White Paper

[DDMRP in Automotive]

DEMAND DRIVEN
TECHNOLOGIES

DDMRP in Automotive

The automotive industry supply chain is a marvel of human ingenuity and innovation. From the early pioneering days of Henry Ford and his innovative assembly line production concepts, the industry has been at the forefront in the development of supply chain techniques that have become pervasive across a wide range of industry segments. Today's automotive assembly plants are clean, brightly illuminated facilities where materials arrive in close synchronization with the assembly of the vehicles. They are truly a model of production efficiency that results in high quality, reliable vehicles at very affordable prices, especially in contrast to those produced in prior decades.

Automotive suppliers have made similar strides in improving their supply chain operations and performance. Tier 1 suppliers are often responsible for complete systems that are integrated into the vehicle during the assembly process. Given the industry's competitiveness and the low-cost expectations of the Original Equipment Manufacturers (OEMs), Tier 1 suppliers must operate efficient and reliable supply chains to ensure they achieve their customer's expectations while generating a return for their shareholders. Tier 1 suppliers often emulate many of the planning and signaling techniques used by the OEMs for sharing expected supply requirements over the planning horizon and issuing just-in-time order releases in the execution phase of activity.

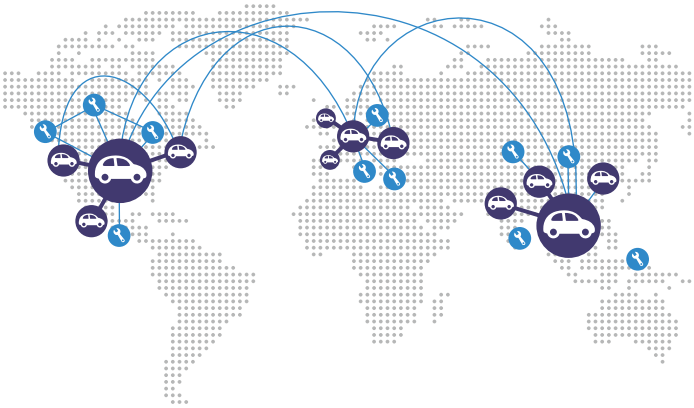
And yet, while the industry has made great strides, there remains substantial opportunity for further improvements in the efficiency of the automotive industry supply chain. Major automotive Tier 1 suppliers are further streamlining their supply chains through the application of Demand Driven Material Requirements Planning (DDMRP) tactics and technology. These implementations are yielding results well beyond the improvements the companies have achieved through the deployment of Lean over the past twenty to thirty years. Implementing DDMRP commonly results in inventory reductions of 20-35% along with reduced spending on expedited freight, which is often required to address supply misalignment. While order fill rates are typically extremely high for the Tier 1 suppliers (who wants to shut down a GM assembly line?), with DDMRP the suppliers find their ability to maintain these service levels is achieved with substantially lower firefighting and expediting.

To understand how these benefits are achieved, it's critical to first review at a high level how the automotive industry supply chain operates as vital processes coordinate supply planning and execution across the layers of the supply chain.

Automotive Industry Structure

At the top of the supply chain are the Original Equipment Manufacturers (OEMS) that produce the automobiles. The industry is composed of a growing number of companies with origins in North America, Europe, and Southeast Asia. Over time, many of these companies have evolved into global operations, producing cars both in their home countries and in the other key markets in which they sell their products.

OEMs often produce some of the key components internally, such as engines and drivetrain components as well as body and structural elements. Tier 1 suppliers provide the OEMs with a wide range of additional components, including dashboard assemblies complete with integrated instruments and electrical components, seating and comfort systems, glass, lighting, and pre-mounted tires and wheels.



The Tier 2 through N suppliers are those providing parts and components to the Tier 1 suppliers for assembly into the products they provide to the OEMs. Many of the large Tier 1 suppliers also participate in the market as a Tier 2 through N supplier as they supply components to their Tier 1 production sites.

Synchronizing the supply chain of this complex industry structure is achieved by cascading supply requirements from the OEM through their Tier 1 suppliers and from the Tier 1 suppliers down through Tiers 2 – N. This communication of supply requirements is handled through an extensive Electronic Data

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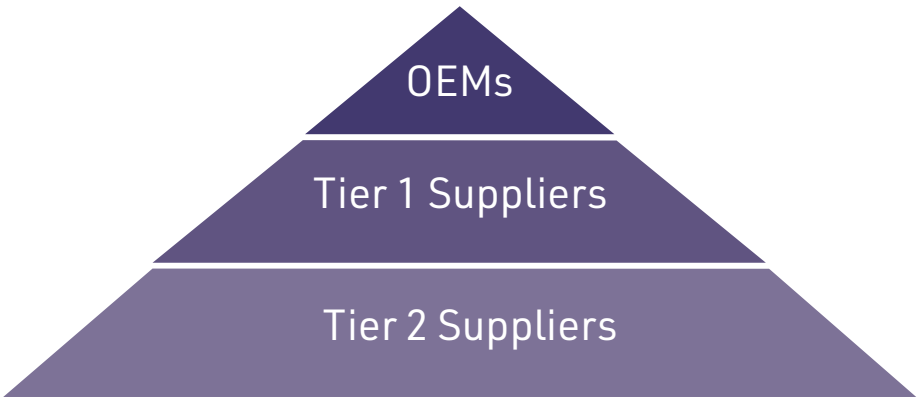
Interchange (EDI) communication protocols and transactions. The EDI transmissions provide forecasted supply requirements over a rolling horizon, just in time orders for materials, and advanced shipping notices and receipts throughout the OEM's supplier network.

Supplier agreements are put in place to govern the commercial and service level expectations between OEMs and suppliers. These agreements help ensure all parties are on the 'same page' regarding expectations and



responsibilities. The agreements typically describe a 'frozen period' in which no changes in the requirement from the OEM receiving the product are allowed. Further, the agreements define the required supplier response time in which the OEM's request must be satisfied by the supplier.

All of this is quite logical and straightforward. Why is it then, that such large opportunities for improvement remain? As mentioned above, DDMRP is enabling companies to achieve inventory reductions of 20-35% over processes that are already quite lean. From an automotive perspective, that level of improvement would be like finishing the Daytona 500 (a 200-lap race) 40-70 laps ahead of the competition!

To answer this question, it is important to understand the level of variation that occurs in the requirements being communicated across the layers of the automotive supply chain. Variation in demand, coupled with supplier lead times and frozen periods, results in misalignment of materials from the actual production requirement.

Signaling Supply Requirements

The following table is from a Tier 1 supplier sourcing drivetrain components to a globally known OEM. The horizontal weeks represent the production weeks, while the vertical axis captures the OEM's forecasted requirements for the production week. This item was supplied with a frozen period of one week.

Reading down the production week column shows the progression of the forecast over time. The final value in the column represents the just-in-time final order placed by the OEM. For example, in forecast week 39, the forecasted requirement for production week 49 was 1320 units. In forecast week 48 (the actual firm order), the requirement had dropped to 1200 units.

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Below the table are statistics and highlighted values where there was greater than a 25% variation (plus/minus) from the average of the rolling forecast. The forecast for week 2 ranged as high as 1260 units and as low as 150 units, settling at a final order of 210 units.

Production Week

Forecast Week / Week	49	50	51	52	53	2	3	4	5	6	7	8	9
39	1,320	1,440											
40	1,290	1,350											
41	1,290	1,350		330									
42	1,290	1,350		330		1,260							
43	1,140	1,410	390	120		1,170	1,200						
44	1,100	1,380	450	90		1,200	1,230	1,140					
45	1,200	1,530	480		90	1,230	1,200	1,140	360				
46	1,230	1,530	300		120	1,140	1,170	1,170	360	1,410			
47	1,230	1,470	780		120	1,140	1,170	1,170	360	1,440	1,440		
48	1,200	1,470	870		60	840	870	1,050	330	1,230	1,200	1,230	
49		1,710	1,110			870	690	690	900	1,050	1,050	1,050	1,110
50			1,350			150	540	990	930	1,020	1,080	1,050	1,080
51						150	540	990	930	1,020	1,080	1,050	1,080
52						210	540	810	600	1,140	1,140	1,150	1,140
53						210	540	810	600	1,140	1,140	1,150	1,140
2							600	750	600	1,140	1,140	1,110	1,110
3								750	600	1,110	1,140	1,140	1,110
4									630	1,110	1,140	1,140	1,170
5										1,110	1,230	1,140	1,020
6											1,260	1,170	1,020
7												1,230	960
8													930
9													
Average	1,229	1,454	716	218	98	798	858	955	600	1,160	1,170	1,134	1,073
Max	1,320	1,710	1,350	330	120	1,260	1,230	1,170	930	1,440	1,440	1,230	1,170
Var to Average	107%	118%	188%	152%	123%	158%	143%	123%	155%	124%	123%	108%	109%
Min	1,100	1,350	300	90	60	150	540	690	330	1,020	1,050	1,050	930
Var to Average	90%	93%	42%	41%	62%	19%	63%	72%	55%	88%	90%	93%	87%

The averages of the Min and Max values for the production weeks indicate high demand signal variation over the rolling 13-week horizon. The average of the Max values was 133%, while the average of the Min values was 69%. Maximum values are nearly two times the minimum.

Finally, the demand in the last few weeks of the year was much higher than the opening weeks of the following year. This may be an indication that the press for production volumes in the latter part of the year resulted in excess inventories that then resulted in a slowdown in production at the beginning of the following year.

Clearly, there is the continuing effect of a changing demand signal for a given production week. This creates challenges for the Tier 1 supplier as they are dependent on components from their suppliers. A large number of items for this part were sourced from their Tier 2 suppliers, many of which had lead times of 2 or more weeks. The consequence was a greater variation on the Tier 2 suppliers due to increasing the amplitude of signal variation through the 'bullwhip' effect.

Signal Latency

This can be illustrated by reviewing the signal flow from the OEM down through the Tier 1 and 2 suppliers for a given component. In this case the illustration is for wiring harness used in connecting electrical components

in a vehicle. The Tier 1 supplier has a lead time and frozen period of one week for the wire harness assembly, while the Tier 2 supplier has a lead time and frozen period of two weeks for the components that are used in the harness assembly.

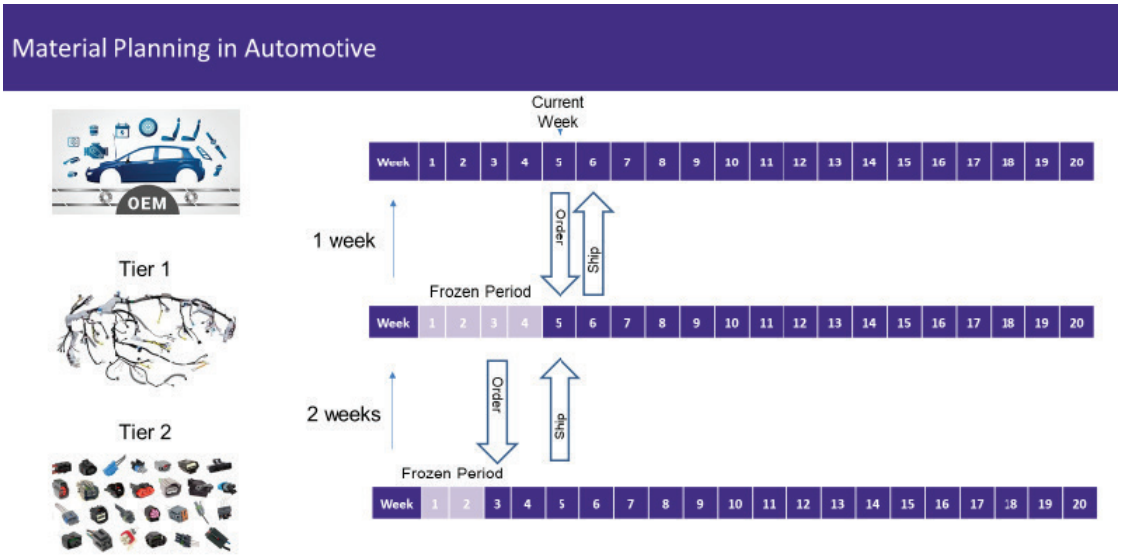
The image below can be interpreted as follows:

1. To meet the production requirement for week 6, the OEM must issue the order to the Tier 1 supplier on week 5, respecting its lead time and one-week frozen period.
2. To meet the expected supply requirement from the OEM for week 6, the Tier 1 supplier was required to issue an order to the Tier 2 supplier for components back in week 3 based on the forecasted requirements from the OEM at that time.
3. Supply requirements for the OEM and the supplier tiers will be influenced by safety stock settings and expectations defined in the related supplier agreements.

The built-in latency resulting from supplier response time and frozen periods for material replenishment requires planning ahead to ensure adequate materials will be available on time. The lead times of the lowest level items in the assembly can stretch the Tier 1 supplier's planning horizon considerably, resulting in a high likelihood of inventory misalignment.

Demand Driven MRP

Demand Driven Material Requirements Planning (DDMRP) was introduced to the market in October 2011, in Orlicky's Material Requirements Planning (3rd edition – McGraw Hill) by Chad Smith and Carol Ptak. A fusion of traditional MRP concepts with the pull-based techniques of Lean and Theory of Constraints,



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the methodology has experienced phenomenal growth over the past nine years.

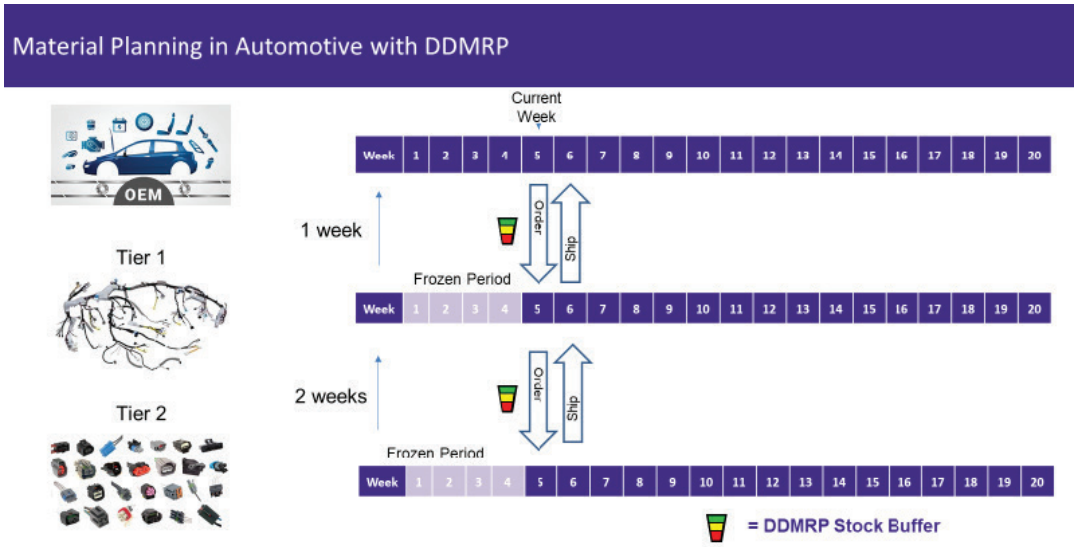
Implementers of DDMRP in the automotive industry have reported substantial improvements in supply chain performance through reduced inventory levels and reduced expedited freight expense while maintaining or increasing on-time, in-full delivery performance.

DDMRP stock buffers are based on a principle of constant material availability and are designed to address demand variation. This ensures constant material availability, allowing users to adopt the most accurate demand signal available – the actual orders from the market. The shift away from forecast to actual demand significantly reduces the impact of forecast error on inventory positions.

In addition, by ensuring constant availability of materials, DDMRP stock buffers decouple lead times within the supply chain. In the example above, the materials from the Tier 2 supplier are decoupled, shortening the Tier 1 supplier's planning horizon and bringing it in-line with the OEM's ordering horizon.

DDMRP functions in a very similar fashion to a Kanban loop but brings added visibility and resilience. Buffer status provides simple and visible signals to users, improving their ability to focus on true priorities. Sized to address variation and dynamically adjusted over time, the buffers align materials to true market demand while protecting order fill rates and reducing expedited freight expense.

DDMRP buffers can be aligned to planning calendars and schedules, ensuring orders are in synch with the transportation 'milk runs' so widely used between the tiers of the automotive supply chain. In addition, auto-approve functionality reduces planning workload, allowing users to focus on other value add tasks.



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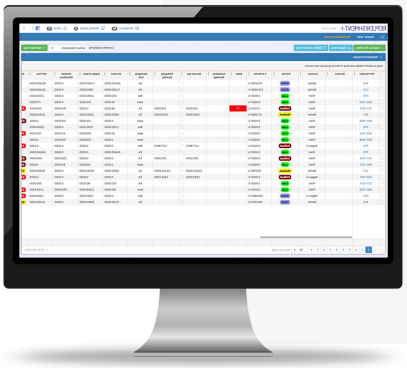
Summary

The automotive industry is well positioned to exploit DDMRP to yield substantial improvements in supply chain performance. The principles of DDMRP are deeply rooted in the pull concepts of Lean and the principles of the Toyota Production System. Our clients have experienced the payback DDMRP and Intuiflow (formerly Replenishment+) yield and are actively rolling out the method and solution across their production sites around the world.



Request a Demo of Intuiflow

If you'd like to learn more about how DDMRP can help your organization, reach out to us. One of our advisors can quickly determine if DDMRP is right for your industry and operations and provide a solution demonstration. LEARN MORE

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DEMAND DRIVEN TECHNOLOGIES

Demand Driven Technologies provides next generation materials, inventory and production scheduling and execution software solutions for the new Demand Driven world. Our solutions are developed with an innovative multi-echelon pull methodology to plan inventories and materials. This approach enables organizations to build more closely to actual market requirements and promotes better and quicker decisions and actions at the planning and execution level – improving Demand Signal accuracy.

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