The use of a web based platform to support Supply Chain business processes in the Automotive Industry: the results achieved by International Engines South America

Carlos Eduardo P. Panitz, MSc.
International Engines South America
Canoas, Brazil
Email: carlos.panitz@nav-international.com.br

Abstract
This paper describes how International Engines South America (IESA) has implemented a web based platform to support several Supply Chain Business processes. The first part of this paper provides an overview of the planning process at IESA. In the following parts it will be presented the applications developed with special attention for three of them: the VMI replenishment model, the Constraint Management model and the Supplier Rating System model. In the conclusion, the results and lessons learned are briefly discussed.

Keywords
Supply Chain Management support systems, Decision and business integration on the web, VMI model

1. INTRODUCTION
Traditionally, the planning process at discrete manufacturing companies use the MRP framework and the JIT replenishment process to release orders and shipping authorization to the supply base. These techniques have been used quite successfully for a couple of decades in many companies worldwide. Some of the biggest challenges for applying these techniques are streamlining the information flow and improving the ‘what if’ analysis in a timely manner in order to ensure responsiveness, low asset utilization and lower costs. The more complex and wider the supply base, the more challenging it is to achieve these goals. Minimizing supplying disruptions and unexpected constraints have been at the top of the agenda of many logistics and manufacturing professionals.

One of the technologies that have been used widely since the 70’s to help integrate the planning process through the Supply Chain is the Electronic Data Interchange (EDI). Forecasts, Shipping Instruction, Advanced Shipping Notices, Inventories transactions and Billing processes are some examples of information broadcasted and received from one company to its supply base. This exchange of information is usually made through a third party called VAN (Value Added Network) and uses a specific protocol (e.g. EDIFACT, X12, ODETTE, RND). Even though EDI transactions has been evolving for more than 25 years, the usage of the most common protocols didn’t delivered a robust framework to provide responsiveness and reliable control at the execution level. Besides most of the EDI standards provide dozens of different protocols, the ones related with JIT practices, event management and constraints feedbacks (acknowledgements) are not a usually known and would required deeper integration with ERP’s systems. Another two reasons why this level of integration haven’t been achieved are the VAN’s revenue model that is based on the number of megabytes exchanged by both partners and the lack of IT support in small companies that belong to a Supply Chain.

In the last eight years, Internet based applications have been breaking through Supply Chain’s business models by allowing lower costs per transaction, higher standard for integration (e.g. XML) and more friendly interfaces to access and navigate. These technologies have opened a huge range of possibilities to create more integrated frameworks along the Supply Chain.

International Engines South America - IESA - has been using EDI transactions with its supply base since 1998 with significant results from a planning and control perspective. However, traditional EDI has proven limited to provide a good framework to support the execution level of the material flow control and the speed of communication required to improve the Supply Base responsiveness. Also, another business processes like constraint feedback and Supplier Performance Measurement couldn’t be implemented in and cost effective way.

For these reasons, in the beginning of 2001, IESA launched a project called International Engines Supplier Network or simply IESN, with the objective to create a web based platform that could support not only the current business process but also some responsive and collaboration oriented practices with its Supply Base.
2. THE SCOPE OF THE PROJECT

The first scope of the IESN project only focused on web-edi applications like: Forecast Release, Shipping Authorization and ASN - Advanced Shipping Notice. During the first discussion, the scope rapidly increased to also include a application to support the Vendor Management Inventory – VMI – replenishment model, a Supplier Performance Rating System and Corrective Action Request forms.

After making a market survey to identify potential solution providers in Brazil, IESA has decided to develop all the IESN applications internally. Due to the broad scope of the project, the development and implementation were broken down into the following two phases. Phase One was defined to cover the following applications:

- Web-EDI Forecast and Purchase Order Release (pdf, html and flat file);
- New release notification;
- Supplier Performance Rating System including Logistics, Purchasing and Quality perspectives;
- Billing information (Account Payable Status, debts and historical data);
- News, Procedures and On-Manuals;

Phase Two was defined to cover the following applications:

- Web-EDI ASN application (file upload or manual input thru a web form). This application would also feature automatic Errors Notification coded by root cause (timing, quantity, value, taxes, etc);
- VMI application, which was designed to provide demand and inventory visibility graphically for planners on both sides and for the 3PL’s;
- Constraint Management application (constraint feedback and analysis against IESA’s Build Schedule);

This paper will focus on the description the VMI application, the Constraint Management application and the Supplier Rating System application, once they were for IESA not only a technological upgrade but mostly a framework for a new group of business processes.

2.1 The VMI Application (Supplier Cockpit)

Most of the discrete manufacturing companies that encompass a large number of suppliers and part numbers adopt the MRP planning process to tell suppliers what and when they shall schedule their own supply base and plant. In addition, pull system techniques can be used to trigger shipments in a high frequency basis. On real life, this processes require very close attention at the execution level because a lot of things can happen in such a complex flow: parts rejection, inventory discrepancies, transportation delays, suppliers delays, mix changes to deliver a urgent order, etc. As most of the corrections to keep the supplying process fitting the customer demand is on the hands of the supplier (even when isn’t his fault), it is reasonable to think that real-time visibility of all these events could improve their response time for critical situations. In addition, when a supplier is facing constraints to delivery precisely what the low frequency, batch process is requiring (MRP), he is not necessarily seeing an accurate picture of the supplying situation. It can be worst or better than the open net requirements presented in the schedule. Usually this gap of perception is covered by shortage lists and follow-up activities, which are timely consuming and suitable to human error. By visualizing the customer real inventory, the Supplier can manage in a more timely and effective way his internal resources in order to ensure a feasible and more reliable delivery schedule. The lack of visibility create redundancy of administrative task on both sides throughout the supply chain.

The context stated above was the major drive for IESA decide to improve its replenishment process by adopting the VMI model with its Supply Base.

As referred by Småros et al. (2003), “in VMI, the vendor is given access to its customer’s inventory and demand information. The supplier has access to the customer’s inventory level and has the authority and the responsibility to replenish the customer’s stock according to a jointly agreed policy. Two of the most significant differences of the VMI model are that Supplier access the customer’s demand, rather than its orders and that one level of order batching is removed. This second aspect helps to streamline information flow and also improves information accuracy. Since the vendor is free to choose the timing of the replenishment shipments, it can further dampen demand peaks, for example, by delaying non-critical replenishments”.

Another important aspect of the VMI model is that the visibility reduces uncertainty. Once one batch layer is dropped off and the Supplier has direct access to its inventory and demand through the pipeline, inventory
policies and replenishment plans can be defined with more accuracy and without clouds of uncertainty. This uncertainty usually leads to poor efficiency and conservative decisions (i.e. excess inventory).

For IESA, implementing VMI would require improvements in its EDI capability by using internet technology, increased frequency of demand updates from its Master Production Schedule and a develop the framework that could use all the data needed.

One of the first assumptions to develop the VMI framework was that the applications should be simple to use and to understand. The framework, latter named the ‘Supplier Cockpit’ was based on two philosophies: ‘More graphical, much better’ and ‘Don’t need, don’t know’. These principles have helped to develop a very comprehensive and effective application from a control and decision making stand point. Figure 1 shows how the Supplier Cockpit was designed to support the VMI model.

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Figure 1 – ‘Supplier Cockpit’ template (VMI application)

The solid green, red and blue bars indicates, respectively between (OK), under (risk of shortage) and over (excess) the min/max range of inventory established in the inventory policy for a particular part number. The dashed green, red and blue bars have the same concept but they refer to in transit batches. Notice that one part number can present different status because the application simulate the days of supply for each individual batch shipped by the supplier. Others information presented in this screen are: Next Delivery, Last Batch, Break Point, total in transit inventory, stock available and quarantined stock. By clicking in a dashed bar, the supplier have access to detailed information of that shipment.

The frequency updates of the information released through the web were defined as follows: weekly for regular forecast and Purchase Orders, daily for real demand updates (based on the assembly line schedule), and every four hours for inventory transaction updates. Figure 2 shows how inventory is treated along the pipeline from the Supplier through the Assembly Line.
2.2 The Constraint Management application

Another business process has received attention was the Constraint Management process. In the past, constraints were treated informally between planners and sometimes late to be addressed in the planning process. As result, constraints not managed in a timely manner drive contingency actions and unplanned changes in the short term schedule. Some common examples of not having a systematic process to evaluate constraint feedbacks are mix changes of the build plan, premium freights for both, customer orders delays and conservative inventory policies. IESA decided to address this issue by creating a systematic and standardized data collection framework, which was called Supplier Acknowledgement. Basically, this application consist in a feedback tool, in which the supplier flag an ‘OK’ for the material schedule received or propose an alternative schedule based on the last release received.

Once the information is submitted thru the web, the IESA planner can easily compare the proposed schedule against the latest build plan available (Gross Requirement). If the proposed plan is consistent with the build plan, even if it’s out of the range of the inventory policy, it can be considered a feasible plan. If the proposed plan creates a shortage at any moment of time, the planner will need to understand deeper the nature of the constraint (demand increases, lack of raw material, capacity bottlenecks or quality issues). The first option is always to look for alternatives and resources that allow the supplier to create a consistent shipping schedule. In some cases, the feasible scenario will be to change the build plan taking in consideration the constraints highlighted by the supplier.

One of the most important aspects of this process is timing to make all the analysis and further, to feedback all supply base. In the past, by using manual procedures and spreadsheet, the analyses were not 100% accurate and usually weren’t made in a timely manner.

As stated by Lambert et al. (2000), Constraint Management may require monitoring not only tier 1 but also tier 2 and 3 and non members of the supply base as well. Besides IESA Constraint Management application only address its tier 1 supplier, other members of the Supply Chain are monitored by others procedures when a risk of potential disruptions are identified in a near future.

2.3. Supplier Performance Rating System

The last application to be described in this paper is the Supplier Performance Rating System. To evaluate the performance of a Supplier, IESA consider three set of attributes: Quality, Logistics and Purchasing. Each of them
represents 1/3 of the total score that a Supplier can reach. For the purposes of these paper, it will be detailed only the Logistic group of metrics.

IESA’s Supplier Rating system was conceived to provide a consistent and comprehensive feedback to the Suppliers and also to support both short term and long term decisions regarding the Supplier Relationship. Strategic decisions regarding new developments and sourcing decisions always use the Supplier Performance Rating System as a important reference and not only the commercial terms provided by the supplier.

The Logistics set of attributes address not only the delivery performance of the Supplier, but also other aspects that may affect the quality and the cost of the product provided. Table 1 bellows summarize the attributes that encompass the Logistic score of a Supplier:

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<tr>
<th>Attribute</th>
<th>Focus</th>
<th>Notes</th>
</tr>
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<tr>
<td>Supplier Schedule Performance</td>
<td>Reliability</td>
<td>It is measured by comparing Supplier Actual Delivery against the Material Frozen Schedule.</td>
</tr>
<tr>
<td>Mix Change / Down Time</td>
<td>Reliability and Cost</td>
<td>If a Supplier causes a mix change or a shut down a ‘Corrective Action Request’ form is released. This process will create a penalty in the Supplier’s score.</td>
</tr>
<tr>
<td>Packaging Compliance</td>
<td>Cost and Quality</td>
<td>It is evaluated if the type of packaging is compliant, if the SKU batch is correct and if the bar code label was properly generated and stamped.</td>
</tr>
<tr>
<td>ASN releases</td>
<td>Reliability and Cost</td>
<td>ASN’s are validated against the Material Schedule, Piece Price, SKU and syntax file accuracy.</td>
</tr>
<tr>
<td>Supplier Self Assessment Form</td>
<td>Reliability and Cost</td>
<td>Made annually thru a web form. Supplier answers a set of questions regarding their logistics and planning business practices. Maximum score is 140 points. If Supplier’s score is under 90 points, an ‘on site’ assessment is assigned to discuss an Action Plan.</td>
</tr>
</tbody>
</table>

Table 1 – Inventory Visibility through the pipeline and frequency updates of the information

The Suppliers have detailed visibility of its score (broken down by group and attribute) and also can make an internal benchmark with the best IESA’s Supplier score and the best of its commodity group. A Supplier does not see the name of the others Suppliers when he access the Benchmarking Charts.

3. RESULTS AND LESSONS LEARNED FROM THE IESN PROJECT

One of the most significant lessons learned of this project was related with the software architecture. As the IESN was conceived to be a real-time transaction model, which access many application of IESA ERP Legacy System, a lot of improvements had to be implemented in order to ensure speed for the end users. The applications were developed using JAVA language running in a Linux environment. The company has also allocated a dedicated backbone to support all B2B transactions and protected them with a firewall application and other security procedures. To access the applications the Supplier was requested to sign a term of Mutual Confidential Disclosure Agreement. Once the term was signed by a legal representative of the Supplier, a login ID and profile was released for them.

Also, it was clear that to implement the VMI model it wasn’t just a matter of bits and bytes. There are also people and atoms that need to be oriented with this new way to manage the materials flow. Here are some of the Critical Success Factors that also have been addressed to fully implement this new replenishment model:

- Ensure 100% standardized SKU;
- Keep inventory accuracy over 95%;
- Keep Bill Of Material Integrity over 98%;
- Keep Transit Time reliability over 95%;
- Ensure all inventory transactions are performed in real time at the shop floor level;
- Review Suppliers agreements to shift deliveries commitments to a higher level;
• Ensure data integrity between all applications and legacy systems;

But the most challenging effort that has been taken by the IESA team was undoubtedly to change the internal and external culture about how to manage the replenishment process in a Supply Chain. This has been a continuous process that probably will last a couple of years before it is evident that there is a new mindset on how to run the business. From a cost perspective, this web platform is much cheaper compared with traditional VAN/EDI services. Because it allows a higher level of information exchanges it also enables more collaborative replenishment methods.

One of the most significant results achieved by using this web platform, and particularly the VMI application is the reduction of the inventory level. Figure 3 shows the weighted average of Days of Supply for the local Suppliers. Considering current days of Supply, the reduction up to now is approximately 20% and it expected to continue dropping down at least more 20% during 2005.

![Inventory Days of Supply Evolution](image1)

Figure 3 – Weighted average of Days of Supply for local Supplier (In Transit + Warehouse + WIP)

Another significant result is related with the ASN process. By using a web application developed to provide manual input capability (very useful for small Supplier which do not have IT structure) and automatic feedback for inconsistencies, the rating of ASN’s integrated without errors rise from 44% to more de 70% (figure 4). Once the Suppliers start to receive automatic feedback of what was causing the ASN’s errors (e.g. Shipment Antecipation), they start to change their behaviour to improve their rating by respecting the deliver dates.

![ASN’s integrated without errors and % of ASN’s error due to Shipment anticipation](image2)

Figure 4 – % of ASN’s integrated without errors and % of ASN’s error due to Shipment anticipation.

The IESN project also has been allowing IESA’s Supply Chain process to support other initiatives like Lean Manufacturing and to improve its Response Time and its Capable-To-Promise accuracy.
7. REFERENCES


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