



# Advanced Planning and Scheduling

## in the High Tech industry

Planning & control solutions  
in leading organisations

An EyeOn white paper



# Advanced Planning and Scheduling in the High Tech industry

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Our special recognition goes to the members of the high-tech and electronics network. The white paper reflects the findings of interviews with the 26 participating companies.

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# Summary

*Advanced Planning and Scheduling has evolved from software developers and academics trying to address the limitations of ERP systems. Compared to these traditional planning systems, APS systems offer the advantage that plans can be optimized within the boundaries of material and capacity constraints.*

From research among high tech companies on these APS systems, EyeOn draws three main conclusions:

1. SAP is likely to grow further over the coming years as the dominant planning solution in the high tech industry, even though satisfaction levels for SAP APO are typically lower than those for i2.
2. Most high tech companies are not looking for planning optimization. Instead, they desire integrated visibility, allowing them to quickly judge the consequences of their planning decisions to various organizational units.
3. Implementing an APS system will only be successful if a certain level of organizational excellence has been achieved. Focus areas include master data maintenance, knowledge management, and discipline in planning process execution.

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# Introduction

*The complexity of planning processes make that high tech companies cannot do without appropriate IT tools. Over the past decades, planning systems have evolved from elementary, standalone tools to the fully integrated ERP systems that most companies have in place today. Although this was a long journey, these current planning tools have their limitations and do not provide the ultimate planning functionality. At the same time, many companies are still struggling to get the most out of their ERP system.*

Advanced Planning Systems (APS) are promoted as the promise of the future for the support of planning functions. These high expectations raise a number of questions. What is advanced in Advanced Planning Systems? What is the added value of APS compared to conventional planning tools? How far are companies in the High Tech and Electronics industry in implementing APS systems? How can companies judge whether APS is a sensible next move? What are experiences in the industry with implementation tactics?

To provide an answer to these questions, EyeOn conducted a research amongst 26 members of the EyeOn High Tech Network. The research consisted of a literature review followed by face-to-face interviews and a plenary validation session. Participating companies cover all parts of the high tech value chain.

This white paper gives a summary of the research findings: placing APS systems in their context, giving insight into the current trends in the industry and providing useful guidelines for companies that are considering an APS implementation.

## Participating companies:

Alcatel	Logitech
Apple	MediaMotion
Arrow	Navteq
ASM Europe	Neways
ASML	Nokia Siemens
Assembléon	NXP Semiconductors
Bosch Security	Océ
Canon	Omron
Ferro	Philips Consumer Lifestyle
Fujitsu Siemens	Philips Healthcare
Hewlett Packard	Thomson
Infineon	Tyco Electronics
Lexmark	Vanderlande Industries

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# APS in context

*There is quite some confusion of what APS actually is or what it should do. This section is intended to lift some of the fog around this subject.*

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## Historical background of planning systems

Planning support systems have come a long way. New developments and innovative approaches have typically been thought out at universities and only became common practice in the business world after ten to twenty years. Let's look at an overview of what happened in planning over the past decades. Before 1950, planning was done manually. Computers were not yet applied to planning issues. During the 50's, the first attempt was undertaken to make the life of a planner easier: spreadsheets saw the light. The concept of Material Requirements Planning (MRP) was developed in the 60's, together with major advancement in Operations Research techniques. Although MRP was yet to be used in practice, the concept extended to MRP II: Manufacturing Resource Planning, which took the basic algorithm of MRP, but included feedback loops at various aggregation levels in which capacity feasibility was checked. This happened in the 70's, which was the decade that also brought the first, be it limited, application of planning theory into practice. In the 80's, MRP further evolved into ERP: planning systems with a much wider scope, including purchasing, HR, finance and marketing. But another development in the 80's would probably have a much bigger impact: computing power became dramatically cheaper. This led to a widespread application of MRP (and ERP) systems. Over the past fifteen years, ERP systems became further enhanced and extended their functional scope. At the same time, planning experts began to acknowledge their limitations when it comes to what it was all about in the first place: the support of planning decisions. Universities started working on a new generation of tooling that would overcome these limitations, a generation that would become known as Advanced Planning and Scheduling systems: APS.

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## Defining APS

Defining APS is not an easy task as there is no unambiguous definition of the term. There is even misunderstanding on whether it refers to a system (Advanced Planning System) or a process (Advanced Planning and Scheduling). In this paper we see APS as a planning system that is aimed at better supporting complex planning decision making. But even if we choose to see APS as a software system, there are many different opinions on APS and many overlapping concepts. If you were to ask the software vendors how they see APS in relation to ERP, you would get different answers depending on who you ask. Traditional ERP vendors like SAP will state that APS should be seen as a bolt-on to ERP. A separate module that will help your company improve the effectiveness of planning processes on top of the traditional ERP system. In contrast, vendors that only sell APS systems will tell you that APS is a completely new technology that solves problems ERP failed to solve. Taking an independent stance, we prefer the first view. Whether it comes from a company specializing in APS or from an ERP vendor, APS systems do not replace ERP. Instead, companies still use ERP for all of its wide-ranging purposes and install an APS solution specifically dedicated to planning.

Therefore, perhaps the best way to understand planning in APS is to compare it to traditional planning in ERP. The key word here is optimization. The MRP approach to planning is to calculate material requirements first, assuming infinite capacity. Next, the required capacity is calculated. If the MRP outcome does not fit within the boundaries of capacity (the plan is not feasible), you will have to make adjustments and start over again. This stepwise approach is simple but cumbersome. It also doesn't tell you what changes you should make: the plan doesn't fit but which of the products do you prefer to produce over others? In contrast, APS systems plan material requirements and capacity simultaneously. This way, the outcome of a planning run is always feasible. But APS claims to do more: the plan is not only

	ERP	APS
Planning goal	Feasible plan	Optimal plan
Planning approach	Material requirements and capacity planned in sequence.	Material requirements and capacity planned simultaneously.
Scope	Company	Supply chain
Functional focus	Wide: Purchasing, Manufacturing, HR, Distribution, Finance, Marketing	Narrow: Planning processes
Supported processes	Operational planning and operational execution	Strategic, tactical and operational planning
Optimization	No	Yes
Planning speed	Low	High
What-if simulation	Limited	High
Lead times	More or less static	Dynamic

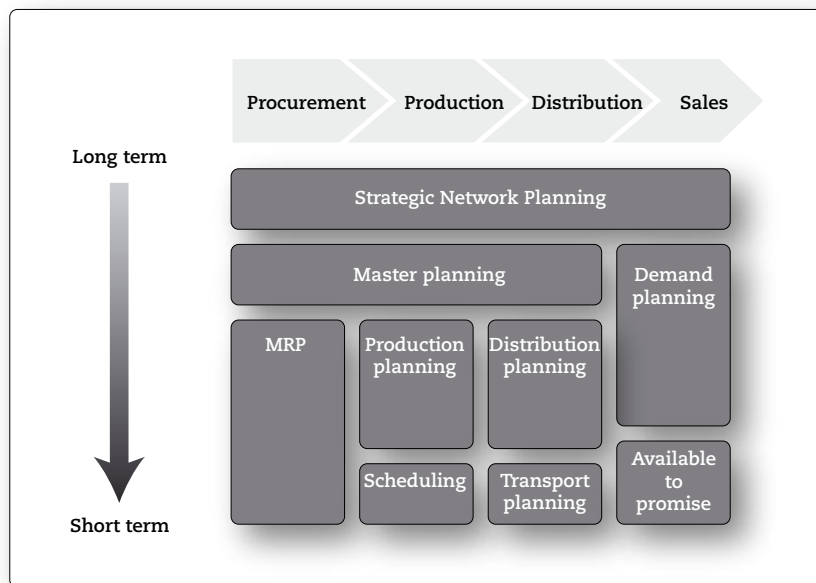
feasible, it is optimal. Within the capacity constraints, APS has calculated for you what the optimal solution for your plan is. In short: MRP tells you what is going on, APS tells you what should be going on.

But there is more. Because APS systems are capable of running a plan much faster compared to MRP, they are also much better suited to adapt to changes in demand, resource capacity or material availability. It even allows a planning department to simulate different scenarios. Typically, an APS system is capable of planning over multiple stages in a supply chain and will support planning on multiple levels (strategic, tactical and operational).

### APS: Three different perspectives

To most people, an APS system is a black box. However, there are several ways to look at this black box. We choose to highlight the three that we think are most relevant. They may be slightly exaggerated, but that will help you see our point.

The terminology used for different planning levels over different functional areas (procurement, production, distribution and sales) is summarized in the planning matrix.





### **The corporate buyers: using the black box**

This is you. Your company might be evaluating whether or not to implement an APS system or might even already have made the first steps to utilizing the potential of APS. The goal of your company will be to gain maximal benefit from an APS system with minimal investment and complexity. Companies have a strong preference for simple tools that work above complex solutions that nobody really understands. APS is a black box, and that's fine as long as it works. For that reason, even companies with considerable experience tend to use only a small part of all available functionality. Instead of focusing on the system solution, companies spend their effort in organization and processes around planning.



### **The software vendors: selling the black box**

Finally, the perspective of the software vendors is quite clear. APS is a growing market in which competition is fierce. Consequently, the goal of a software vendor is to gain market share as quickly as possible. Their focus is not on the underlying algorithms, nor on the organizational context in which these solutions should be used, but on time to market and functional coverage. They will tell you there are endless possibilities and that's probably not far from the truth. But the real challenge is for you to pick those that will help you solve your planning problems.



### **The academic world: perfecting the black box**

As opposed to corporate buyers, researchers actually do open the black box to see what's inside. And they always seem to find some blank spots. So the goal of an academic researcher is to find algorithms for business situations that are not covered yet and to further improve existing algorithms. A search in an operations management database will give you hundreds of articles describing mathematical models solving specific planning problems. Research groups are focusing on models and algorithms and hardly any research has been done yet on how these are used in practice.



In the next section, we will consider the use of APS systems in high tech companies today.

# APS in practice

As the use of APS systems is gaining foothold in the high tech industry, we set out to answer two questions: what are the main players in the field of APS systems and what are currently the trends in the industry when it comes to planning systems?

## The APS landscape

APS vendors come in two varieties: those who provide traditional ERP packages and those who offer APS as a specialized solution. The biggest ERP player in high tech is the German software giant SAP, which offers APO (Advanced Planner and Optimizer) as its supply chain planning module. Competitors of SAP include Oracle, which acquired Demantra in June 2006 and JDA, which also bought a software company to offer an APS solution in 2006: Manugistics.

The main specialized APS vendor is i2 Technologies, having competition from a number of companies, including Adexa and Infor.

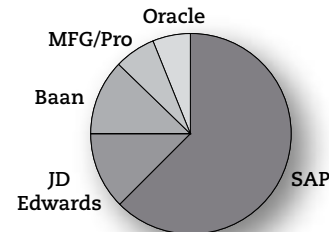


## Planning systems in high tech companies

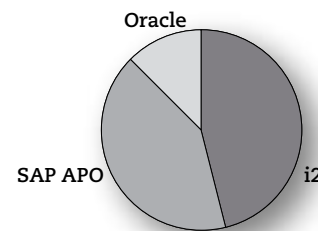
The high tech companies that we interviewed for this paper use four planning systems on average. There are many differences between the companies, but there is one thing that they all share when it comes to planning systems: they use Microsoft Excel for part of their planning support.

All of them have an ERP system to support their operations, SAP being by far the most dominant vendor. Of all the ERP systems, only SAP and Oracle can be expected to be around in a couple of years. Their implementations were more recent compared to the others and

almost all companies running JD Edwards, Baan or MFG/Pro have plans to replace their system.



Of the participating companies, 35% have implemented some functionality of an APS system. Most of these have implemented the demand planning modules only, and are thinking of including strategic network planning and production scheduling functions. Of these implementations, SAP and i2 share almost 90%, leaving the rest to Oracle.



i2 can be expected to lose ground to SAP APO, although it scores better in terms of customer satisfaction. Most companies using i2 are considering replacement, while all SAP APO buyers are planning further roll out (as Oracle buyers are).

How can SAP APO be gaining market share while i2 gets better ratings from its customers? These are what we consider the main reasons:

- Many companies apply an 'SAP centric' strategy: SAP unless
- License cost of i2 are high compared to SAP APO, with SAP offering very low prices for APO while at the same time limiting system support for the planning functionality in their traditional R/3 ERP environment
- The availability of skilled i2 resources is

- relatively limited
- For companies using SAP ERP, the integration of i2 is more difficult compared to SAP APO
- i2 suffers from failed projects in the past (although APO benefits are yet to be proved)

Many high tech companies are currently enhancing their IT architectures. This is mainly driven by the need to integrate various geographical kernels and to standardize business processes. In the process, many companies are reviewing their offline and homegrown tools as data integration and system support for these tools is more and more becoming an issue. Also, when these tools were built, the standard solutions didn't meet the requirements but this gap is closing over time as companies have learnt to define their requirements better and software providers have improved their packages.

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## **What high tech companies really need**

When we asked companies what functional needs they had on top of their wish lists, it came out only some of the typical APS offerings are in demand: constrained planning and the possibility to quickly simulate different scenarios.

Optimization, the main point of interest for academic researchers and supposedly a strong selling point of APS compared to ERP based planning, hardly raises the interest of high tech companies. The general agreement is that it is too much of a black box, giving a 'optimal' solution that is highly depending on correctness of the inputs and impossible for a planner to validate.

On the contrary, the key requirement that most companies have is a better way to support the management of their margins. An APS system however offers no help to oversee the consequences of planning decisions for margins. In general, companies are struggling much more to reach integrated visibility than they are interested in optimizing their planning.

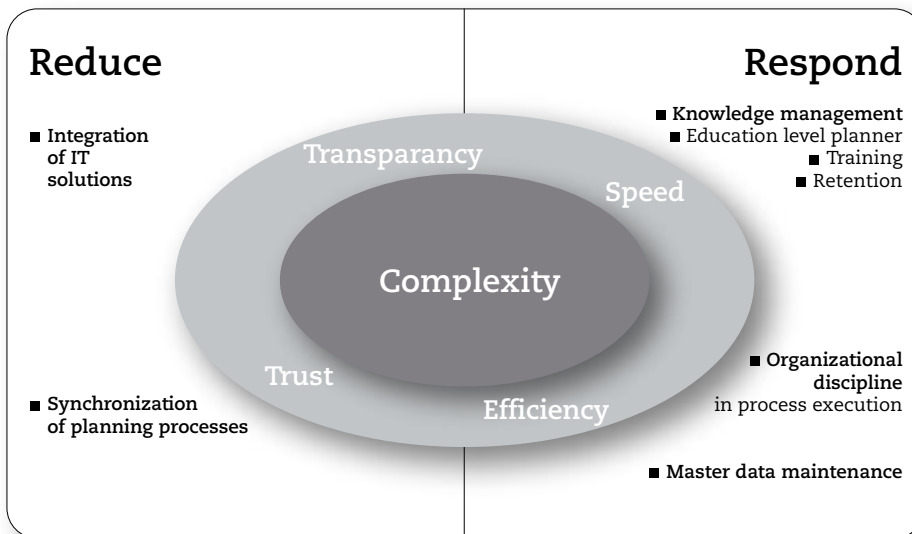
# Considering APS?

Is your company considering implementation or enhancement of an APS solution? This section tries to help you find the answer to two crucial questions: how can APS help you and to what extent is your company ready for it?

## Can APS help you fight your challenges?

The overarching challenge that high tech companies face today when it comes to planning is ever increasing planning complexity. The production of high tech goods typically involves a high number of components and many manufacturing tasks. Production processes are capital intensive and volatile market conditions necessitate frequent planning and schedule changes that are hard to predict. A company two basic options when faced with this complexity challenge: try to reduce avoidable complexity and accept inevitable complexity but respond to it in the best possible way. Avoidable complexity in planning includes the often scattered system landscape that makes it difficult to integrate data. This can actually be one of the reasons to implement an APS system, replacing a self-built solution. Unsynchronized planning processes make another source of unnecessary complexity. Many companies are working to synchronize their planning processes over various

horizons and functional scopes. Both efforts are aimed at reducing complexity in planning. When it comes to responding to complexity, companies are focusing on the knowledge level of the planners. This includes the education level for new hires as well as training programs. Many companies recognize the need to make sure planners stay in their planning position longer so that their specific knowledge is better preserved. Another improvement area is organizational discipline in process execution. If you have to respond quickly and efficiently, you better make sure everybody knows what needs to be done when in the process. Therefore it's vital that roles and responsibilities are clear, people adhere to a tight planning schedule and make their deadlines and process details are communicated clearly and consistently. Getting this discipline in place and keeping it alive requires constant management attention. A further main point of notice for many companies is the quality of the master data. A lot of companies have started initiatives to improve the reliability of their data.



Most of the challenges companies face in relation to increasing complexity cannot as such be solved by implementing an APS system. Instead, we view synchronized processes, knowledgeable people, organizational discipline and solid master data management as prerequisites to successful implementation. If you have them in place, an APS system can become part of your solution in dealing with the complexity challenge. If not, the APS system will most probably become part of your problem. Why? In comparison to conventional ERP planning, APS requires even more knowledgeable people, puts even more strain on process synchronization and organizational discipline and will demand even more master data to be maintained.

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## Is your company ready for APS?

So how do you know whether this might be the right time for your company to start thinking about a full fledged APS roll out? A simple test can give you a hint. Consider the following ten statements and assess your company on them:

1. People almost never complain about the accuracy of master data in your planning systems.
2. If you review a report containing transactional data (inventory levels, actual sales, WIP, etc) you can always fully rely on the figures.
3. Cost and profits in the system on which decisions are based (eg holding cost, stockout cost, setup cost) are fully understood and give a fair representation of the actual situation.
4. You trust the system and almost never cross-check and verify the production bill of material, routings and process descriptions.
5. Struggles with incomplete and/or inaccurate master data settings are a thing from the past.
6. The same problems or issues rarely repeat themselves.
7. A typical working day for a supply chain planner seldom starts with fire fighting or urgent dispatching decisions.
8. A decision making task can be started and finished without interruption (e.g.

- developing a sequence, resequencing, etc).
9. Most of the day is actually spent planning and scheduling for the future, versus reacting and deciding about what is going on today.
10. A short-term planned sequence or decision rarely ever has to be changed (eg instead of doing ABC next, do DEF).

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## Implementation learnings

If you think your company stands the test, the next section will give you some guidelines on how to make sure you implement an APS system successfully. The companies that have hands-on experience with APS systems have shared with us the learnings they encountered.

### Before you begin

- Don't underestimate the effort
- First standardize processes, then tools
- Make sure processes are under control and understood
- A lot of knowledge is required, both internal and external
- The APS should support the planner, not replace him/her!

### Moving ahead

- Work with most knowledgeable people
- Involve planners from the start to avoid mistrust
- Use an iterative, phased approach
- Customized interfaces are generally unavoidable
- Focus on creating visibility instead of complexity
- Try to stick with the standard solution as much as possible

### When it flies

- Ensure proper documentation
- Embed the tool, the real work comes after go-live!
- A lot of effort is often spent in understanding the planning outputs
- Keep the implementation team available

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## About EyeOn

Within 100 days EyeOn will supply structural improvements in terms of the speed, efficiency, and output reliability of planning processes. EyeOn is a consulting firm specialized in designing and implementing planning solutions in complex organizations.

For more information: [www.eyeon.nl](http://www.eyeon.nl)

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## About the knowledge network

The EyeOn High Tech Network offers professionals a learning network on contemporary trends and best practices in planning and forecasting within the High Tech and Electronics industry. It enables members of over 40 participating companies to share experiences and learn from each other through research, presentations and benchmark studies. EyeOn initiated the network in June 2005. Members meet twice a year on a network event at Croy Castle, Aarle-Rixtel.

Participants include: Acer, Alcatel-Lucent, Apple, Arrow, ASML, ASM, Assembléon, Avnet, Bosch, Canon, Dell, Epson, FEI, Ferro, Flextronics, Freescale Semiconductors, Fujitsu-Siemens, Harman, Hewlett-Packard, Imation, Infineon, KPN Mobile, Lexmark, Logitech, MediaMotion, Motorola, Navteq, Neways, Nokia-Siemens, Numonyx, Omron, Panalytical, Philips Consumer Lifestyle, Philips Healthcare, Pioneer, NXP Semiconductors, Siemens, STMicroelectronics, Thomson, Tyco Electronics, Vanderlande Industries, Vodafone and Vogel's.



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