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Introduction

Modern manufacturing companies must manage, coordinate, and synchronize numerous activities to perform operations successfully in today's competitive global marketplace. The scheduling challenges that they face make it extremely difficult for even advanced algorithmic based systems to actually meet and solve every situation that can affect the throughput rates, supply chain maintenance, and quality control procedures which are required for ideal efficiency and maximum profitability.

Production facilities need scheduling tools that have the power to facilitate the lean manufacturing principles that characterize the most successful assemblage operations, with system solutions that offer compelling visualization and adaptive controls that respond to the constant stream of variables that daily bombard production operations managers. These scheduling tools must be able to also allow a natural lack of definition in the schedule rather than just optimizing by following clear (but often artificial) "black-and-white" rules. Incorporating a visual element into current or proposed ERP, APS, or MES solutions allows the users not only to benefit from superior algorithmic scheduling solutions and extensive domain expertise, but also from user controlled, drag and drop features which are imminently useful for achieving and maintaining lean production goals.

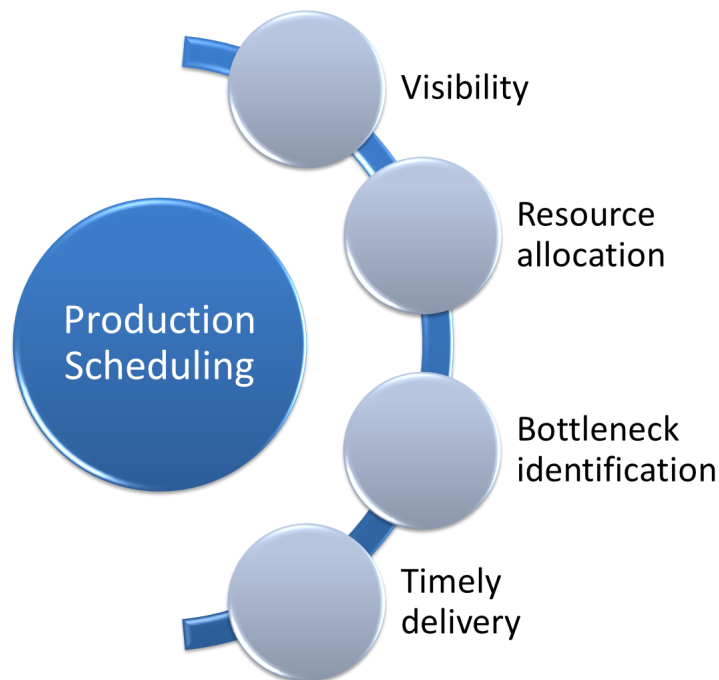
"These scheduling tools must be able to also allow a natural lack of definition in the schedule rather than just optimizing by following clear (but often artificial) "black-and-white" rules."

Manufacturing companies must orchestrate operations within singularly slim profit margins. By simplifying production schedules with visual Gantt chart technology embedded in the system, ERP, APS or MES solutions can get enhanced with intelligent, intuitive features, which provide more a powerful, effective tool for manufacturing users. One that offers practical management applications for controlling production activities with greater precision and accuracy, as well as streamlining the supply chain, assemblage and shipping procedures, consequently establishing significant reductions in labor inefficiencies and inventory wastes.

Scheduling Challenges

1. Overview

Production scheduling is an essential process of every manufacturing company. It has an immediate impact both on the top and the bottom line of any manufacturer. The complexity of both supply and demand networks and of production processes has been ever increasing. Hence, production scheduling seems to always face one or more of the below challenges.



Many initiatives had been started to address these challenges. Many production scheduling software solutions had been invented and developed to master these challenges. Independent of how sophisticated they are, all of them share one element: they all include a graphical planning board to visualize the production plan.

Increase Production Planning Visibility. Production planners need to always understand what is happening at the shop floor at any given time. If they do not have proper visibility, they cannot identify problems and cannot take counter measures in time. Typical questions requiring visibility are:

- Will my production order be completed in time?
- How is my resource utilization?
- What is the status of any production order or operation?

This kind of production scheduling visibility typically is achieved with an interactive Gantt chart. The Gantt chart as planning board visualizes the production schedule and provides all relevant information at one glance.

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Optimized Resource Allocation With A Planning Board. The planning board visualizes which operation had been allocated to which resource. It also shows free resources and often also the degree of capacity utilization. However, state-of-the-art Gantt diagrams do not stop at visualizing the schedule. They are interactive and allow the planner to intuitively change the resource allocation by drag and drop operations. Hence, the planner always has control and can make sure that he achieves a maximum utilization of all capacities.

Bottleneck Identification. If the production planning application is based on a proper Gantt chart tool, it includes a histogram to visualize the utilization of all available resources. Typically, a histogram indicates a capacity overload with a signaling color (e.g. red) and hence the manufacturing planner can identify the bottleneck immediately. It is recommended to also provide a planning board view that shows all resources' histograms on one view so that the planner identifies bottlenecks as well as underutilizes capacities.

Keeping Delivery Dates With Gantt Diagrams. Ultimately, the purpose of a thorough production scheduling is to achieve customer satisfaction. One key driver of customer satisfaction is the on-time delivery. With a visual production schedule, manufacturing companies are able to make realistic delivery time commitments to their customers. In addition to this, intelligent Gantt diagrams will alert them in case of delivery time violations.

2. Production Challenges

Even with advanced algorithmic scheduling and planning tools it remains a challenge for manufacturers to optimize production throughput, especially in a make-to-order environment. The lean ideal, “sell one, make one,” is the ultimate goal. However, this ideal requires a very high flexibility of the day-to-day operations and hence of the software tools which should support these operations. Yet many ERP, MRP, and MES systems lack the visualization and user friendly controls that would allow that type of optimization. This is mainly true for two reasons: Many of these solutions still contain functional “black boxes” that prohibit interference. In addition to this, systems working on mathematical algorithms often are based on the (implicit) assumption of perfect data feeding the algorithm. Hence, these systems tend to struggle with dealing with “grey areas”.

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“Black boxes”. Conventional scheduling systems often are hard to understand as the core element – the scheduling algorithm – is a kind of black box. Typically, it requires a massive amount of training to even operate these systems. However, even well trained operators not necessarily understand what is happening when they start the scheduling engine. This makes it hard to impossible to understand and systematically correct operational flaws in the manufacturing process. What makes this even worse: if the scheduling engine is fed with suboptimal data, it generates suboptimal scheduling results. They can hardly be spotted (as users tend to accept the results rather than to understand them), which can result in bottleneck floor operations.

Missing capability to deal with “grey areas”. Manufacturers operating with production planning and scheduling systems that rely solely on sophisticated algorithms often find it difficult to react to, or incorporate unexpected customer changes or alterations on current assembly line operations. For example: Imagine a production order that was planned to finish at the end of the shift. Shortly before starting to work on that order, the customer calls and asks to produce a few more items. An automated system would recognize the shift’s end and would indicate that the order would get finished the next day. In real life, however, it would turn out that it would only require half an hour overtime to complete the order at the originally planned date. These kind of “grey areas” are typically not dealt with properly in automated systems.

Without a compelling visual component, these systems often lack the ability to integrate the scheduling changes needed to optimize production runs, last minute line changeovers, or product substitutions. The difficulties produced from a lack of instant visual access to current floor activities help conceal any costly, inefficient workflows or picking problems that exasperate labor wastes and increase lead times.

3. Supply Chain Challenges

Effectively managing the supply of consumable parts, raw materials, and components needed for the assembly process and then ensuring shipping of completed products consumes an extensive amount of administrative labor for manufacturers. In addition, algorithmic based systems require accurate data input to produce accurate results, either relying heavily on manual input or on automated production data acquisition (PDA). Whereas the manual input is prone to typos and data entry errors that can wreak havoc in the supply chain and generate erroneous results, the PDA often is too cost-intensive especially for small to mid-sized production companies. In many cases, the cost of installing and implementing a proper PDA outweighs the cost of deploying an MRP, APS or MES system.

As outlined earlier, if this kind of data is missing, the automated systems produce suboptimal results which the users do not identify as suboptimal. Visual systems could highlight a lack of data – and as such could also point to issues in the supply chain:

- Without a compelling visual complement to the scheduling and planning system, any count inaccuracies, either in the consumable parts or WIP stock levels can result in inventory shortages that generate costly line down situations and hinder production throughput while compounding labor wastes.
- Overstock items and housed inventory parts accumulate soft costs daily, and the longer they remain unused, the more expensive each item becomes. Controlling the holding costs that compound on stocked parts is essential to lean manufacturing strategies, but without intelligent visualization, operations managers are unable to effectuate turnover rates, manage procurement techniques, and arrange production runs that would significantly limit these costs.
- Discrete manufacturers also face compliance challenges on certain regulated materials or rated parts. Effectively tracking these items through the production process is time-consuming and tedious without compelling visualization, making the mandatory compliance performance difficult

4. Administrative Challenges

Effectively managing production operations to achieve maximum profitability means applying lean strategies in every area of activity and in every resource, including the area of staff labor and administrative personnel. However, with traditional scheduling systems, the effort expended by the administrative staff to manage resources is entirely disproportionate with the outcome.

- Dealing with delayed reporting, multiple task screens, and no composite sketch of the on-going operations contributes to vexatious delays and tedious, repetitious tasks that consume valuable administrative time, which could otherwise be redirected toward more profit centric areas of operation.
- The lack of user accountability within the assembly process creates confusion as well. Without suitable transparency, administrators are unable to correctly identify the source of sluggish or imperfect production points, and must expend additional hours to trace them before implementing any changes that will solve line disruptions.
- The lack of compelling visualization hinders staff abilities to quickly and accurately quote completion and delivery dates for customers, and prevents accurate price comparisons by making it difficult to forecast potential demand, and whether or not the facility has the current resource feasibility or capacity to meet it.

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Visual Scheduling As Answer To The Challenges

Fortunately, the drains to a manufacturer's resources and the various challenges to productivity can be eliminated. With proper visualization techniques embedded into scheduling and planning system, manufacturers can effortlessly incorporate the lean practices that have been proven to generate profitable improvements and have such a positive impact on overall operations.

By transparently displaying scheduling data graphically, which is easy to understand and simple to modify, Gantt charts offer visual management for every area of the production process, from current floor activities to future daily, weekly, and monthly planning and scheduling information. Entirely comprehensible, each data chart can be monitored and utilized to enact lean strategies on an hourly basis, offering manufacturers real solutions for production woes.

1. Discrete manufacturers

Discrete manufacturers can benefit from visual management charts that provide effective tools for improving lead times, reducing wastes, and increasing production capacity, allowing operations managers to quickly confirm current assembly conditions, inventory amounts, and the shop floor status at a glance. Furthermore, procurement issues disappear when the administrative staff can instantly view PO status and inventory levels conjunctively.

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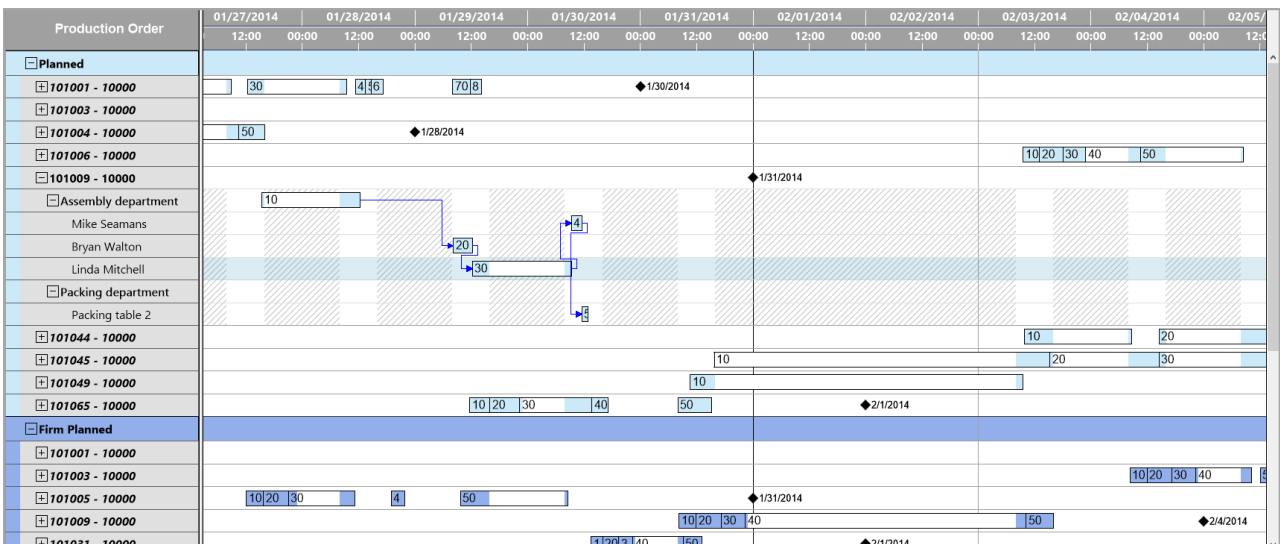
Highly regulated industries, such as aerospace, heavy equipment, and automotive manufacturers utilize rated parts. The fasteners, components, and adhesives used for assembly must conform to stringent industry guidelines that detail the tolerances, specifications, and origins of these items. Consequently, oversight committees and regulatory bodies have the authority to issue hefty fines for non-compliance, and although manufacturers in general purchase and employ the correct parts, tracking procedures very often fail to follow the part through the entire assembly process, which can lead to expensive monetary repercussions.

The ability to integrate procurement information compartmentally adds a valuable tool for controlling inventory levels in discrete manufacturing environments as well. With visual access to current stock counts, purchase orders can be synchronized to reduce over-stock amounts, which are highly susceptible to shrinkage and inhibit facility space, as well as to coordinate delivery times with usage requirements, allowing manufacturers to introduce lean practices such as Just-in-Time replenishment models proven to reduce inventory costs. This type of intelligent visualization also reduces inspection times at the point of receiving by allowing instant access to shipment details and stocking locations.

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Made-to-Order driven production models necessarily face similar, yet more expansive challenges to the planning and scheduling matrix. For lean manufacturing techniques to generate cost savings effectively, alterations and change of orders must be enacted quickly, and seamlessly incorporated into current production schedules.

With intelligent Gantt order charts, the made-to-order process can be streamlined with graphical displays that show each step in production, offering visual management for each specific order, along with a breakdown that correctly corresponds with each order and the relevant tasks required to generate its completion. This type of transparency in the scheduling system enables manufacturers to monitor due dates and effectively alter activities to ensure timely delivery, improving customer satisfaction rates.



Made-to-order facilities rely on repeat business. Intelligent Gantt technology includes visual order charts that feature drag and drop user controls which positively contribute to customer satisfaction. The company's administrators can smoothly assess the feasibility of order alterations, determine whether or not the changes can be accomplished without significant delays, and instantly see if current stock is available to perform the request. By incorporating visual charts that outline current and planned production runs with individual order specifics, manufacturers also have the tools they need to properly, and accurately quote projected order prices and delivery dates at a glance, which reduces labor rates and improves staff efficiency.

Furthermore, Gantt chart technology allows operations managers to view specific days of the week and certain times throughout the day. This feature provides the supervisory staff with keen insight into workflow inefficiencies, allowing them to initiate facility re-configurations that streamline assembly procedures and reduce labor costs. Because Gantt visualization charts contain information that is easy to understand and interpret, it's possible for any employee to ascertain important tasks.

2. Process Manufacturers

Process manufacturers work with raw materials, and therefore operate their production facilities according to demanding strict sanitation guidelines and precisely regulated environmental controls. Visual solutions help maintain proper manufacturing conditions by charting crucial maintenance information within the scheduling system.

The visual component, offered through Gantt chart technology provides an exceptionally productive way to integrate planned maintenance within the daily, weekly, and monthly operating schedules, the simplicity of which prevents unscheduled work stoppages due to quality control issues that are entirely avoidable with regular maintenance and cleaning. In addition, incorporating a visual element makes it very difficult to overlook vital inspection procedures, ensuring governmental or third-party oversight compliance.

Controlling inventory wastes in the process manufacturing environment is another production aspect that can be immediately improved through intelligent visualization. Avoiding costly shrinkage rates through material obsolescence is simplified with Gantt chart solutions that incorporate the relevant spoilage dates and temperature control settings required for each consumable item. By utilizing the integrative features available with drag and drop optimization, operations managers can manipulate production runs to eliminate the shrinkage costs associated with dated materials.

Conclusion

For manufacturers, relying on an algorithmic system, however advanced, which does not incorporate a visual element, but operates solely in accordance with the data introduced, is an only marginally effective method for creating the scheduling and planning solutions that improve operational efficiency and achieve lean production goals. Because essentially, without user controls that allow quick access to line alterations, even the most superior algorithmic based systems lack the necessary applicable solutions that are required to remove the scheduling conflicts produced by order changes, customer alterations, and production change-overs that will effectively reduce overall operational costs.

Furthermore, the inability to manually alter various production schedules according to unforeseen and unanticipated circumstances, coping with a system that features black boxes opposed to readily comprehensible visual graphs, and dealing with misleading or inaccurate results due to data entry errors does little to inspire trust and reliance on the system itself or its developer.

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Just having a strong algorithm is simply not sufficient to achieve the streamlined results manufacturers need to maintain ideal production efficiency. In order to produce effective results the company must also invest in quality data entry techniques as well as the system itself, which for smaller manufacturing operations with a singular focus, creates an added expense that is understandably not practical.

However, any size production facility can realize the manufacturing advantages achieved through intelligent visualization. Gantt chart technology simplifies production scheduling, generating solutions that positively affect every area of production and assembly operation, by providing user friendly, drag and drop controls that effectively minimize inventory and labor wastes, while eliminating down time and any other hindrance to optimum production performance.

By offering your manufacturing clients software options that include intelligent visualization and innovative drag and drop features, you're offering the technical resources that are essential for initiating lean manufacturing strategies throughout the production and assembly process.

“However, any size production facility can realize the manufacturing advantages achieved through intelligent visualization. Gantt chart technology simplifies production scheduling.”

Gantt chart technology incorporated into traditional algorithmic scheduling systems provide a more powerful and intuitive method for improving production scheduling and operation techniques, and it gives your manufacturing clients the instant access to ongoing assembly processes, that can provide a clear, systematic method for evaluating production procedures, current inventory levels, and subsequently responding to unforeseen situations.

With compelling, easy to interpret views that incorporate every facet of the production operation, from procurement to delivery, with Gantt charts, manufacturers have the tools they need to implement effective lean practices in their supply chain, floor operations, and shipping commitments, succinctly providing the framework for effective lean production with a visual solution.

NETRONIC— Gantt Charts for Visual Scheduling

The Aachen (Germany) based NETRONIC is long-term provider of interactive Gantt charts that bring transparency into production, project and process data and improve planning and scheduling of resources, jobs and workflows. Since decades, the Gantt chart is our core competence – resulting in three business lines:

- (1) With the Gantt chart controls VARCHART XGantt and VARCHART JGantt, we address software vendors who typically develop industry-specific planning and scheduling solutions.
- (2) The Visual Production Scheduler, the Visual Jobs Scheduler and the Visual Service Scheduler are for partners and customers of Microsoft Dynamics NAV and provide a fully integrated, intuitive graphical visual scheduling support for the manufacturing, jobs and services module.
- (3) Based on our Gantt know-how, we also develop custom-made scheduling applications for end customers who want to improve their short-term production scheduling.

For more information,

- please visit our [website](#)
- read our [blog](#)
- connect with us on [Facebook](#)
- or follow us on [Twitter](#)

Additional Resources

After reading this whitepaper you now should have gained an idea that sophisticated algorithmic scheduling systems are not the only answer to today's production scheduling challenges. Intelligent visualization can be more than just a supplement to these systems. Visualization helps to create a better imagination, and this alone can become the key to more efficient production process. ...

“ Imagination is more important than knowledge. For while knowledge defines all we currently know and understand, imagination points to all we might yet discover and create. ”
- Albert Einstein

Hence, we highly recommend that you actually start visualizing your production schedule in an intelligent way. Independent, if you are

- A manufacturing company
- A software company developing production scheduling solutions
- A production user of Microsoft Dynamics NAV

we want to help you getting started with intelligent production schedule visualization and offer **to build a complementary Gantt chart prototype** for you.

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