigation, the detail requirements analysis can be captured from the Tier 1 supplier and OEM

1. Supplier assessment: Determine if the supplier is capable
  - a. Risk assessment
  - b. Supplier history
  - c. Production Process
    - i. Sequence capability
    - ii. Logistic activities
  - d. Overall assessment
2. Determine OEM opportunities for improvement
  - a. Evaluation of internal Logistical processes

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### Supply Planning Methodology

**Testing, Construction and Implementation**

- Once negotiations have taken place and the project has been approved, more planning with regards to the construction and implementation of the system must be carried out.
- Prototypes for the new system must be manufactured for testing purposes. These can comprise of:
  - Stillages
  - Conveyors
  - Truck modifications
  - Handling equipment
  - Tooling
- These prototypes must be tested approximately 4 months prior to pre-series production
- Cognizance of the lead time that is required to erect any fixtures must be taken into account and planned for accordingly. Fixtures should be erected a few months before the start of production.

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**Termination**

- For the Supply Planner, the Start of Production marks the end of the project
- However, any recall on the project with regards to supply problems resulting from the newly implemented system will be on the onus of the supply planner.
- For future reference, all aspects of the project must be fully documented and submitted to the relevant people. These documents should be signed off so that if any disputes arise, they can be resolved through perusal.

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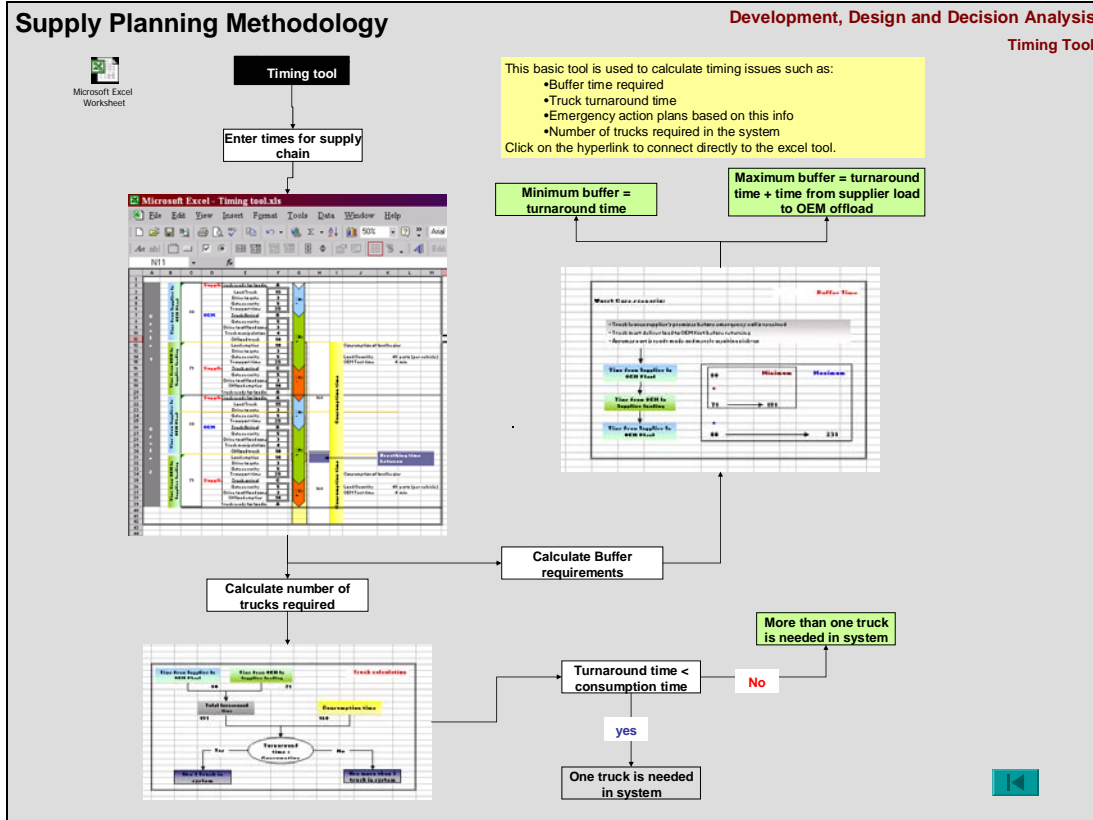
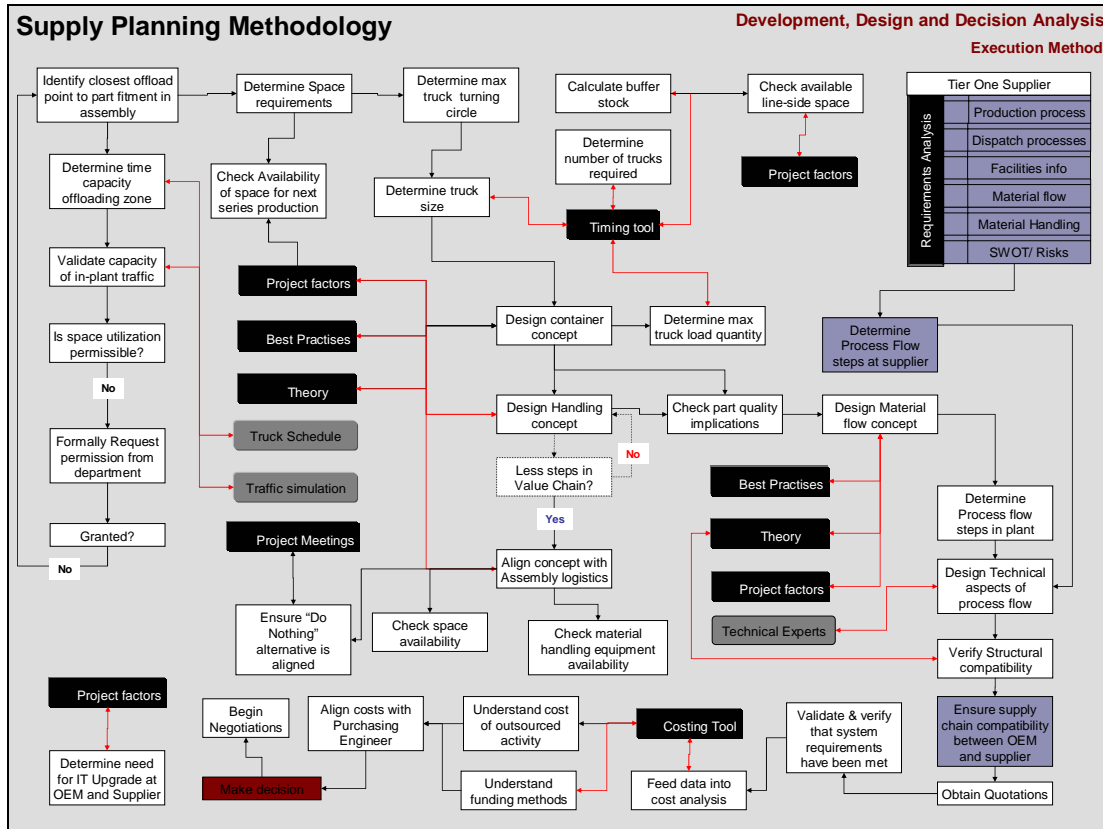
### The Automotive Industry in South Africa

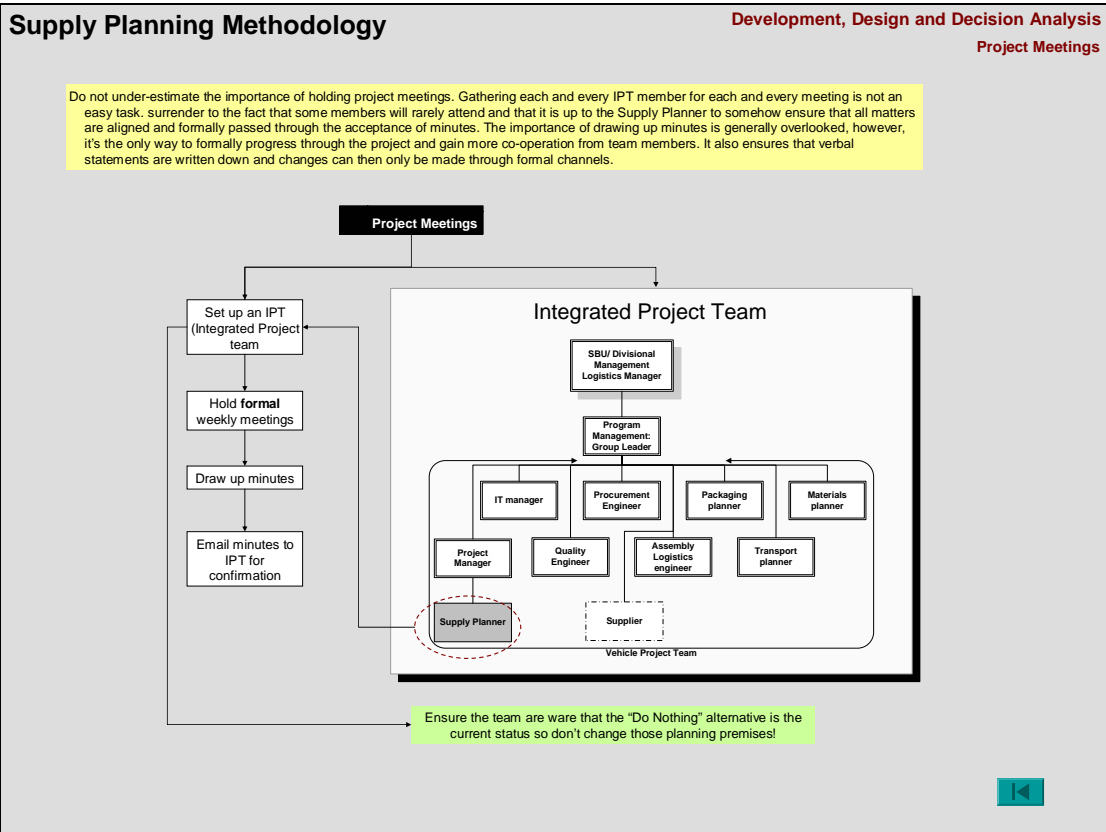
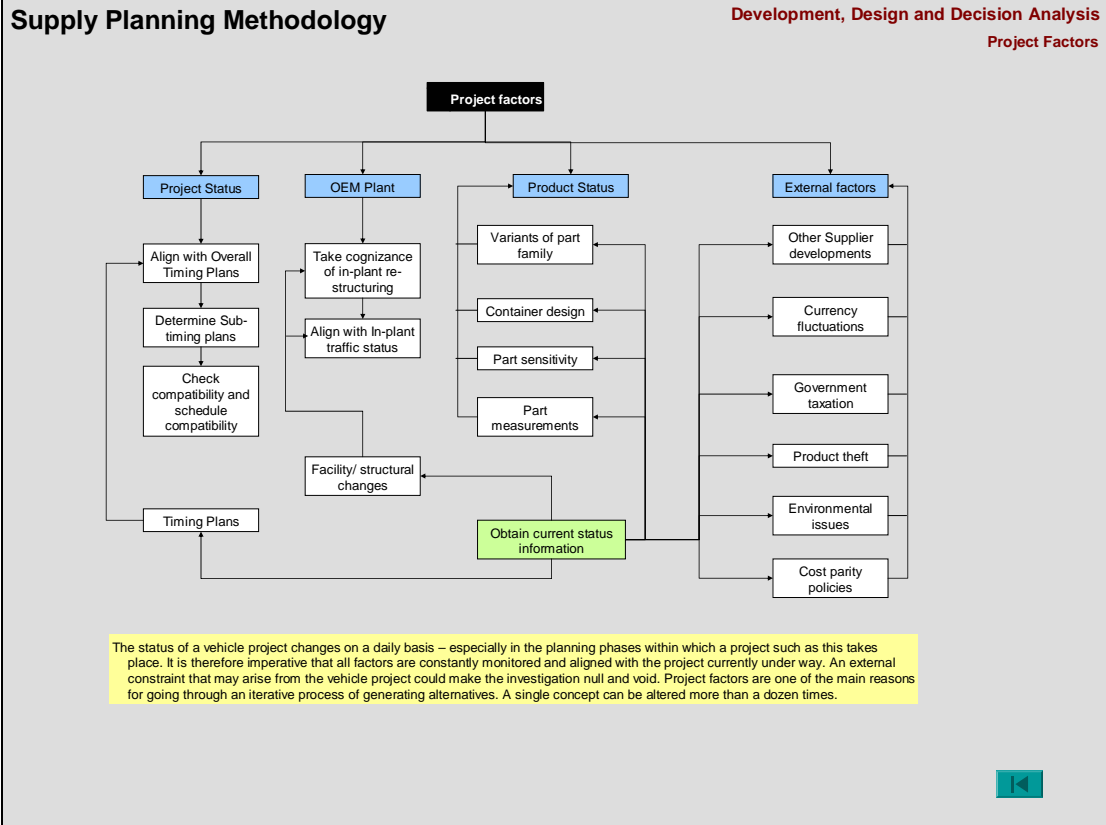
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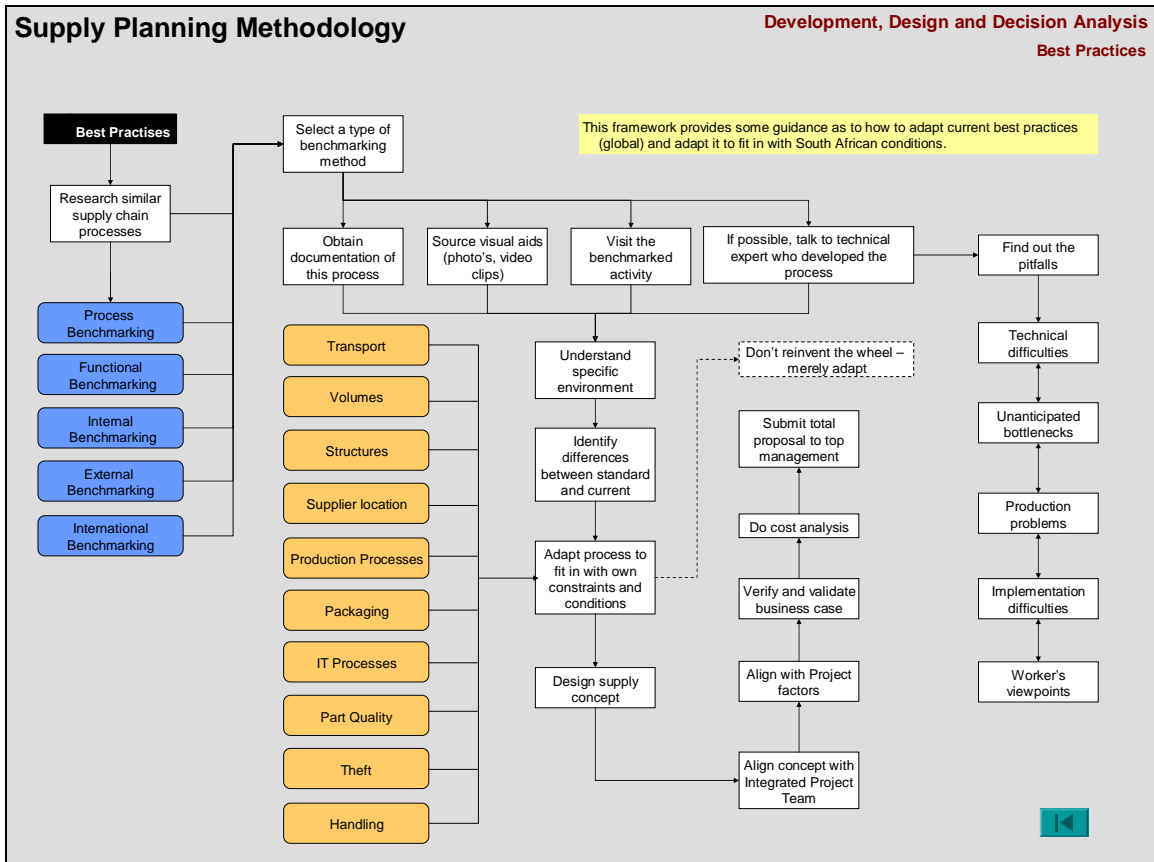
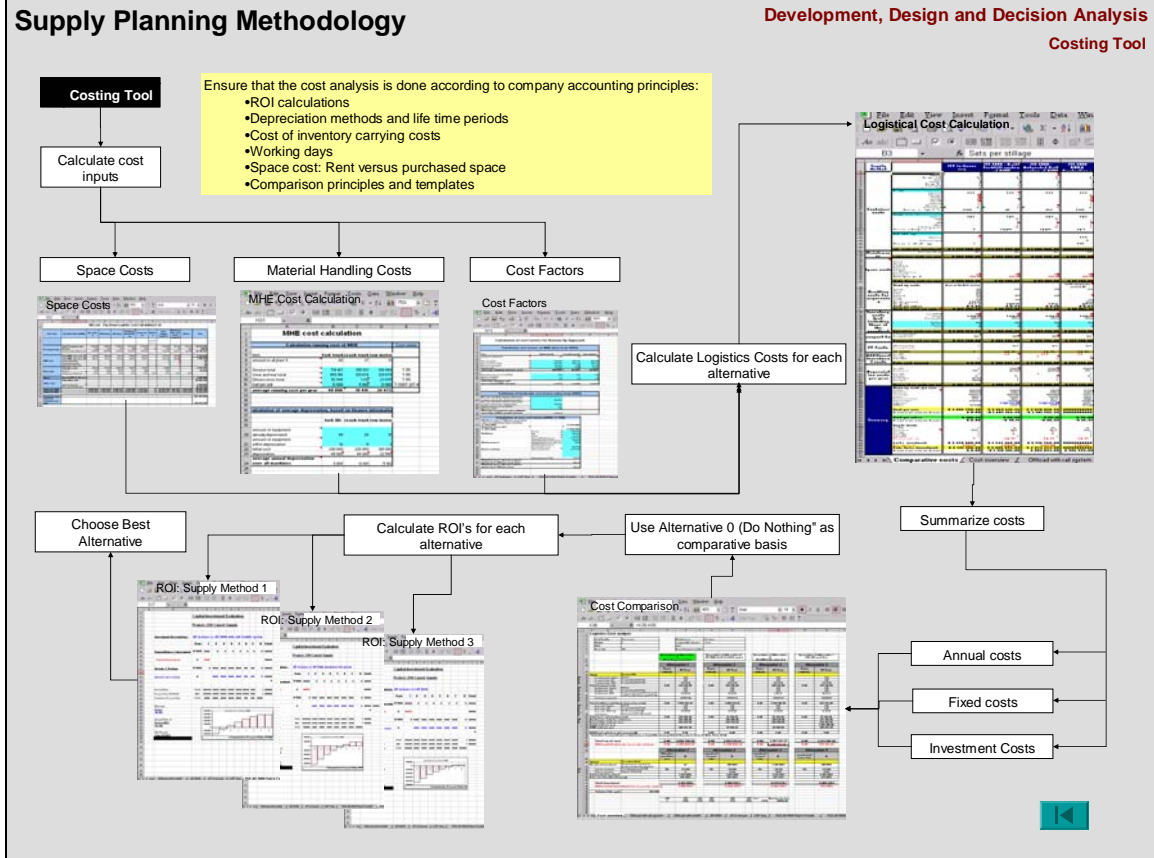
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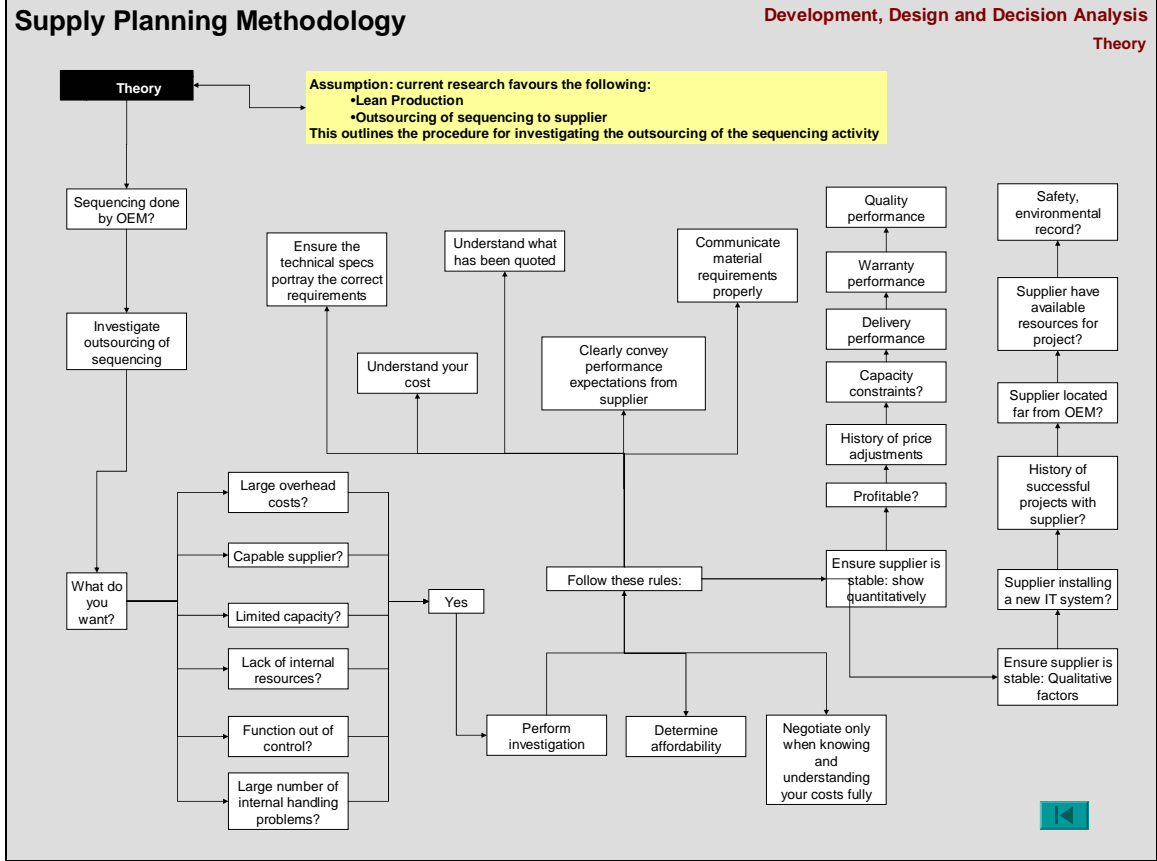
- Think Globally
- Adapt Locally
- Continuously Improve & Innovate

# Appendix D: Supply Planning Methodology









## Appendix D: Supply Planning Methodology

Microsoft Excel - Timing tool

File Edit View Insert Format Tools Data Window Help

C12  $= (F12+F13+F14+F15+F17+F18+F19)$

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