The Role of Advanced Planning & Scheduling (APS) software in a Supply Chain

Summary: A supply chain's success is heavily dependent on the right planning and information flow within and outside the boundaries of the supply chain. One of the enablers for this is an 'Advanced Planning & Scheduling' system also known as APS. This article investigates what an APS is and tries to give an overview of the system along with certain examples.

Introduction - The supply chain along with its various entities and flows is very much related to the human body with the various entities like factories, retailers, etc similar to the various body parts. In the case of the supply chain, the flow of information and physical assets is similar to the flow of blood. A good IT enabled supply chain would be like the nervous system in the human body, which is very vast and so interconnected that if there is a slight stimulus, there is an immediate response. Similarly in a well-informed supply chain, even a slight change in the customer demand (stimulus) would initiate a quick decision enabling the response to the demand. This is where typical supply chain attributes like faster turnaround times and immediate information dissemination come into prominence. Information can be of two types, one is the typical transactional or operational type of information, which can be used in daily decision-making. E.g. Enterprise Resource Planning (ERP) systems. The other is tactical or strategic information which can aid in decision making in the long run. E.g. Advanced Planning & Scheduling (APS)

Advanced Planning & Scheduling (APS) – We all know that ERP systems are being used in many organizations. ERP helps in integrating all 'functional' aspects of the supply chain with regards to transactions. For example in a manufacturing scenario, it integrates production, procurement and distribution. But ERP has certain weaknesses viz. The focus is on transactions between departments of the company and therefore it neglects a more comprehensive focus. Also the planning approach is time consuming and it considers demand, capacities and capital separately. Thus it does not take a holistic view while planning. And although simulation capabilities are present in ERP systems, they are limited. For a beginner, there might seem to be much of a difference between ERP and APS systems since the logical argument would be that ERP also considers the entire functions in a company. So really, what's the difference? The description of I2's Rhythm product line (found at http://www.i2.com) gives the answer: "RHYTHM's Supply Chain Planner provides advanced planning capabilities to leading companies in many industries. RHYTHM plans and optimizes the supply chain as a continuous and seamless activity that integrates all planning functions across the supply chain. RHYTHM goes beyond traditional planning solutions like MRP (Manufacturing Resource Planning) and DRP (Distribution Resource Planning) by simultaneously considering demand, capacity and material constraints." This provides a better idea of the chief differences between ERP and APS systems. APS if successful will result in tremendous savings in tied up capital, and will ensure competitive advantage by making the supply chain more responsive to changes in demand.

Advanced Planning & Scheduling (APS) is basically a software package, which is more of a planning tool in the sense that it uses data from the ERP or legacy systems for planning and scheduling operations. In some cases, it can also be used for strategic decision making in the supply chain like supply chain network design whereby the efficient locations for the production/distribution facilities are determined using APS. Thus it is a tool used for strategic, tactical as well as operational planning. APS involves more than just handling orders and transactions, because of their capability to realize bottlenecks in advance, evaluate alternative modes of operations and therefore reduce costs and improve profits. Simulations and what-if capabilities help the APS in planning in advance and enable companies to reduce planning lead times. Also unlike ERP, an APS has few users who are SCM specialists in the organization (ie. People who are more into planning). APS users also need to be well versed in supply chain concepts so as to appreciate the benefits of APS. They have to work in conjunction with the ERP or legacy system planners to maximize the benefits accrued from using APS.

Thus APS is:

- A decision support tool for managing throughput, inventory and order/demand management
- A modeling technology that enables the supply chain planning process by:
- Modeling “What If” scenarios to solve problems
- Incorporating resource and capacity constraints
- Optimizing plans and schedules around those constraints

APS is NOT:

- A smart ERP system or execution system
- Will not manage entire bill of Materials
- Will not replace financial functions
- Will not maintain inventory movements and position
- Receipts for purchase and production orders
- Issue to production orders

A typical APS system would be divided into four modules:-

1) Demand Planning
2) Supply Network Planning
3) Transportation Planning & Vehicle Scheduling
4) Production Planning
5) Global Order Promising
6) Collaboration and monitoring

Architecture of an APS system – An APS system typically consists of a database server where the data resides. It also has an application server, a presentation server and a huge memory server (similar to RAM in computers). This helps it to take the data to the memory server and then perform calculations and then transfer it back to the database server. This has a huge implication in terms of performing calculations quickly. In addition there is an optimization server to solve complex calculations. Thus there is a lot of interaction between the various servers

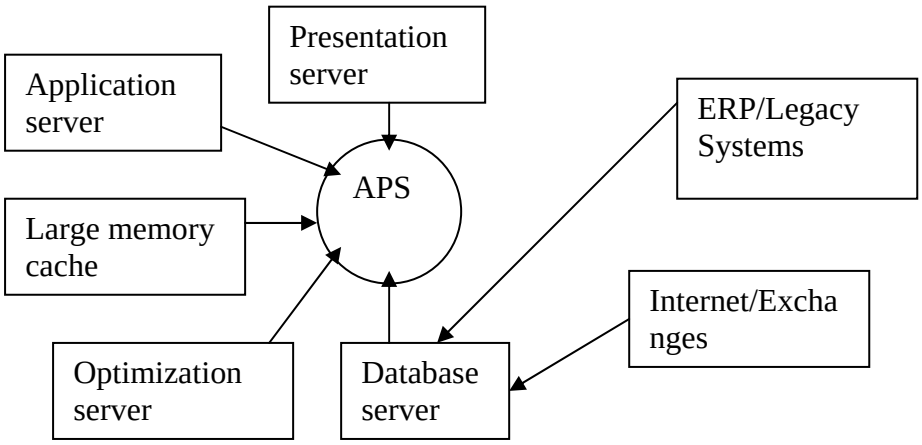

Fig 1. Architecture of an APS

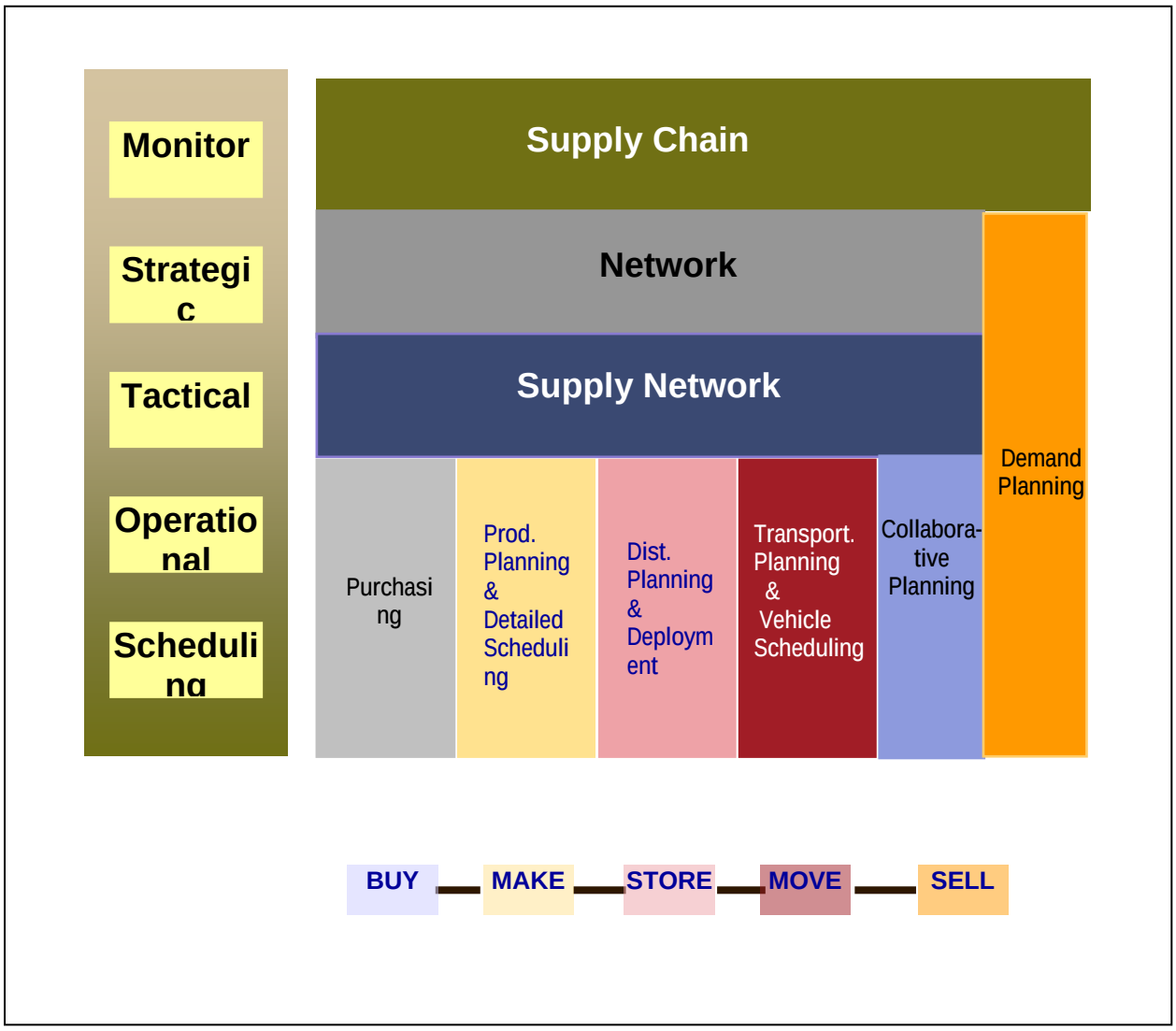

Fig 2. SAP APO (a typical APS system)

Let us look at each of the four modules in a little more detail.

1**) Demand Planning** – *Demand Planning* is concerned with that end of the supply chain which is near to the final customer. This module helps a planner to use statistical forecasts and do promotional planning so as to come up with a demand plan. Market intelligence is also factored here and it is a good means for collaborative planning between different entities in the supply chain. For example SAP APO makes use of what are known as 'planning books', which have functions for the various entities like distributor, retailer to enter their own demand. The demand is thus collated and a final demand figure is available for the whole supply chain based on the final decision of the entities. Thus Demand Planning is more of a tactical tool.

2) **Supply Network Planning (SNP)** – *Supply Network Planning* (SNP) integrates purchasing, manufacturing, distribution, and transportation so that comprehensive tactical planning and sourcing decisions can be simulated and implemented on the basis of a single, global consistent model. SNP uses advanced optimization techniques, based on constraints and penalties, to plan product flow along the supply chain. The result is optimal purchasing, production, and distribution decisions; reduced order fulfillment times and inventory levels; and improved customer service. Starting from a sales plan, SNP determines a permissible short- to medium-term plan for fulfilling the estimated sales volumes. This plan covers both the quantities that must be transported between two locations (for example, distribution center to customer or production plant to distribution center), and the quantities to be produced and procured. When making a recommendation, SNP compares all logistical activities to the available capacity. The Deployment function in SNP determines how and when inventory should be deployed to distribution centers, customers, and vendor-managed inventory accounts. It produces optimized distribution plans based on constraints (such as transportation capacities) and business rules (such as minimum cost approach, or replenishment strategies).

3) **Transportation Planning & Vehicle Scheduling** – The module *Transportation Planning & Vehicle Scheduling* is concerned with planning for transportation once there is stock available for deployment. This module tries to do load balancing with the available transport capacity. It tries to maximizes transport capacities by optimizing load building. The Vehicle Routing capability helps in optimization of routing.

4**) Production Planning & Scheduling** - The module *Production Planning and Scheduling* (PPS) enables you to plan production in a plant while taking into account product and capacity constraints with the goal of increasing throughput and reducing product stock. The result of planning is a feasible production plan.

PPS supports you in the creation of a production plan based on planned requirements. It also can be used to schedule sales orders that come in with short notice with desired delivery dates that lie in the near future.
The advantages of using the component include:

- Higher degree of customer satisfaction because desired delivery dates are met
- Increased throughput of products based on better resource coordination
- Reduced inventory carry costs because the work in process inventory is reduced as a result of better coordination of product release

5) **Global Order Monitoring** – *Global Order Monitoring (GOM)* is used to know how quickly an order can be fulfilled and from where and when it can be fulfilled. For example if a customer order requests for a part, GOM will look whether that part is in stock first, if not then it looks at other locations, if still not present then it issues a production order and updates the customer as to when the order can be fulfilled. Thus GOM will try to fulfill the order quickly. In some case GOM is modified so that the order is filled immediately with minimum costs. This is known as Profitable to Promise.

6) **Collaboration and monitoring** - *Collaboration and monitoring* is more concerned with features for collaborative planning. This can be done with the help of common planning books, internet exchanges. Monitoring involves certain metrics for assessing supply chain performance. Thus standardized metrics are set in place and an alert is sounded every time there is a violation of the set value for the metric. For example, if the backlog is to be no more than 5 days, and if there is a backlog of 6 days, then the system throws up an alert. Users can monitor these alerts and can take actions on it.

In addition to the above six modules, an APS will also have a strategic supply chain planning component, amongst which is the typical problem of designing the supply chain with regards to the optimal location of factories, distribution centers, etc. These tools generally have advanced simulation capabilities and generally require a lot of data to get meaningful results.

Groundwork before installation of APS – Since an APS is a costly package there needs to be a proper justification before it can be finally bought and installed. Thus the whole procedure is similar to a DMAIC project except that there is no statistics involved Many APS providers along with the clients do a supply chain opportunity assessment whereby the need for APS is justified. This is very much like the Define Phase in DMAIC. The 'Measure' Phase involves preparing a business blueprint of the various processes and functions with the constraints involved in the process. The 'Analyze' phase involves benchmarking the process, which means a 'To-Be' process map is chalked out. An ROI justification is also carried out for installation of APS. The 'Improve' phase would roughly involve the installation, testing for APS. Finally '*Control'* involves preparation of SOPs, FMEA, team helpdesk to ensure that the software functions smoothly.

Pitfalls of APS – It must be remembered that APS is not a software which will solve all supply chain problems at the click of a few buttons. There are many issues which contribute to failure despite having an APS system in place. Let us look at a few:-

1) Data integrity – One of the nightmares for a successful APS installation is the level of data integrity. It is pointless to work with expensive software if the data to work upon is wrong. This will give the wrong answers by the right software.
2) Communication with legacy systems – This proves to be a litmus test for selecting a good APS. A good APS will be able to 'talk' to other legacy systems. Otherwise software application known as 'middleware' is used to 'talk'. These middleware systems are expensive.
3) Change Management – This is the biggest and the most important factor that ultimately decides the success or failure of an APS system. People should be made aware of their roles and responsibilities. The buy in of various departments need to be obtained if the implementation is to be successful.
4) Organizational alignment – the organization should be aligned with the goals and objectives of SCM strategy. This would involve organization realignment as well as definition of standardized metrics.

APS vendors – Some of the well know APS are:-

1) i2 Technologies – Rhythm
2) SAP – SAP APO
3) Manugistics – Manugistics supply chain suite
4) Numetrix – Schedulex
5) Oracle – Oracle APS

The effectiveness of the above vendors lie in how their packages handle customization. Also integration with legacy systems is a key factor. Finally, reporting capabilities also play a huge role in deciding the vendor to be chosen. A particular APS suite may be chosen because of many factors like easy integration with the existing legacy systems, better ROI (calculated),

Conclusions – We have seen that the advantages of APS would be:-

- Planning cycle time reduction
- Reduction in costs due to simulation, 'what-if' capabilities
- Integrating companies in the supply chain
- Simultaneous planning of the problem to reach a synchronized sales, procurement, distribution and transport planning across the supply chain.

These advantages could vanish quickly or may not be realized fully if there is no plan for tackling the pitfalls mentioned in the article. Also, an APS may not be able to fully replace the experience of a good planner and hence the inputs to the APS and the data integrity are of utmost importance. The more the data, the better the results. Having said that the next part shall focus on how an APS implementation was done in an organization in India.

Summary:-

The role of IT in a well-informed supply chain is very much like the nervous system in a human body, which generates a rapid response in response to a stimulus. It is here that Advanced Planning & Scheduling Systems better known as APS play a

key role. An APS is different from a traditional ERP (Enterprise Resource Planning) system in that is uses advanced planning techniques and tries to optimize the supply chain as a continuous and seamless activity that integrates all planning functions across it. Thus it is more of a planning tool than a transactional tool and is armed with superior 'what-if' capabilities, simulation tools as well as different 'modules' for different industries. The advantage of having APS is that it can do concurrent planning for the supply chain as opposed to sequential planning. Also unlike ERP, APS will need dedicated users who are well versed in supply chain concepts.

A typical APS architecture will basically have a database server, an application server, a presentation server, an optimization server (to perform complex calculations) and a huge memory cache where the data resides for a short time while calculations are being performed. It is then sent back to the database server. The memory cache thus functions similar to a RAM in a computer thus saving on computation time. An APS will generally have six modules:-

- Demand planning
- Supply network planning
- Transport planning and vehicle routing
- Production planning & Scheduling
- Global Order Management
- Collaboration and Monitoring

In addition to the above, it also has a strategic network planning tool which helps the decision maker in deciding the optimal location of facilities for the supply chain network. All these modules are tightly integrated so that the supply chain entities can change their plans according to the needs of the market and this change can be seamlessly integrated across all the modules. Some well known vendors for APS are:-

1) i2 – Rhythm suite
2) SAP – Advanced Planner & Optimizer (APO)
3) Manugistics Inc. – NetWorks
4) Numetrix – Schedulex

The effectiveness of the above vendors lie in how their packages handle customization. Also integration with legacy systems is a key factor. Finally, reporting capabilities also play a huge role in deciding the vendor to be chosen.

Since an APS is an expensive package there usually is a cost benefit analysis. The installation and running of APS is construed as a project which can be roughly modeled on the lines of a 6 sigma DMAIC project. '*Define'* would involve justifying the need for the project for supply chain excellence. '*Measure'* involves preparing a business blueprint of the existing supply chain processes and measuring the present performance eg. Inventory turns are at present 6. '*Analyze'* involves benchmarking against best-in-class performance and defining the 'To-Be' process. '*Improve'* involves installation and testing of the APS software. Finally '*Control'* involves preparation of SOPs, FMEA, team helpdesk to ensure that the software functions smoothly.

Not all companies going for APS installations have reported success, the most famous (or rather infamous) amongst them being Nike, which discovered a glitch in its i2 Demand planning software. The problem with most companies is that they feel that an APS is a silver bullet. Unfortunately an APS cannot improve your basic processes. For example if the lead time is 10 days, then the APS will work having this hard constraint of 10 days. It cannot suggest ways and means to improve upon the lead time. A very important prerequisite in installing APS is that the data is accurate, otherwise one can get erroneous results. A third reason why most APS installations

are not successful is the lack of proper communication with the legacy systems. Finally the biggest challenge for APS is the organizational and change management issue. The organization should be aligned to SCM objectives and there should be a buy in of important entities in the supply chain if APS is to be successful. Further the metrics to decide the performance of the supply chain should be aligned such that a holistic view is taken as opposed to metrics focusing on functional performance.

In conclusion it can be said that an APS system is a great tool in planning for supply chain effectiveness. But as with any software system, there needs to be a proper plan in place before installation as well as a diagnosis of the supply chain and a road map needs to be made justifying the need for APS. The 'To-Be' process should be mapped in the APS. An APS installation project is similar to a DMAIC project and hence needs to be monitored even after installation. Having seen what an APS is, the next part in the series will see s case study on how an APS project was carried out in an automotive organization.

About the author: Nikhil Muzumdar is a post graduate from IIT Bombay and specializes in supply chain management. He has over 5 years of experience in various aspects of supply chain management. His main interests lie in the supply chain analytics whereby one develops analytical solutions for tackling the problems of any supply chain. He can be contacted at : nikhil.muzumdar@gecisglobal.com