

SUPPLY PLANNING IN THE SOUTH AFRICAN AUTOMOTIVE INDUSTRY

V. Stark¹, C. de W. van Schoor² and J.J. Strasheim³

^{2,3} Dept of Industrial and Systems Engineering
University of Pretoria, South Africa

²chrisvs@supremespring.co.za, ³johan.strasheim@up.ac.za

ABSTRACT

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.

¹This author was enrolled for the M Eng (Industrial Engineering) at the Department of Industrial and Systems Engineering, University of Pretoria

1. INTRODUCTION

An important development in automotive supply chain management during the last decade 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.

Original Equipment Manufacturers (OEMs) are moving towards implementing supply approaches 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. South Africa's OEMs 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 to 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 to design the supply chain. The responsibility of the supply planner is to integrate these functions and design optimal logistical processes – from first tier suppliers to OEM assembly fitment. “Supply Planning” is becoming an increasingly important function of complex vehicle planning in the automotive industry.

This paper investigates and explains the role and responsibilities of a supply planner in the automotive industry through an analysis of the business requirements and insights from a case study on supply planning.

2. SUPPLY PLANNING IN THE EUROPEAN ENVIRONMENT

Supply planning is not a new phenomenon. European countries consider supply planning as a vital part of the successful planning of vehicle projects. The E-Business- und Prozess-Consulting (EBP) methodology [1] for supply planning provides the most comprehensive description of this functional role. It deals specifically with the role, tasks and effects of the so-called “Supply Planner” within the automotive industry. This approach describes what supply planning represents and what its effect on the vehicle project is, but the practical side of the activity is lacking. This methodology was developed in the context of a European environment and therefore becomes less relevant when viewed in the South African automotive industry. Figure 1, taken as an extract from this EBP methodology, illustrates the responsibilities and influences of the supply planner.

Supply planning within the production development process:

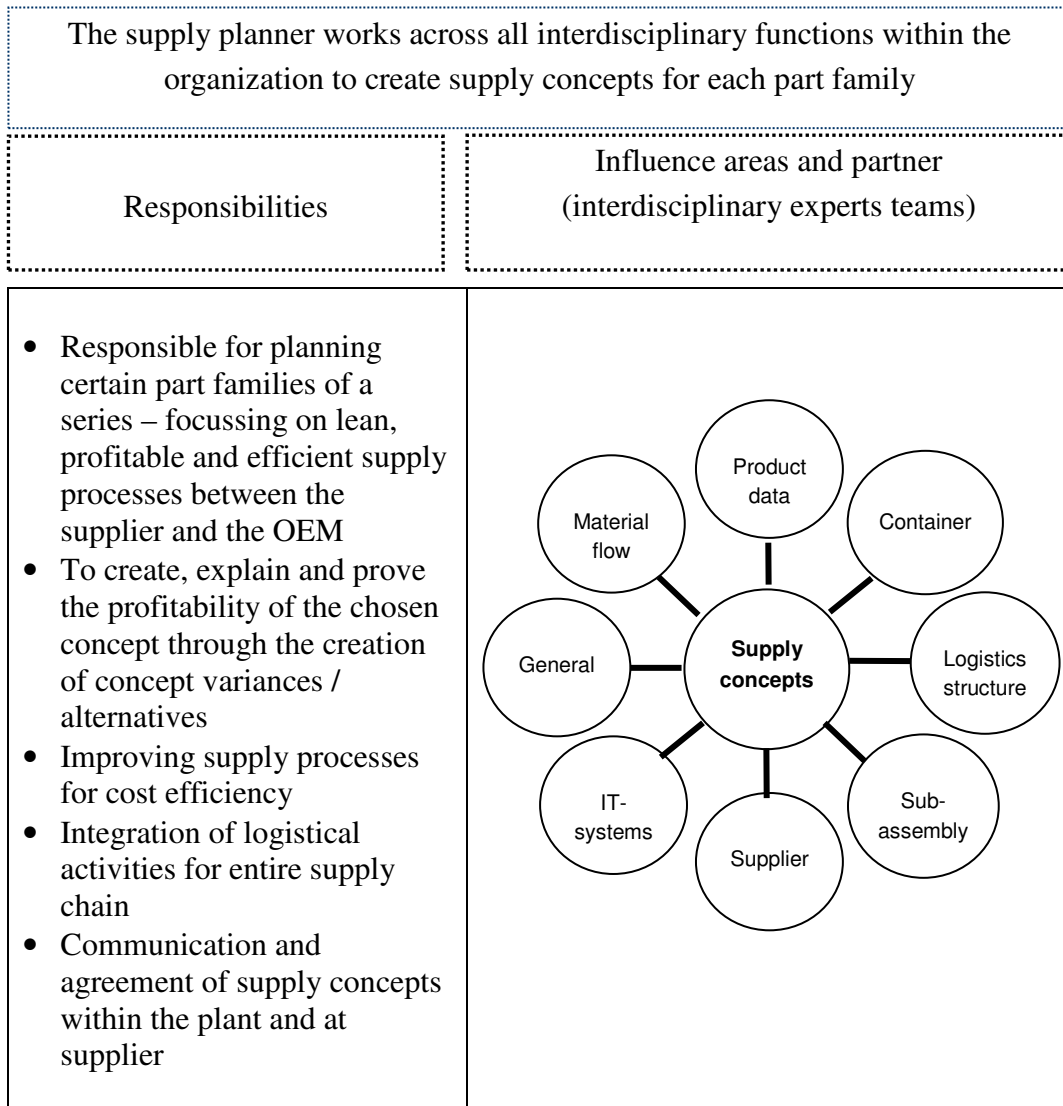


Figure 1: Responsibilities and Influences of the supply planner [1]

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 the logistical function within the organization cannot be underestimated. These effects are depicted in figure 2 below. It sums up the potential influence that a supply planner can have on redefining the supply chain. Instead of playing a functional, competency role within a company, the supply planner spans the entire organization and serves to integrate these diverse business functions in order to achieve total system integration.

The impact of the supply planner in the South African automotive industry is no different. However, the manner in which supply planning is executed is significantly different from the business practice in Europe.

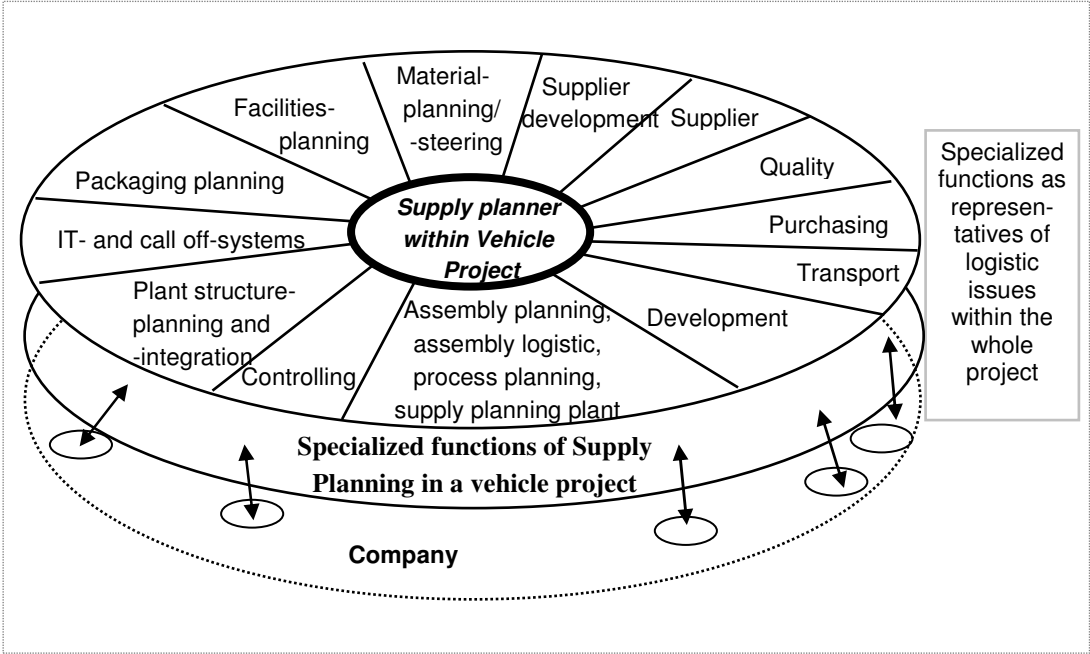


Figure 2: Effects and potential of supply planning [1]

3. SUPPLY PLANNING IN SOUTH AFRICA

One of the major worldwide trends in the automotive industry is increasing modularisation concepts that will cause a shift from production-orientated plants to pure assembly oriented plants. This trend is expected to also impact on the structure of the South African automotive industry. A strong supply chain structure will therefore become an increasingly important quality criterion for automotive plants of the future. As a result supply planning can be a strong differentiator for the future success and integration of supply chain partners and offer several opportunities for increased competitiveness [2].

Most automakers in South Africa are supported by their international holding companies, which play an important part in ensuring 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. In addition, the development status of the lower tier suppliers in South Africa is not at the same high level as in Europe, USA and the Eastern seaboard countries. There are many reasons for this large gap but the main concern lies in how it should be bridged to ensure that more local content can be introduced and, through optimised processes, more exports can be realised.

An industry case study at BMW South Africa provided firsthand knowledge and experience into the practicalities of developing the supply chain for a specific part family. By undertaking this project as the supply planner, a clearer understanding was gained of the conditions, constraints and challenges in the South African automotive industry. These factors will be discussed in the next paragraph – all serving as an input to the proposed method for supply planning in the South African automotive industry.

4. THE CHALLENGE FOR BMW

An industry case study was undertaken at BMW (South Africa) Rosslyn Plant. The pilot project involved the transformation of a supplier from a JIT to a JIS supply. The floor carpet supplier produces in batches and delivers directly to the BMW sequencing centre on-site. At the start of assembly, the parts for the 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.

In line with the best practices encompassed in lean manufacturing, the method of this particular supply concept had to be questioned and scrutinized. The scope of the project was to investigate, develop and implement an improved supply chain method of supply so that the total system cost between the first tier supplier and the OEM could be reduced.

The Strengths, Opportunities, Weaknesses and Threats (SWOT) are summarized in Figure 3. The supply planner needs to address and investigate all these factors for potential supply chain improvements in cost, quality and time.

Numerous alternatives were generated, and after lengthy investigations the elimination of redundant, non-value-adding supply chain activities was achieved.

Although a successful project outcome was realised, it was obvious that room for improvement in terms of the project method and approach existed. From the lessons learned, experienced gained and research undertaken, a clear motivation for the development of a practical supply planning methodology was established.

By following the proposed “theoretically-based” EBP supply planning methodology, numerous differences in the underlying assumptions of the method were also found. A new set of assumptions were required to develop a South African based supply planning methodology. The following section outlines these important factors.

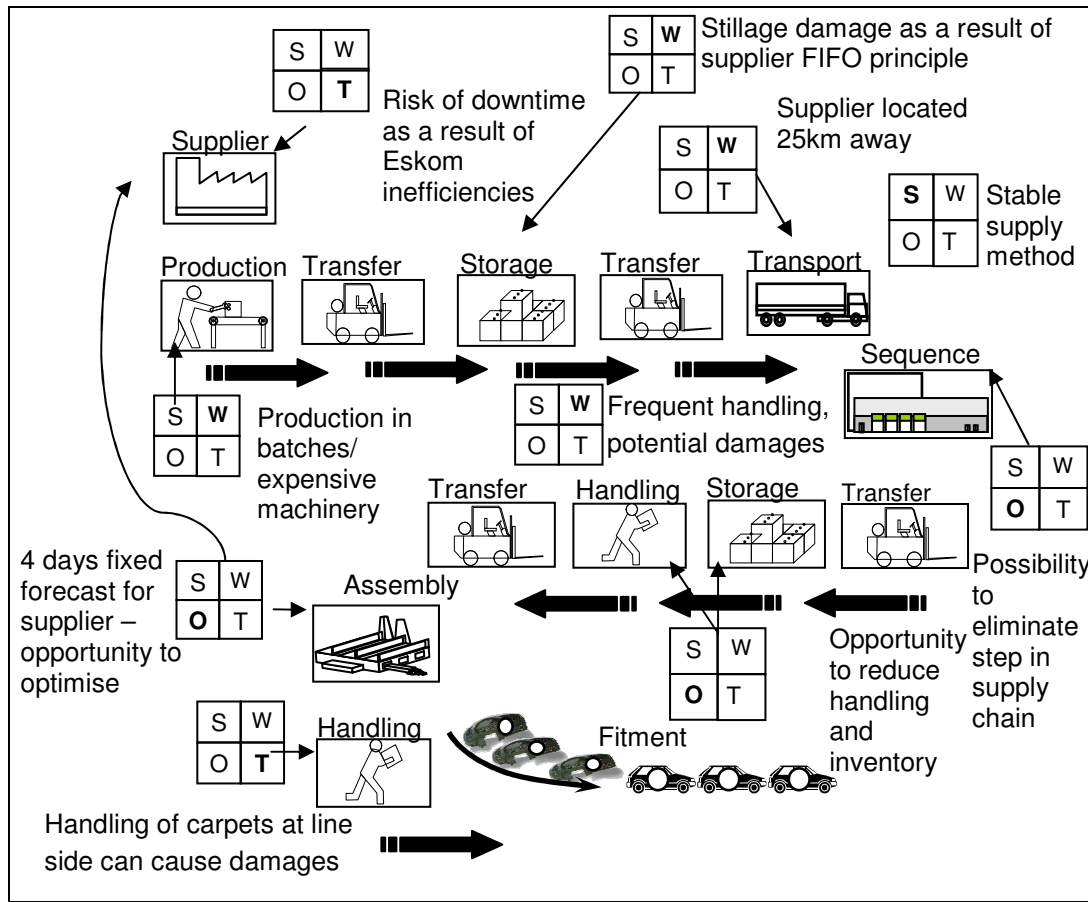


Figure 3: SWOT overview of current supply chain

5. THE SOUTH AFRICAN AUTOMOTIVE ENVIRONMENT

From the lessons learned from the industry case study 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.

5.1 Scope of supply planning

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 scope of supply planning in terms of the interface between the first tier and OEM needs to be extended slightly. The supply chain between the OEM and first tier is highly influenced by the supply of parts from the second tier supplier, which are mainly imported. South Africa cannot avoid its remote geographic position with vast supply distances. In Europe, supplies can be delivered to any destination via road freight, whereas in South Africa, parts enter the country either via air or sea

freight. This in turn results in long lead times, more pipeline inventory, and high transport costs.

5.2 Just-In-Sequence philosophy

According to the EBP methodology, Just-In-Sequence (JIS) interprets the supply chain flow as follows:

1. Produce in sequence at supplier
2. Transport
3. Dispatch and transport to assembly manufacturer (OEM)
4. Offload and prepare for fitment
5. Fitment of part in sequence

This is in accordance with the theory of JIS and this too, is possible in South Africa. However, there are a number of constraints that inhibit the exact adherence to 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 faces in this regard are considered below.

5.3 Transport

As part of the risk analysis with a JIS supply method, the reliability of deliveries becomes important. In South Africa, a very different set of risks needs to be considered in comparison to that experienced in Germany. Security considerations such as high-jacking and a higher incidence of breakdowns and accidents, etc are not uncommon in South Africa and thus need to be considered when calculating time lines and buffer stock. Risk must be planned for through contingency plans. This normally results in extra stock on hold to safeguard against these eventualities. The German application of 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.

As opposed to Europe where rail transport is predominantly used to move goods, road transport is dominant within South Africa. Rail transport is extremely reliable and cost effective for European conditions. However, South Africa lacks the same 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.

5.4 Packaging

Another aspect that is affected by South African conditions is packaging. The long distances that trucks need to travel to reach ports for shipment and receipt of imported goods has a significant impact on the design of packaging. A pallet or stillage that is designed in Europe may not be viable in South Africa for the distances and the type of roads that a truck will encounter. A large number of these stillages must be redesigned to sufficiently protect parts against 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 port and an inland location could differ to that for a route of a few kilometres.

5.5 Batch processing to achieve economies of scale

The fact that South Africa needs to be competitive with low production volumes has an important influence on the selection of the supply method to reduce overall system cost. In an effort to achieve 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 efficiency. For the OEM, the ideal would be for the supplier to produce in sequence – the so-called *simultaneous synchronized manufacturing*. 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 can defeat the object of minimizing system cost.

This conflict cannot be overlooked and requires that an adapted form of the JIS philosophy be developed. Many may argue that an approach of producing products in batches is a JIT-based philosophy and not JIS in nature. This is only partly true. By viewing the operation at the supplier in isolation, this is a JIT type production. However, considering the production process in the context of the entire supply chain, it can still be viewed as a hybrid 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:

1. Produce in batches at supplier
2. Sequence parts according to OEM requirements
3. Dispatch and transport to assembly manufacturer (OEM)
4. Offload and prepare for fitment
5. 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), the type of supply would not be classified as a JIS but rather a JIT supply. According to supply chain trends, this is exactly what OEMs do not desire and the drive towards shifting more responsibility (sequencing in this case) to the supplier is realised by transforming the JIT supply to the JIS scenario depicted above. This is sometimes the only way to accomplish this upgrade in supply chain development in South Africa.

5.6 Automation

Continuing with the impact of low volumes on South Africa's automotive industry, consideration of its influence on automation cannot be omitted. Almost all of the

plants in Europe are considerably more automated than those in South Africa. Low volumes and lower labour costs inhibit the justification of automating the supply process to the same extent. This can significantly reduce the opportunities for South African manufacturers to become more competitive. Although labour cost is lower, 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.

5.7 Timing constraints

South Africa's geographical location in terms of world markets creates a number of logistical problems that do not exist in Europe and Asia where resources are readily available and accessible in short time frames. In South Africa, the lower tier suppliers lack the expertise, technology and machinery required to produce products that are of the same quality standard as those produced by companies in first world countries. For this reason, OEMs and certain 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. Long lead times force them to maintain large buffer stocks to minimize risk and this in turn increases overall holding cost and ultimately supply chain cost. There is an urgent need for suppliers to upgrade their processes, improve their quality levels and become reliable partners of the next level of customers. The need for localisation is heavily understated and cannot be emphasised enough as a major ingredient of becoming more competitive in the global sense.

5.8 Technology

Europe's stable economy and high level of technology has a major 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 of 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 first tier suppliers can also accurately predict their production quantities. These can then be optimised, which in turn means that the second 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 a minimum.

South Africa, because of the lack of investment due to lower volumes, does not have the advanced technology to create as stable a sequence adherence as in first world countries. It does not follow that the only reason for lack of stability is technology related, but it does have a significant impact. The OEMs have an advantage over the lower tier suppliers because of its subsidiary support from holding companies. Certain suppliers also experience these advantages. For the

most however, the lack in technology has a large influence on becoming and sustaining competitiveness. The focus should be to enhance South Africa's suppliers' standards and thereby greatly improve stability at OEMs through the use of technology.

5.9 Operational conditions

Although not an obvious aspect to consider when comparing South African conditions to that of manufacturers abroad, the physical methods of executing operational activities is indeed different. The most extensively used internal transport equipment in South Africa is the forklift. Although reliable, the operation of the vehicle tends to incur delays and damages. The training of the forklift driver is thus an extremely important factor. Similarly, 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 the design. A satisfied workforce is as imperative as a productive one.

5.10 Definition of a Tier-One supplier

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 occur under the correct premises. The following aspects should typically be considered when developing the tier-one supplier in South Africa:

- Lower level supplier networks are unstable and risky in terms of reliability, quality and timing.
- Lack of funding from parent companies to upgrade technology levels may prevail.
- Development often depends on the OEM for funding.
- Volumes are low and therefore machinery costs may be high.
- Labour intensive production versus mechanised production from companies abroad.
- In general, quality standards are not as high as those of international counterparts.
- Education levels of suppliers are very practice based – not managerial and visionary.
- Operators (labourers) are not educated to the same level as in developed countries. This has a considerable impact on the implementation of new processes – training is a fundamental aspect that must be incorporated in developing supply planning processes and operations.

6. DEVELOPING A NEW SUPPLY PLANNING APPROACH

Based on the industry case study that was undertaken at BMW South Africa, a number of premises must be mentioned in limiting 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.

6.1 Supply planning overview

Figure 4 provides an overview of the tasks that the supply planner should perform 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, the danger exists that certain aspects can be omitted, resulting in sub-optimal planning.

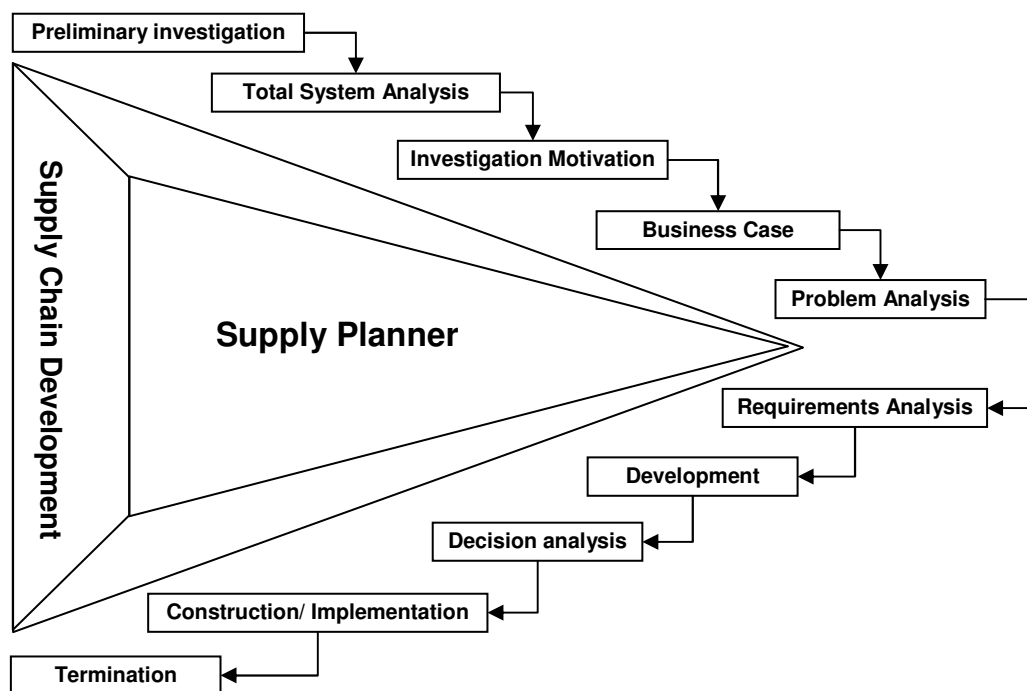


Figure 4: Overview of the supply planning methodology

Figure 5 shows how these phases are translated into high-level activities that encompass all the necessary activities that need to be executed 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.
- Consider current internal business procedures so that the project is not stalled as a result of neglect. An example is to ensure a proper procedure for setting up the project by creating a project letter that is agreed by the relevant business partners.

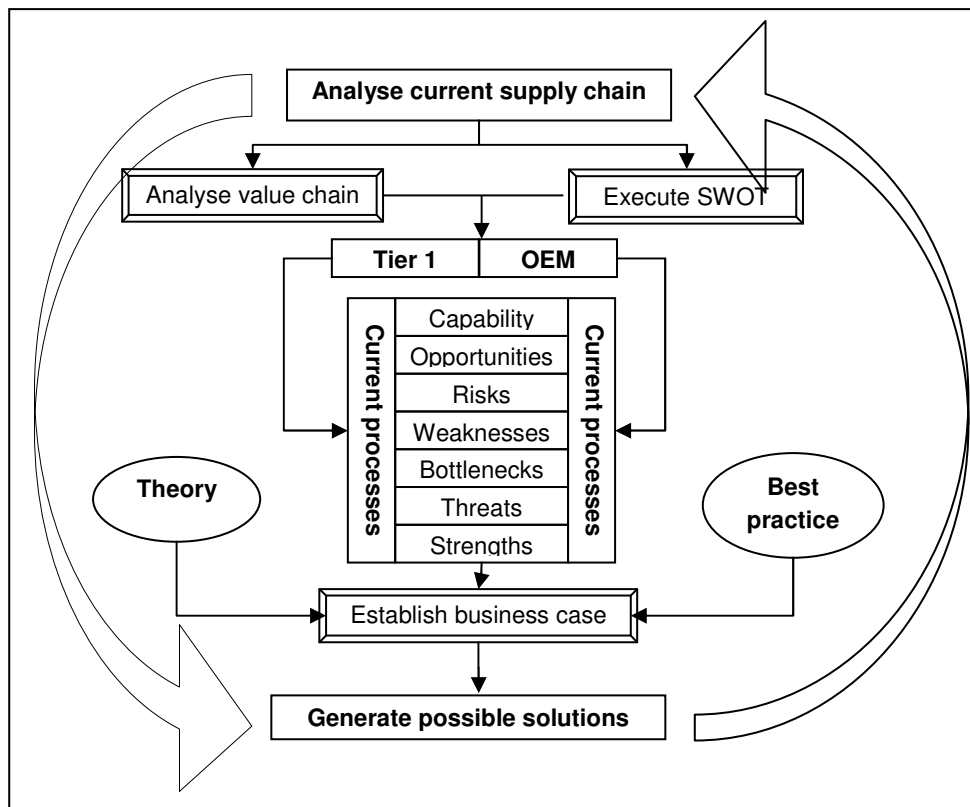


Figure 5: Overview of the supply planning methodology

In accordance with the above framework, each phase of the supply chain development is discussed in the next paragraphs.

6.2 Preliminary project phase

The first phase, the preliminary investigation, is crucial to achieving the project's goal. It is during this phase that the supply chain (between the tier-one supplier and the OEM) is analysed in its totality. This means that the OEM's processes cannot be viewed in isolation of the supplier's processes and vice versa.

To achieve this viewpoint, the supply planner should analyse the supply chain through a number of activities. Based on experience gained from the BMW case study, the following are the most effective:

- Value chain analysis
- SWOT analysis
- Analysis of current best practises and supply chain trends

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 illustrates the potential for improvement and optimisation of the supply chain. If the redundant activities can be eliminated, the supply chain can become leaner and this may result in cost reduction. As this analysis covers the entire supply chain, sub-optimisation between tier one and the OEM is prevented. An example of this type of analysis, based on Porter's value chain [3], is shown in Figure 6 below.

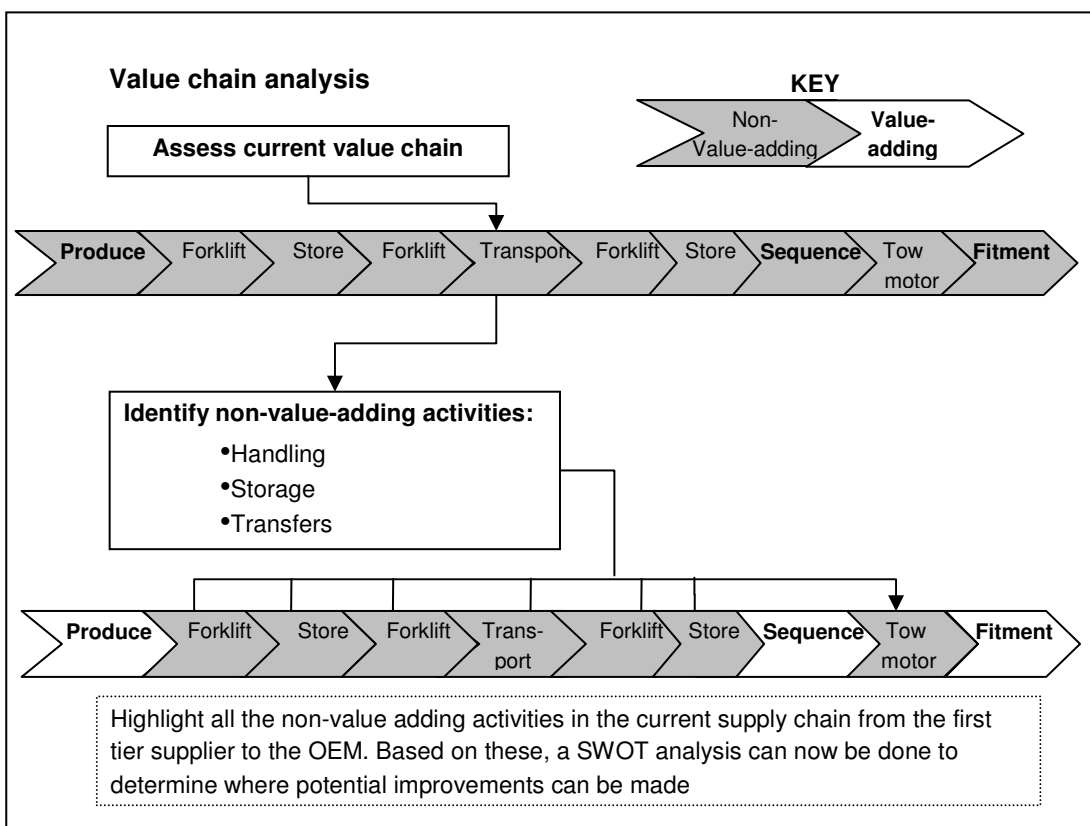


Figure 6: Value chain analysis

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 the tier one suppliers and the OEM. The strengths and weaknesses show how the supply chain is affected internally, typically from a process view. The opportunities and threats evaluate the external influences on logistic operations.

Research best practices and trends

An essential aspect of optimising the supply chain in any environment is to transform current processes in accordance with best practices. Organisations have unique ways of carrying out this type of investigation and innovation is sometimes suppressed as a result of resistance to change current internal processes. The supply planner needs to research the relevant best practices and trends to ensure that up-to-date trends are considered and world-class practices are incorporated in key supply chain processes and activities.

6.3 Stating the business case

Once the total system has been analysed, the project feasibility in terms of company policies needs to be considered. This means that although the project is viable, the company may require that specific procedures be followed before approving the project's go-ahead. The so-called "business case" is often a company requirement and should be defined in terms of:

- Cost
- Time
- Quality

Figure 7 illustrates some of the detail of the three drivers.

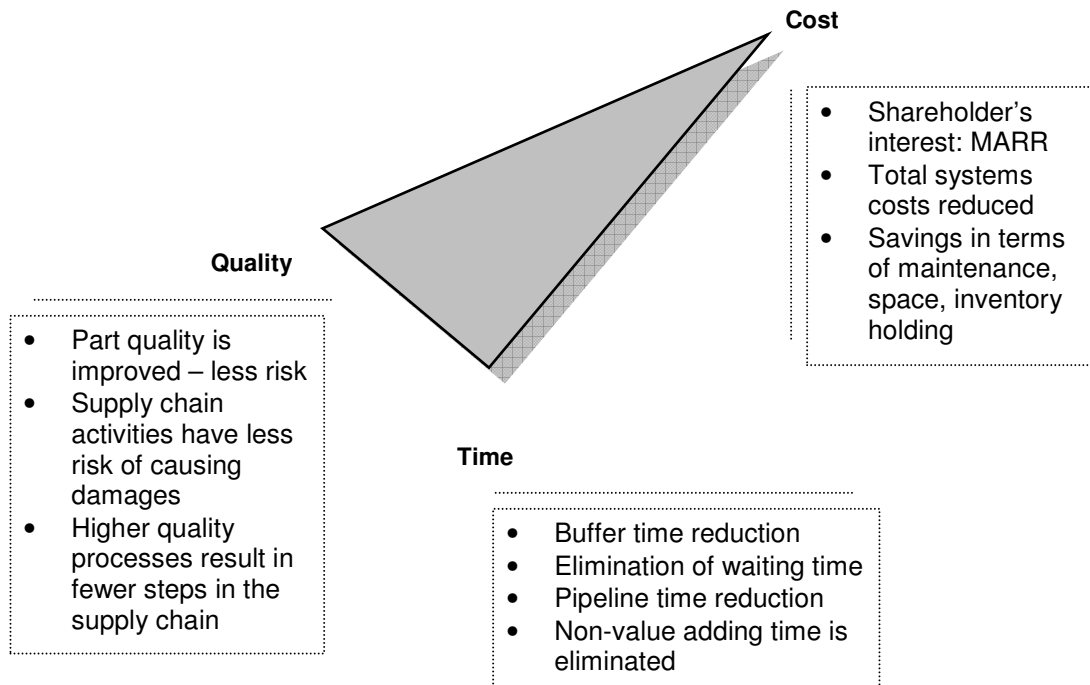


Figure 7: Business case justification [4]

Although most organizations wish to see a cost, time and quality triangle as favouring the cost corner, according to Baker [4], the quality and time factors are

more of a priority in today's competitive world. Cognisance must be taken to ensure that these two aspects are the driving forces behind a supply chain development project. If these factors are improved, the cost will in many cases be reduced as a direct result.

When attempting to motivate the investigation to improve supply chain processes, all stakeholders must support the project fully from the outset. Stakeholders comprise all the system's users, owners, benefactors, sponsors and affected persons. Personal relations are important in gaining support and stakeholders' influence in driving the project's success must not be underestimated.

After the Preliminary Investigation, Total System Analysis and Business Case phases have been completed and the project's feasibility was proven to be sound, the remaining project phases can be carried out in greater 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," [5].

6.4 Problem analysis phase

The first and foremost task is to clearly define the aim of the project. Examples could be to improve quality and/or to minimise handling. Based on experience from the case study, there should be only one or two major driving forces in 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 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 [6]. This approach, depicted in the figure 8 below, serves as a basic guideline when embarking on a supply chain development project.

6.5 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.

Supplier assessment

According to Baker [4], if the supplier is not capable of what is required of them, an alternative solution needs to be found or the supplier changed. 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. The following areas of risk must be identified:

- Lower tier problems
- External supply chain problems
- External political, legal and environmental factors

- Historical information with regard to supply chain problems between tier one and the OEM

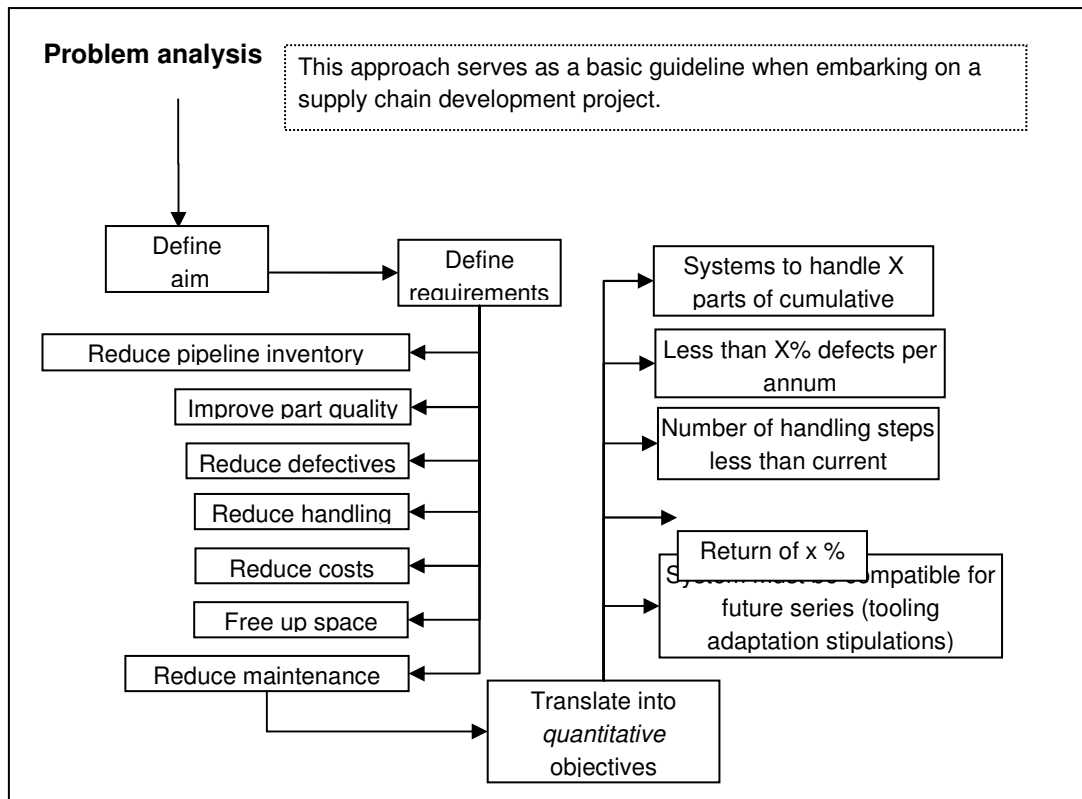


Figure 8: Problem analysis guideline

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 formulation of the supply concepts by the supply planner, but also reveals any possible bottlenecks, supply problems and quality problems.

Suppliers are being urged to become capable of producing at the same rate and sequence as the OEM to minimize lead times and stock levels at both ends – 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 the 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 as the OEM and still delivers 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. The reasons for this inflexibility are not limited to, but include the following:

- Long set-up times
- High machinery cost
- 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 cost (cost per trip)

The aim of supplier assessment is to ascertain whether the supplier is capable of being developed and if so, which areas need to be focused on. Since such an assessment is not easy 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 or green. For example, an overall red light will indicate that the supplier is too unstable for the project and therefore an alternative solution should be investigated.

Current OEM supply method assessment

Ensuring that the total supply chain is analysed, the assessment of the OEM and supplier cannot be done in isolation of each other. The same assessment procedure used for the supplier's production process should be used 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. If the OEM requires that the supplier be able to receive delivery call-offs at any time during BMW working hours, the supplier must be able to accommodate such a system. If one party operates in a manner that does not compliment the other, mismatches in terms of systems, material and information flow, will occur, jeopardising the total system operation.

6.6 Development, design and decision phases

The planning phases of a new vehicle series project are very unstable in terms of the premises on which it is based. The status of project factors such as number of variants, in-plant structural changes and legislation issues, influence the planning of the supply chain. All project factors need to be considered on a regular basis so that the supply planning is based on correct assumptions. It may occur that a change in one project factor may affect the entire investigation.

Since 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 to reach the desired goals.

Before embarking on developing alternative solutions to the current supply chain processes, it must be noted that most project policies and procedures of OEMs insist that at least three alternatives be investigated. For example, for the case in which a supplier is currently producing in batches and supplying to the OEM's in-

house sequencing centre on a just-in-time basis, the following alternatives should be investigated:

- Alternative 0: “Do Nothing” – keep as current
- Alternative 1: “Supplier Sequencing” – outsourced sequencing at Supplier and not OEM
- Alternative 2: “Logistic Service Provider sequencing” – functional outsourcing

Note that alternatives 1 and 2 can comprise 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.

6.7 Supply planning execution approach

In accordance with the Domino effect [7], if the OEM’s 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 process therefore begins at the OEM.

Keeping in mind that the aim of the project 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 regard to the project status, supplier influences and constraints. It is an iterative approach that 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 9 depicts the flow of events that should occur when carrying out this phase.

Some of the key activities and tools are discussed in following paragraphs.

Timing Analysis

A timing 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 trucks required in the system

The tool is spreadsheet based and requires the user to record the relevant times – from the truck loading at the supplier to the offloading of the part at the fitment point at the OEM. Capacity requirements such as the number of trucks that will be required in the system and the buffer size in the plant to balance the supply with the consumption time of the truckload are calculated based on these factors.

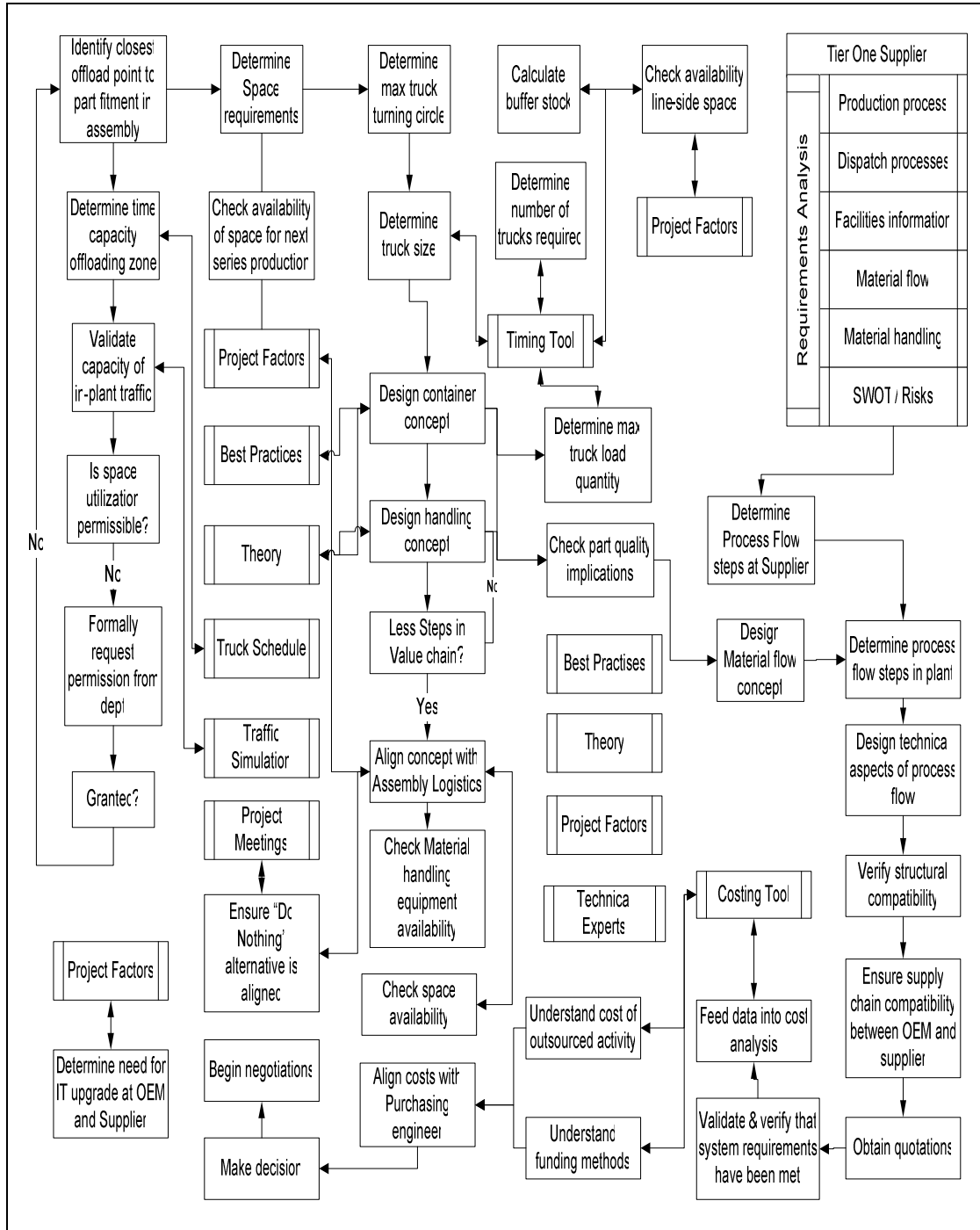


Figure 9: Supply planning execution framework

Project factors

In the case of a large project such as a new vehicle model introduction, the status of the project changes on a regular basis. For South Africa, it is especially important to constantly monitor the status of the planning premises upon which the supply methods are based. The parent companies of the South African OEMs dictate this status and 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 of the main reasons for going through an iterative process of generating alternatives. A single concept can be altered more than a dozen times.

Some of the factors relevant to a supply planning project are the following:

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

Evaluation of 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
- Product theft – could change supply concept in order to prevent proliferation
- Environmental issues – disposable packaging restrictions

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). Gathering all IPT members for each meeting is not an easy task. Some members will not attend such meetings regularly and it is 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 is 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 from the industry case study at BMW, was that the “Do Nothing”-alternative was not sufficiently stressed. Because the investigation was a lengthy one, some team members assumed the status would automatically change to one of 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 supposedly not feasible any longer and another alternative had to be generated. The supply planner, although responsible for gaining each member’s support, should thus re-iterate that the investigation is just that and not a status change until formally decided upon.

Costing tool

A costing tool was developed during the investigation. A detailed costing framework was non-existent and therefore had to be developed from scratch. From experience, it is vital that before such a costing analysis is done, the supply planner must know the company procedures with regard to accounting practices, costing formulae, templates and acceptable rates of return. If these procedures and processes are not adhered to, the decision making process will be stalled or aborted.

The framework for the 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, container costs and handling costs per alternative. These elements all need to be calculated in accordance with GAAP (General Accepted Accounting Practice) or the applicable practice. For each alternative, the ROIs (Return on Investment) must be calculated and graphed. The “Alternative 0: Do Nothing” must be used as the basis for comparison. The alternative with the highest ROI will be the most favourable.

Determine best practices

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 increasingly 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 working 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, an expert should be approached. The pitfalls, teething problems and technical difficulties that were encountered when implementing such a system, need to be understood. 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.

Current trends and best practices need to be incorporated into the design of the new supply concept. Based on research of current automotive supply chain trends and best practices, the supply planner should investigate the feasibility of implementing such processes. The underlying philosophy is to uplift the South African automotive industry to world-class standards by implementing processes that are based on latest trends and practices. An example of such a trend that can be used to develop the supply chain is outsourcing. The assumptions and aspects that need to be considered when outsourcing an activity to a third party must be translated into a decision matrix when to outsource and a stepwise process to implement such a best practice.

6.8 Summary of the supply planning framework

The supply planning framework as presented above and summarised in Figure 10, attempts to demonstrate the way in which the planner should carry out his/her role of developing the supply chain. 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 related and what their impact will be on one another if changed. Both soft and hard factors of a vehicle supply chain project are considered.

7. CONCLUSION

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 [8]. 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, ensure integration of suppliers and safeguard critical supply chains [2].

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.

There are also 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.

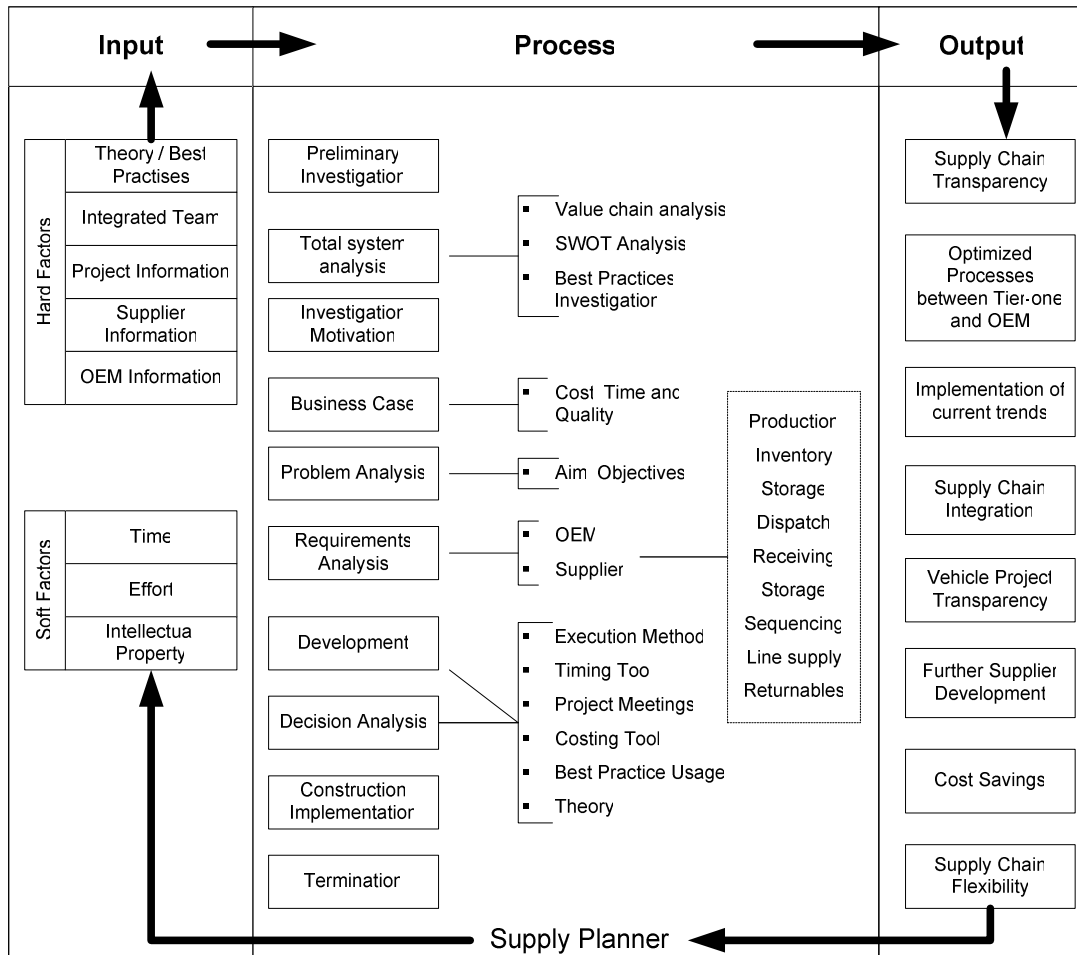


Figure 10: Supply planning framework overview

8. REFERENCES

- [1] **Braun J.**, *Versorgungsplanung in Der Automobil Und Zulieferindustrie: Der Weg Zur Etablierung Wegweisende Logistischer Lieferantenprozesse*, (“Supply Planning In the Automotive and Supplier Industry: The Road to Establish Pioneering Logistical Supply Processes”), EBP-Consulting, Germany.
- [2] **Freese J., et al**, August 2004, Increased Competitiveness Through Integrated International Supply Chains, *Supply Chain World Conference Southern Africa*, Sandton.
- [3] **Porter, M.E.**, 1985, *Competitive Advantage*, The Free Press, New York.

- [4] **Baker T.L.**, June 2003, Adventures In Outsourcing – Lessons Learned, *SAPICS International Conference*, Sun City.
- [5] **Deming W.E.**, 1996, *The New Economics*, as quoted by Martin J.N., *Systems Engineering Guidebook: A Process For Developing Systems And Products*, CRC Press LLC.
- [6] **Martin J.N.**, 1996, *Systems Engineering Guidebook: A Process for Developing Systems and Products*, CRC Press LLC.
- [7] **Voortman C.**, June 2003, "The Domino Effect In Supply Chain Management", *SAPICS International Conference*, Sun City.
- [8] **Aberdeen Group**, September 2004, *Supplier Performance Management: What leaders do Differently*, The Supplier Performance Management Report.