

Resilient production system with adaptive lead time planning

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Abstract

Almost all industries face external challenges like demand uncertainty, higher risk, and increasing competitive intensity. Several solutions are proposed in the literature for mitigating the effects of these externalities.

To prepare our case company for these challenges, various methods of creating responsive and order-winning manufacturing processes were analysed for the automotive industry. The current processes of the case company are not prepared and equipped to adapt to the rapidly changing situations. Our paper identifies the need for “quick response” in logistics processes.

Keywords: QRM, Quick Response Manufacturing, Lead time, Automotive Industry

Introduction

Like several-week lead times in the automotive industry, this will be less likely to be held on the markets for the future. Customers at the end of the supply chain are increasingly impatient and even willing to pay a larger amount for a vehicle in return for the company to reduce the time it takes to get the finished product, so they can get the vehicle / product of their choice sooner. The automotive industry has been aware of the vitality of this topic for years.

Several solutions are proposed in the literature for mitigating the effects of these externalities. To prepare our case company for these challenges, various methods of creating responsive and order-winning manufacturing processes will be analyzed for the automotive industry. The case company must respond to the numerous challenges from the external business environment. The current processes are not prepared and equipped to adapt to the rapidly changing situations.

After the literature review of the approaches for responsive manufacturing, the current processes are critically evaluated. The identification of unresponsive process parts is followed by the linking of already existing methods to the current processes. The aim is to create a more responsive manufacturing process that can withstand the challenges of rapidly changing business environment and thus creating sustainable

operations. The aim of this paper is to collect these solutions and propose some of them for the case company.

Literature review

Today's social, economic phenomena are growing in an increasing proportion of exponential trends according to (Gleick, 2003.). It is forming and growing a time-sensitive layer in society for them time – like irreplaceable resource - becomes more and more valuable. Quick Response emphasizes the creation of capabilities to speed up customer service through collaborative models based on the development and operation of supply chain data connections. They are designed to track product flow, respond to customer demand and respond quickly to them (Süle E.). Customers constant desire for innovation requires very fast stock rotation, short lead times, and high accuracy from the supply chain (Coyle et al., 2003). The Quick Response Manufacturing (QRM) is a production approach that emphasizes the beneficial effect of reducing internal and external delivery times. But what is QRM? A new trend? QRM helps to get shorter lead times, higher margins, better forecasting, lower inventory levels, less working capital, more competitive products and lower overall costs (Suri).

“Quick Response Manufacturing is a company-wide strategy for reducing lead times throughout the enterprise. QRM pursues the reduction of lead time in all aspects of a company’s operations, both internally and externally. Specifically, from a customer’s point of view, QRM means responding to that customer’s needs by rapidly designing and manufacturing products customized to those needs. This is the external aspect of QRM. Next, in terms of a company’s own operations, QRM focuses on reducing the lead times for all tasks within the whole enterprise. This is the internal aspect of QRM. “(Suri, 1998.)

Table 1 – Comparison of QRM with similar methods based on (Rajan,S. 1998)

Approach	Comparison with QRM
JIT (Just in Time) Flow TOC (Theory of Constraints)	Best applied with stable demand, higher volume products (need to have the line rate or rhythm and need to identify the constraint). QRM can be applied to one-of-a-kind custom products too (with rates and constraints that change from day to day). Western implementations of JIT focus on factory floor and suppliers. QRM expands to the whole organization. JIT has become synonymous with kanban. If used with QRM, the kanban method needs significant modification. However, if JIT/Flow has been implemented, it paves the way for QRM.
TQM (Total Quality Management) Kaizen TEI (Total Employee Involvement)	Quality and kaizen targets can become arbitrary, and employees can lose motivation for ever improving targets. TEI programs can lose momentum or not show results. None of these builds on understanding manufacturing dynamics. Without this, quality improvement or employee involvement produce only limited gains in responsiveness. By understanding the dynamics, QRM motivates specific quality achieve goals. If in place, TQM, kaizen, and TEI can thus support a QRM program.
SCM (Supply Chain Management)	Seeks to coordinate production/inventory throughout the supply chain. The focus is on optimizing across facilities, rather than how to improve within a facility, like QRM. However SCM complements the QRM approach to suppliers and customers.
Agile Manufacturing	An evolving concept: Examples of agile behavior have been given, but core principles of how to implement it are still being developed. Agility may take us beyond QRM, but many managers still do not support the core principles of QRM. After a company has mastered QRM it can target agility. By then, the principles may be better understood.

If we want to implement this strategy in to our business, then first we must see how it differs from other approaches. In the above table we can find a comparison of QRM

with other methodologies. In contrast to JIT QRM expands its strategy to the whole organization. TQM, Kaizen or TEI doesn't rely to understand the dynamics of manufacturing, but QRM does. By understanding dynamics, QRM motivates concrete quality goals. The principles of BPR are not unequivocal, till QRM has a clear strategy and implements focused aims, rules in distinct steps. By SCM is the focus on optimizing across facilities, rather than how to improve within a facility, like QRM. Agile Manufacturing is a next step after implementing QRM.

From the methodologies above JIT is the most typical approach in our company. We produce thousands of engines on a day with a high complexity level on several production lines but counter to QRM we can't produce most of our products modular. The company is not resilient enough. The company can't hold a higher stock from the parts, hundreds of them arrive to the production on the same day as they are needed.

Principles with examples from the automotive industry

As I mentioned earlier we live in a rush, fast variable world with an impatient society. In this competition situation where the technology is evolving the mentality of the managers and companies must be also adaptable for the new trends. Before companies decide to use or live QRM they want to know the details about it. Our company needs also a new direction to manage its progression. Here are the 10 principles of QRM from Mr. Rajan Suri with some practical explains. We should look at these norms, rules and think about how we could involve them into our processes and build up the basics to our new trend.

- 1) Find whole new ways of completing the job, with the focus on lead time minimization.
- 2) Plan to operate at 70-80% capacity on critical resources
- 3) Measure the reduction of lead time and make it the main performance measure.
- 4) Stick to measuring and rewarding reduction of lead times.
- 5) Use MRP but restructure the organization into simpler product-oriented cells. Complement with a new material control method that combines the best of push and pull strategies.
- 6) Motivate suppliers to implement QRM.
- 7) Educate customers about QRM and negotiate a schedule of moving to smaller lot sizes at reasonable prices.
- 8) Cut through functional boundaries by forming a quick response office cell responsible for a family of products.
- 9) The reason for embarking on the QRM journey is that it leads to a truly lean and mean company with a more secure future.
- 10) The biggest obstacle to QRM is not technology, but "mind-set". Combat this through training. Next, engage in low-cost or no-cost lead time reductions. Leave technological solutions for a later stage.

1: Find whole new ways of completing the job, with the focus on lead time minimization.

Reducing lead times is important not only for production or storage but also in the speed of processes and in the interoperability of each hierarchy level. It really matters in what a type of structure a company is working in, the structure of each department is constantly being reviewed, how each process is built on each other if it can be optimized somewhere. Not so long ago, one of the departments in the company was moved to

another section, which is better suited to the process map. This made the workflows faster and better, but they did not have to spend more time for their work. We must optimize our processes.

3: Measure the reduction of lead time and make it the main performance measure.

We can measure the minimum of our lead-time, but we can't count with the risks, for example we don't consider with a bottleneck product, when we suddenly run out from a part and couldn't produce our products. Our process must be flexible, even if it means that we work with higher lead times. Processes must react quickly to the order of production. If we cannot produce a certain type of product because of a missing component, we need to advance another product (with another complexity) in our manufacturing program so that there is no production stop and that the production lines can manufacture continuously.

4: Stick to measuring and rewarding reduction of lead times.

It is very important to measure the lead times in the production, storage and in the whole process continuously. Our lead time is calculated from the arrival of the parts into the warehouse till the departure of the products from the factory. Because of the high variety of complexity of the manufactured products at the company, they have a different lead time. It is important to work with an average value where these different lead times cohere so they equilibrated each other and shift their value towards the target aim. These values are based on day-to-day evaluations, so the management can keep track of lead times permanently. To reward this performance is another question. This is approached either from a negative side, and this is a big problem. When the departments can't reach their goals than they get much more focus from a higher level and stricter guidance how to work.

5: Use MRP, but restructure the organization into simpler product-oriented cells. Complement with a new material control method that combines the best of push and pull strategies.

Complexity is constantly increasing, and the current production lines are not flexible enough. Nowadays is modular production (for example by custom manufacturing) a lot more effective to the custom requirements and to the higher complexity. In our company we have by only one product production cells because of its high complexity (we have here the highest lead time) and the low quantity (compared to our other products).

9: The reason for embarking on the QRM journey is that it leads to a truly lean and mean company with a more secure future.

To reach this lean company is complicated. In the automotive industry we can see companies with a very complex hierarchy system. Because of this complicated structure the processes and decision-making are slow, so for example the projects often stall because this.

10: The biggest obstacle to QRM is not technology, but "mind-set". Combat this through training. Next, engage in low-cost or no-cost lead time reductions. Leave technological solutions for a later stage.

Despite the globalized, rapidly changing economy, the many new technologies and trends, if the way of thinking and vision in the heads does not change accordingly, we will not be able to sustain competitive advantage.

Supply Chain processes in the automotive industry

Over the past two decades, supply chain management has been gaining in importance, with particular regard to the analysis and research of the process's flexibility. As we saw above we have to change the perspective in more ways by the examined company. If we emphasize for example the lead time reduction, we have to look at the whole supply chain process. We have to find its labile points in its course. By managing the supply chain, a competitive advantage can be achieved, which is reflected in the increase in turnover and profits, decrease in inventories and shortening lead times.

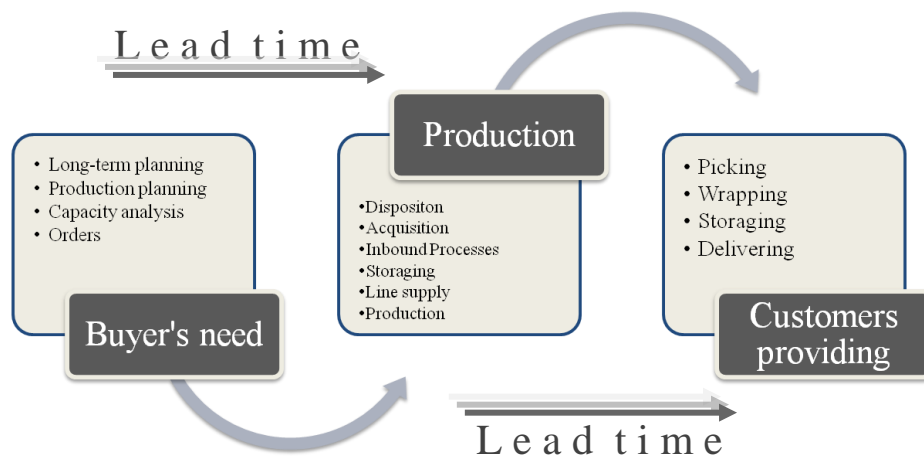


Figure 1 – Lead Time in logistics processes

Lead time determines the whole process. Every company wants to minimize its storage costs, the stocks (parts and finished goods too), delivery time etc. The strategic guideline also sets the targets that various departments must keep their lead times low. By the selected company we can see that it operates on a low level at lead times. It works with more than 750 suppliers worldwide and it has more than 30 customers, with a very high and complex product range. One product needs more than thousand parts and it is very difficult to keep the stocks on a minimum level and bear the production line save. Of course, that all would be sufficient theoretically, but the practice does not show that. Every company must fight with delivery delays, quality problems so as here hundreds of parts arrive on the same day or hour when they are needed to the production line. So the lead time is on a low level, that by any kind of problems the company has to react agile. The conditions change extremely fast and the process must change with it similar along flexibility. Because our processes live in symbiosis with a continuously changing environment we can say that our supply chain is adaptive specific. It has to work in every situation bearing in mind that the buyer needs can't be injured.

If the company wants to keep its costs low, but they want to be in a good position on the market and won't risk the customer's care it has to be agile. They can only maintain an agile manufacturing if they have the smart and necessary processes for that, they can respond quickly to the changeable customer's needs. With that they can work cost-efficient.

Conclusion

As we said previously we have to change the perspective by our company on the management level to have a good position in the competition and be prepared to the future changes. We not only speak about lead times in the production but also in other processes. We have to inspect all of the processes in this regard. As we said we have to change also the mentality by the targets and KPI systems. We have to follow the right aims with the suitable dispatches. We are at the early stage of the development of this method but based on our findings we can conclude that the necessity for including a new strategy in context of lead time reducing is a must to stay in competition.

We have to implant this new way of mentality to the strategic management. Modern society needs won't change in the next years, and to compete with it will only be harder.

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