Benchmarking Supplier Network Collaboration

Sheeba Pathak

Business Analyst, Mahindra Logistics Ltd., Mumbai, Maharashtra, India.
Email: sheeba.pathak2015@sims.edu

Abstract

The supply chain requires the collaboration and synchronisation of each entity for the success of need fulfilment. Hence, entities cannot work in isolation. Thus, the need for collaborations with reference to not just customers and the manufacturer but also with the supplier is pivotal.
ABC's two suppliers are selected for the scope of the study. Their manufacturing processes are understood and the lead times are analysed. The researcher arrived at the conclusion that immense number of shortages amount due to lack of information sharing and transparency. Hence, with the help of IT support an effective supplier network is introduced and implemented for the supplier PQR Incorporation. This is then used as a benchmark for another supplier: XYZ Motors.

Keywords: Benchmarking, Supplier Network Collaboration, Lead Time

Introduction

Benchmarking

According to Camp (1989, 12-15), in the formal sense benchmarking is an ongoing investigation and PQRning experience ensuring that best practices in a given field are uncovered, analysed, and implemented.

Xerox Corporation (1979) is given credit for first discovering that it would become vital to use benchmarks to compare itself to competitors as well as to reference points within their own organisation.

There are different types and techniques for benchmarking, and for the scope of the CPS internal process benchmarking is used. Comparisons within the processes of the two suppliers are made and improvement within the techniques are arrived at.Thus, though benchmarking is primarily carried out against the processes of different organisations; in this case the manufacturing process of one supplier is compared against another. Hence, improving the performance by measuring it against the past performance and standards.

Spendolini's benchmarking model is used for the study. The procedure of Spendolini's benchmarking process is described as follows:-

1. **Determine What to Benchmark:** The first stage of the process is to identify the customers for the benchmarking information and their requirements and define the specific subjects to be benchmarked. Once the subjects to be benchmarked and the customer requirements are known, the resources required to conduct a successful project can be identified and secured (for the CPS the parameters ae to be benchmarked).
2. **Form a Benchmarking Team:** Although benchmarking can be conducted by individuals, most benchmarking activities are team activities. The process of selecting, orienting, and managing a benchmarking team is the second major stage of the process. Specific roles and responsibilities are assigned to team members. Project management tools are introduced to ensure that benchmarking assignments are cPQRto everyone involved and that key project milestones are identified.
3. **Identify Benchmarking Partners:** The third stage of the process involves the identification of information sources that will be used to collect information. These sources include employees of benchmarked organisations, consultants, analysts, industry reports, computerised databases, etc. (for the CPS the suppliers and MES reports comprise of the partners).
4. **Collect and Analyse Benchmarking Information:** During this stage of the process specific information collection methods are selected. It is important that benchmarking partners are contacted at an early stage of the process according to the *Benchmarking Code of Conduct*. Benchmarking information is analysed in accor-

dance with the customer requirements and recommendations for action are provided.

5. **Take Action:** The action taken may range from the production of a report or presentations to the production of a set of recommendations to the actual implementation of change based, at least in part, on the information collected in the benchmarking information. Finally, follow-up activities including the continuum of the benchmarking process are agreed.

The entire process is then used as a standard for the supplier XYZ and benchmarking is further carried out.

Supplier Network Collaboration

The Council of Supply Chain Management Professionals defines supply chain management as: "Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies. Supply chain management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, finance and information technology."

In the process of meeting the customer's demand; the procurement of material plays a major role. Hence, it is important to collaborate the supplier and send him the requirements at appropriate times.

Supplier network collaboration is a means to send information to the supplier with respect to the plans, demand requirements, and capacities. The visibility of information enables the supplier to adjust his raw material plans, procurement process and produce as per the demand requirements; hence synchronising material flow from the supplier's supplier, the supplier and the company. Thus increasing supplier reliability.

ABC Vehicle Manufacturers Ltd. (ABC) has over 300 suppliers spread across the globe. ABC Vehicle Manufacturers is a 100% owned subsidiary of ABC. This multi-purpose manufacturing plant was set up in as a greenfield project. Spread across 700 acres and with more than 2000 employees; its annual capacity is 3.2 million vehicles per annum. The plant comprises of the BIW (Body In White), 2 Paint Shops (45 JPH and 21 JPH), and the TCF blocks. It has different blocks for each category of vehicles i.e. MPV (mini-passenger vehicles), LTV (light transport vehicles), passenger vehicles.

Within the radius of 3 km are a number of suppliers and one of the key suppliers is PQR Corporation. It supplies seats imported from Italy's leather tanneries. The plant also has a supplier park within its premises.XYZ Motors is an exclusive supplier of front axles and exhausts for ABC's passenger and commercial vehicle manufacturing. The model shown in Fig. 1 depicts the 2 entities as PQR and XYZ Motors comprising the supplier network

A supplier network is introduced for PQR and the safety lead time is measured. After the implementation and success of PQR's network, it is used a benchmark for XYZ Motors and tested.

The philosophy of lean manufacturing comes into practice by eliminating the redundancies and wastes in the present system for JIT manufacturers.

XYZ Motors used a MTS (Made to Stock) strategy and hence finished goods inventory was observed to be piling up. The MTS strategy increases the piling up of inventory and safety stock, thus introducing a push mechanism of products in the market. This strategy is unfit for JIT parts and is primarily used where the demand requirements is known to be a constant.

Since these suppliers are JIT suppliers, hence it is important for them to follow an assemble to order strategy wherein many end items can be made from combinations of basic components and sub-assemblies. Forecasting and planning production thus becomes simplified when dealing an ATO strategy. However, even though PQR is following this strategy; its line capacity is underutilised because of ineffective systems for information sharing. Hence, PQR's process is studied and improved and then used as a benchmark to introduce the ATO strategy for XYZ Motors.

Literature Review

Close collaboration among supply chain partners can be to align the parties and then enhance the value of the network's combined activities. Collaborating with suppliers, manufacturers will derive benefits in such key activities as new product development, order fulfilment, and capacity planning. Collaborative product development enabled by sharing and modifying design documents will help manufacturers develop products better and faster. Similarly, co-ordinating all tier-supplier production schedules will help ensure that future material needs are satisfied. This, in turn, results in improved order fulfilment and increased capacity utilisation (Sahay, 2003).

According to Spendolini (1992, 20), often significant amount of information sharing accompanies internal benchmarking. Many organisations are able to realise immediate gains by identifying their best internal practices and then transferring that information to other parts of the organisation. Hence, the need of an effective supplier network arises.

The primary objective of initiating collaboration in any supply chain is to enhance the overall performance of supply chain and this can be achieved through the collective effort of all supply chain members (Angerhofer & Angelides, 2006).

Barratt (2004) identified managing change, cross-functional activities, process alignment, joint decision making, and supply chain metrics as essential elements for successful supply chain collaboration.The relationship between the partners, instead of being restricted to coordination only, should transform to a more collaborative one. Failing to collaborate would result in the distortion of information (bullwhip effect) as it moves through the supply chain, which, in turn, can lead to costly inefficiencies, excess inventories, slow response, and lost profits (Lee, 1997).

Benchmarking is a continuous, systematic process for evaluating products, services and work processes or organisations that are recognised as representing the best practices, for the purpose of organisational improvement (Spendolini 1992, 10-11). Benchmarking is thus carried out to ensure that there is continuous improvement in the organisation in terms of processes, quality so as to meet customer satisfaction. Hence, to ensure that time, cost, quality and the scope is in tandem; benchmarking is used to measure, monitor and control the productivity. Hence, supply chain collaborative networks ensure that there is a smooth flow of information across the entities involved. Thus, enhancing the performance and output which ultimately enables to meet the benchmark standards.

Research Design

Objective

The objective of the study is to benchmark the process of the supplier network collaboration in ABC Vehicle Manufacturers Ltd. By studying PQR Incorporation, suggesting improvements & then using it as a benchmark for XYZ Motors.

Methodology

Primary data were collected by means of an unstructured interview with the suppliers. MES reports of ABC were referred to calculate lead times. The sample size for PQR was 16,000 XXX 500 vehicles produced in the year April 2013-April 2014, while for XYZ Motors 19,500 LTV and MPV vehicles were analysed in the same period. No secondary data were used.

Demand forecasting and the planning mechanism was studied to understand the intricacies involved in managing the synchronous form of the supply chain between suppliers and manufacturers.

The sample size includes the industries within the automotive sector; however this study is limited to the scope of 2 suppliers-XYZ Motors and PQR Corporation for the study.

The process benchmarking model of Spendolini is used to benchmark the production process of PQR and XYZ.

Analyses, Interpretation & Discussions

Spendolini's internal process benchmarking model is used to analyse the benchmarking parameters for PQR and XYZ Motors.

Spendolini's Process Benchmarking Model involves the following steps:-

Determine What to Benchmark

The two suppliers' performance was tested on the following 9 parameters. The parameters were selected on the basis of ease of comparison and the prominent factors that effect in demand fulfilment for ABC.

Weights were assigned for each parameter, from 1-5 (where 1 indicates poor performance, 3 is satisfactory and 5 rated the best).

No. of Shifts: The number of shifts is equal to one weight point assigned. Since, PQR has shifts matching the shift of ABC hence the weight assigned is 3. XYZ operates in only one shift, hence the weight assigned is 1.

Type of Assembly Lines: The assembly lines are exclusively for ABC products and hence are assigned a high weight of 3. If the assembly line has 2 different products of ABC's competitors, then a weight of 2 is assigned. For greater than 2 products and competitors 1 is assigned.

Manufacturing Strategy: Since, these parts are JIT parts thus the suitable strategy is that of ATO and is assigned a weight of 3. Made to Stock strategy increases inventory, thus increasing inventory carrying costs and hence is least preferred and assigned 1. For any other strategy the weight assigned is 2.

Line Capacity: PQR matches the line capacity of ABC's (i.e. 14/21 Jobs per Hour) and is thus preferred as there is expected to be no inventory or shortage of material. This is thus assigned 3. While XYZ operates at a constant capacity, it is assigned a lower weight of 2. For any other capacity i.e. less than that of ABC's a weight of 1 is assigned.

Planning: The suppliers ought to plan as per the 3-day trim plan and monthly plans shared by ABC, however PQR and XYZ plan only as per the monthly plan and hence is assigned a weight of 2. If a supplier plans as per both plans shared then a weight of 3 is assigned. For no plan being referred, the weight 1 is assigned

Manufacturing Lead Time: For 4 hours the weight assigned is 3, for 5 hours the weight is 2 and for 6 hours the weight assigned is 1; as these are JIT parts and suppliers are at a maximum distance of 3km, 4hours is an optimum time for manufacturing and making goods ready for despatch

Finished Good Inventory (Duration): The finished good is expected to keep flowing as these are JIT parts. Yet, for inventory to be stocked not more than an hour's inventory is to be kept in storage as it takes 1 hour to despatch and deliver the goods. Hence for 1hour the weight assigned is 3, for duration between 1 hour and 5 hours the weight assigned is 2; for any duration greater than 5 hours the weight assigned is 1. 5 hours is the time for XYZ to despatch goods, as it operates for only 1 shift; despatch occurs the next day

Finished Good Inventory (**Quantity**): The weight assigned for less than 10 items is 3, between 10-100 is 2 and greater than 100 is 1. 10 is the minimum amount that is shipped in a mini-truck while 100 is the maximum that is shipped.

Table 1: Comparative Analysis of Suppliers' Operational Metrics

Parameter	PQR Corporation	Weight Assigned	XYZ Motors	Weight Assigned
No. of shifts	Matches ABC	3	1	1
Type of assembly lines	1 exclusively for ABC	3	1 for each vehicle (exclusively for ABC)	3
Manufacturing Strategy	Assemble to Order	3	Made to Stock	1
Line Capacity	Matches ABC (14/21JPH)	3	20 JPH (axles)	2
Planning	As per plan shared by ABC	2	As per plan shared by ABC	2
Manufacturing Lead Time	4 hours	3	6 hours	1
FG Inventory (duration)	1 hour	3	24 hours	1
Amt. of FG Inventory	12	2	240	1
Type of Manpower Employed	Fixed	3	100% contractual	1

Type of Manpower Employed: 100% contractual is assigned a weight of 1, a mix of contractual and permanent employees is assigned 2 and 100% fixed employees is assigned 3.

From Table 1, it can be observed that XYZMotors does not follow any planning mechanism and thus as per its Made to Stock strategy, it has 20 times the inventory that PQR Corporation has. The manufacturing lead time of PQRis only 4 hours as compared to that of XYZ Motors. Hence, to increase the safety lead time the manufacturing lead time needs to be reduced.

As per the weights assigned, PQR has a higher sum total of 26 as compared to a meagre 13 for XYZ Motors. While PQR is already above the industry benchmark of 18.9 (i.e. 70%, as per the company's requirements); XYZ is way below the industry benchmark. Hence, XYZ Motors requires immense improvement in its manufacturing style and strategy.

The basis of the production plan is very pivotal in maintaining synchronous flow of material. Hence, the plans made at ABC's end are shared with the suppliers. However, there are no specific systems in place to ensure the shared plans are followed by the supplier.

Identify Benchmarking Partners

After laying down the parameters that needed benchmarking, the sources to gather information and key players were identified i.e. the suppliers and the MES reports.

The above comparison led us to believe that the current systems in place to inform the supplier regarding production and assembly are insufficient. PQR matches the number of shifts (2) and line capacity of ABC (14JPH) as it has a dedicated line for ABC's seats manufacturing. Yet, due to unavailability of plans, its line remains vacant. Situations arise when the line has an excess amount of activity and stress due to excess demand requirements from ABC's end. This problem was confirmed by the assembly line-workers of PQR, once the researcher interviewed them on the manufacturing process and strategy in place.

Collect and Analyse Benchmarking Information

The sample size for PQR was 16,000 XXX 500 vehicles produced in the year April 2013-April 2014, while for XYZ Motors 19,500 LTV and MPV vehicles were analysed in the same period.

Fig. 2 Shows the Manufacturing Process of Vehicles in ABC:-

PQRis a supplier of seats which is affixed during in the TCF shop of ABC. It was, however observed that there were immense shortage of seats on the line. It being an important component, the vehicle cannot be rolled out without a seat. Hence, the line is stopped until a seat is procured and affixed. In the year April 2013-April 2014 there were 23 instances of line stoppages. Thus, the reasons for the shortage in seats were analysed.

Fig. 2: Vehicle Manufacturing Process-Flow

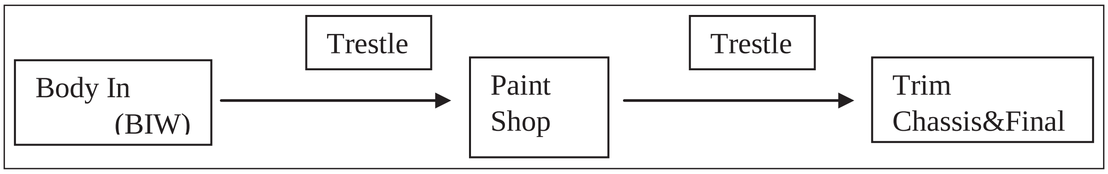
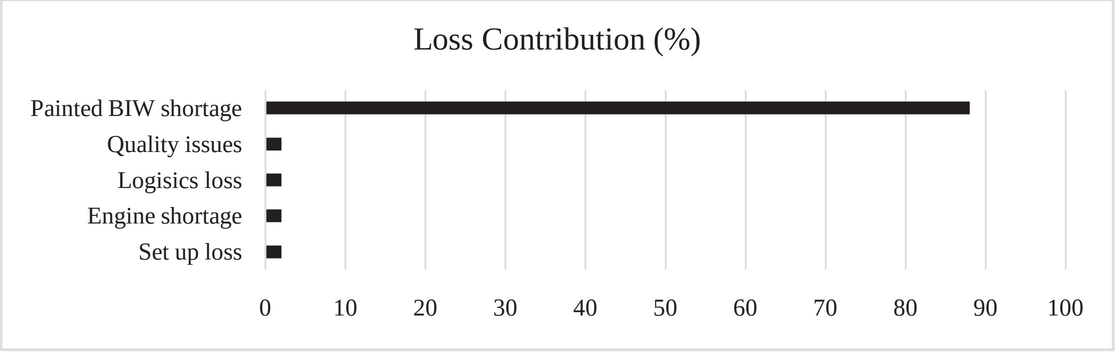


Fig. 3: Types of Losses and Their Contribution in Percentage



A sample size of 16,000 XXX 500 cars was analysed for the year April 2013-April 2014 and it was found that 88% of seat shortages arises because of Painted Body In White (PBIW) shortages.

The paint shop has a through put efficiency of only 60% and hence invariably there is no set order in the input of vehicles and the sequence of those outputting it.

Thus, this in turn impacts the planning, manufacturing and despatching sequence of seats from the supplier's end as he is unaware of which type of seat to produce and in which order.

If the seats are produced without any sequence, then at the time of despatch another non value added step will be required just for the process of sequencing the seats in order.

Hence, the PBIW shortages needs to be addressed. On further investigation of the data, it was found that this loss occurred 68 times in the year April 2013-April 2014

In the case of PQR Corporation it is observed that batching occurs. This thus has a cumulative effect on the manufacturing lead time.

The gap between the manufacturing lead time and the customer lead time needs to be increased. Increasing this gap will thus increase the safety lead time.

The shortages thus led to a cumulative loss in car production time to the tune of 110 hours for the period April 2013-April 2014.

This heavily impacted the cost incurred as, to produce 1 XXX 500 it takes 6 minutes. Hence, when 110 hours were lost:-

110 hours=110*60mins=6600 minutes lost

thus, implying that 1,100 vehicles were not produced

Each XXX 500 is priced between INR 10.80 lakhs to INR 12.88 lakhs. For the easeof calculation an average of INR 11.84 lakhs is assumed. Hence, since 1,100 vehicles were not produced, this amounted to a monetary loss of INR 130 crores.

Thus, it was important to find the root cause of the shortage of seats. By means of a fishbone diagram (Fig. 6), the root cause was arrived upon.

Fig. 4: No. of Times PBIW Losses Occurred in the year April 2013-April 2014

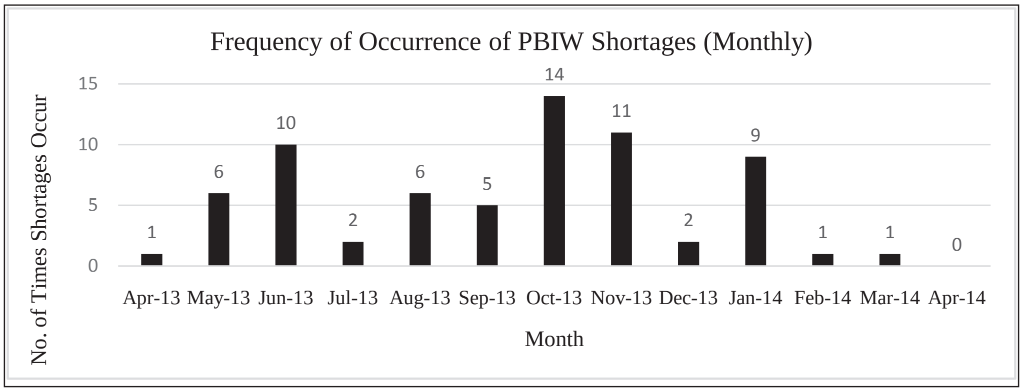


Fig. 5: Time Lost due to PBIW Shortages in the year April 2013-April 2014

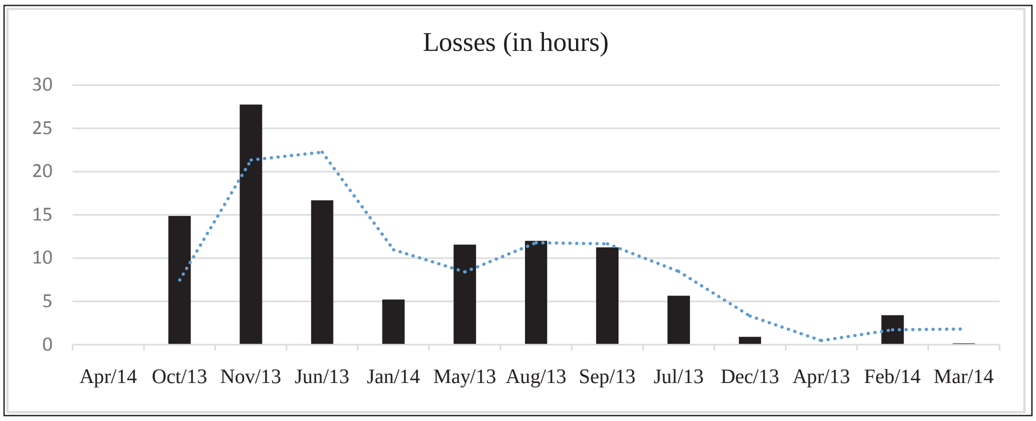
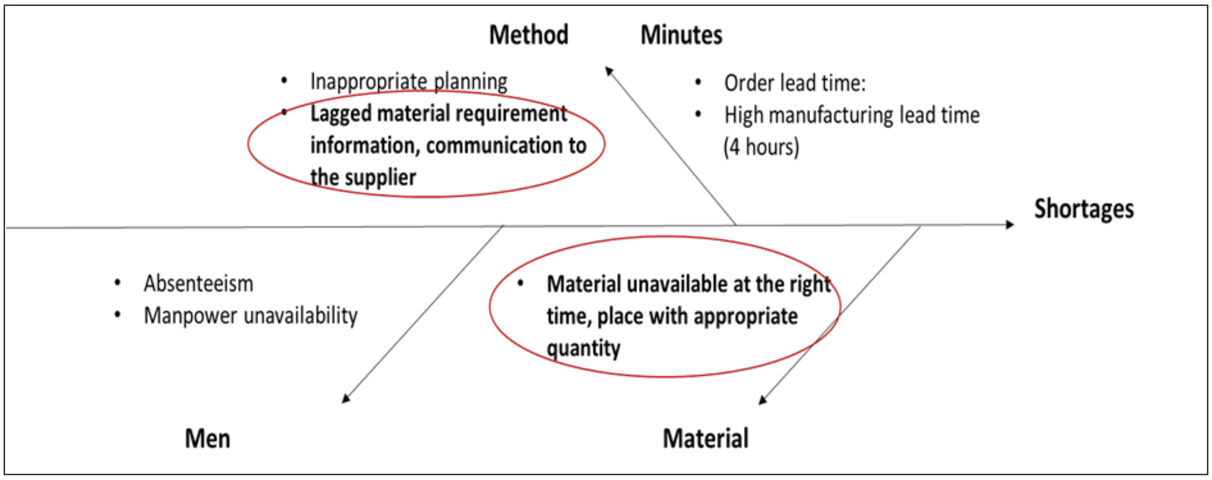


Fig. 6: Fishbone Diagram



With the aid of a 5-Why analysis (Table 2) the root cause was furthered delved upon.

It was found that there were no effective systems in place to inform the supplier regarding the seat requirements and hence his material planning and procurement were not in synch with that of ABC's requirements.

The following is a brief description of the current system in place for information flow:-

1. The 3-day trim plan for material planning (vendor raw material planning) at the mix level is shared daily at the end of the first shift with the supplier.
2. To intimate the suppliers for dispatch of JIT parts, the MES Rockwell system is used. The system sends triggers of material requirements, via an email, to the supplier (PQR Corporation) at a frequency of 1 hour i.e. a lagged amount of information sharing is in place.

   At this instance, in case of PQR the reorder level is 36% (i.e. 32 sets of seats out of 90 in WIP). Hence, within this 1 hour, 37.5% of the stock (12 sets) in the inventory flows to the next job.
3. There are times when the body exiting the paint shop is skipped and such vehicles are not detected until they enter TCF. This leaves the supplier with less than 1 hour to supply parts as there is no buffer stock available for JIT parts. This is a major shortcoming of the present system in place.

Take Action

After analysing the data within ABC, I visited PQR to understand its manufacturing process. The data was collected for the minimum safety lead time i.e. when the trestle between paint out and TCF in, is least. Fig. 7 depicts the time duration of the vehicle at each shop and the simultaneous production of seats at the supplier's end.

For a vehicle exiting the paint shop at 08:04 am, the Rockwell system sends a delayed trigger to the supplier for the seat requirement. Till the time the vehicle is in the trestle and enters the TCF, the production and despatch of the seat takes place.The safety lead time between ABC and PQR is only 125 minutes as observed in the diagram. Hence information must be shared real-time.With the aid of IT support, a system was introduced to share WIP reports on a daily basis and real time data was shared with PQR. Improvement is noticed in the parameters shown in Table 3, assuming the other parameters to remain a constant.

Table 2: 5-Why Analysis

Why 1	Why 2	Why 3	Why 4
Seat shortages	Supplier was unaware of the exact seat requirement and sequence of production	Untimely information to supplier	No effective system in place for communication with the supplier

Fig. 7: Simultaneous Process Flow of Vehicle and Seat at ABC and PQR respectively

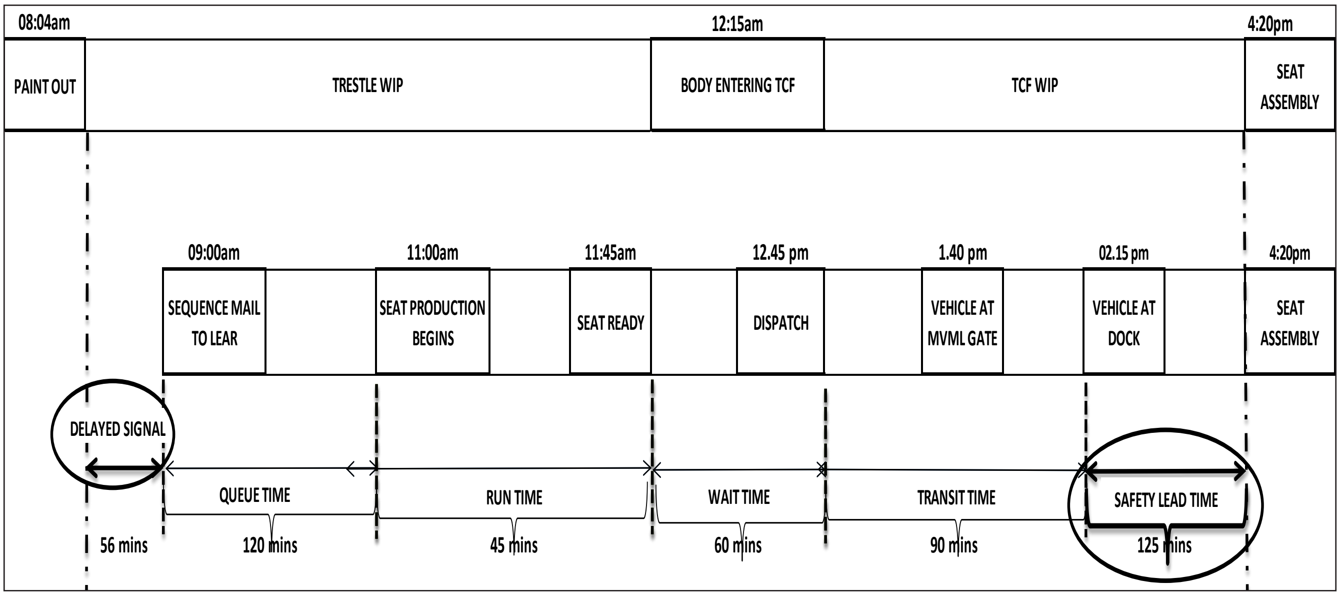


Table 3: Performance Improvement Depicted by Weights Assigned

Parameter	PQRCorporation	Weight Assigned	Weight Assigned after Improvement
Planning	As per plan shared by ABC	2	3
FG Inventory (duration)	0.5 hour	2	3
Amt. of FG Inventory	6+2(safety stock)	3	3

Taking PQR as a benchmark, the process of manufacturing LTV & MPV vehicles was studied and analysed. The vehicle flows from the BIW-Paint shop-TCF, however the body waits for the successive activity to be completed before moving to the next job. Hence there are bodies waiting the trestle as well.

Thus, a sample size of 12,500 LTV and MPV vehicles was studied to assess the time spent in each component of the vehicle-making process. This is further illustrated with the help of the graphs and diagram shown in Fig. 8 through 13.

The run time at each job (BIW-Paint Shop-TCF) and the queue time between jobs was analysed. The sample size was 12,500 LTV and MPV vehicles. The run time was calculated on the basis of the data captured on the MES reports in the SAP system. The queue time was calculated as the difference between the entry time (from successive job) and exit time (from previous job).

The graph shown in Fig. 9 depicts the run time of the vehicles in the BIW shop, in terms of the number of occurrences and the time (in hours). The run time is calculated for the period when the vehicle is worked upon. It is observed that 70% of the occurrences occur between the first 6 hours of operation. Hence, these first 6 hours are critical for job completion and determine when the vehicle moves for the next job.

Fig. 8: Vehicle Manufacturing Process-Flow

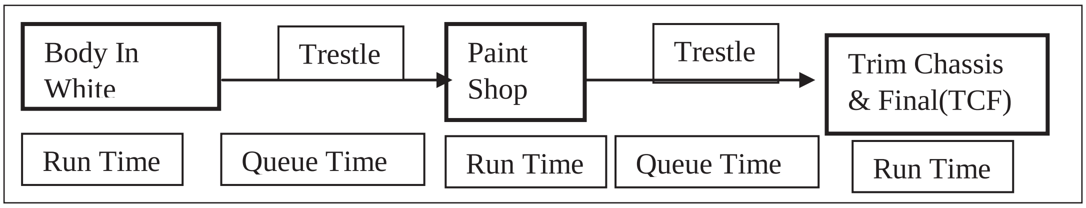
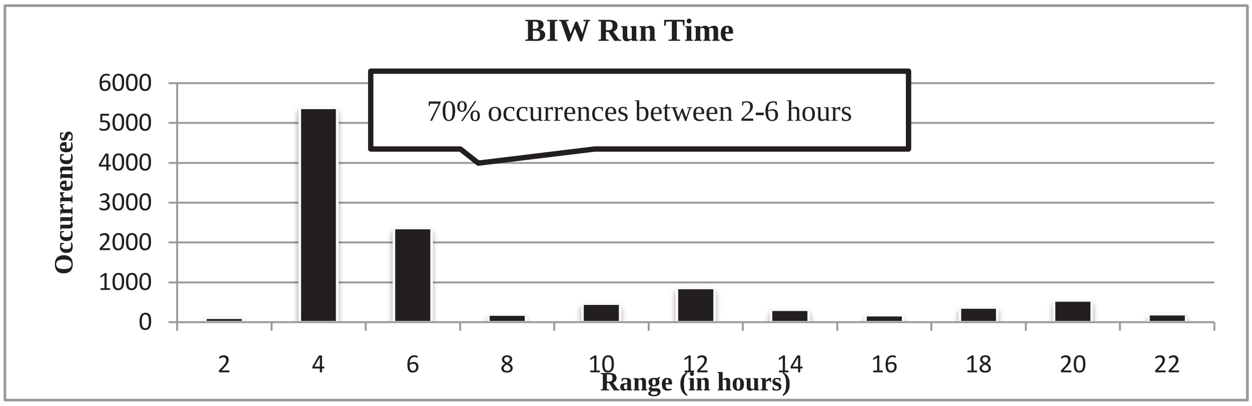


Fig. 9: BIW Run Time for LTV and MPV



The graph shown in Fig. 10 depicts the queue time/waiting time of the vehicle after it has exited the BIW shop and is yet to be serviced at the Paint shop. The graph highlights the number of times the vehicles are made to wait before servicing. 85% of the occurrences occur between the first 24 hours, hence the body is made to wait for a day till it is inputted in the paint shop. The paint shop's through put inefficiency is a major cause for this enhanced queue time.

The paint shop takes maximum time, with 77% of the occurrences between the first 30 hours.

Fig.10: BIW-Paint in Queue Time for LTV and MPV

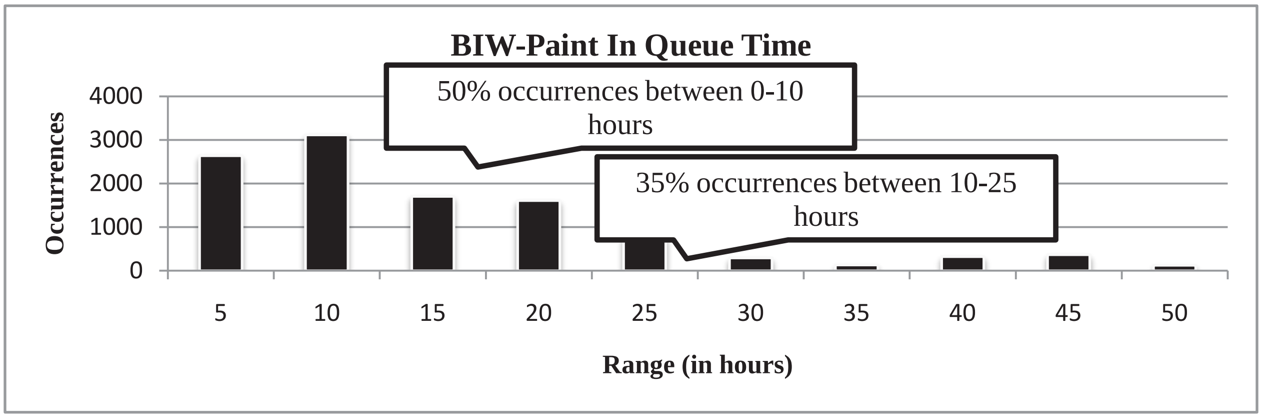


Fig.11: Paint Shop Run Time for LTV and MPV

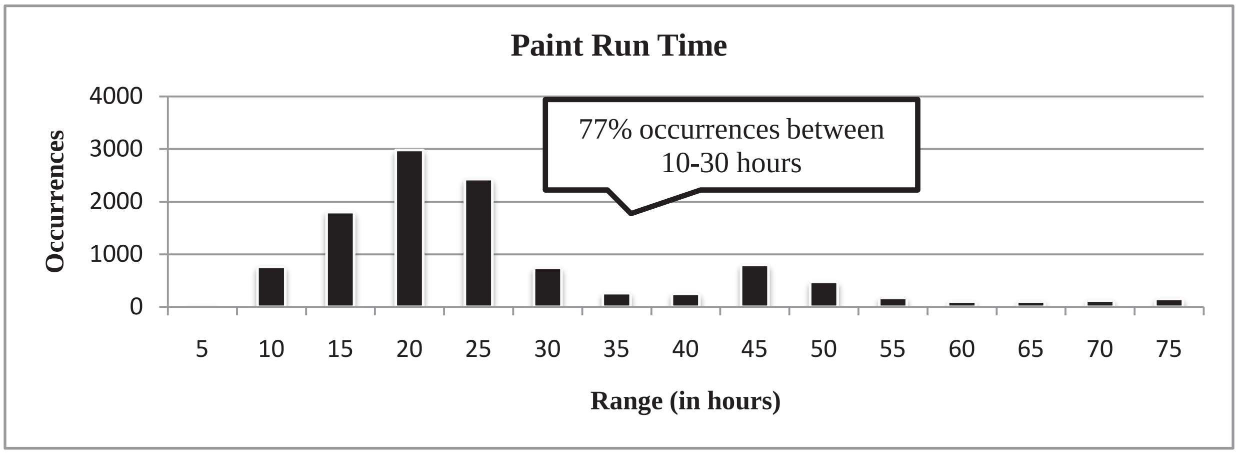
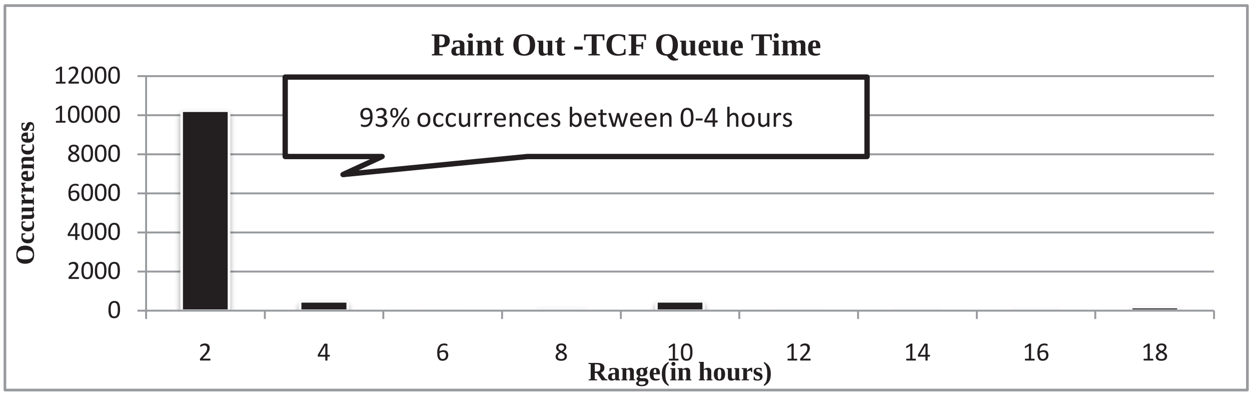


Fig.12: Paint Out-TCF in Queue Time for LTV and MPV



Similarly, the graph shown in Fig. 12 depicts the queue time between the vehicle exiting the Paint shop and when it enters the TCF shop.

Thus the cycle time from the BIW shop to the TCF shop was found to be as shown in Fig. 13.

There are situations when the trestle is left empty and hence the minimum total time for the entire process is 10 hours, while on an average the time taken is 20.5 hours. Hence we can conclude that the plan should be as per the minimum run time to meet the optimum vehicle production. Presently XYZ Motors is not producing as per the 3-day trim plan but as per its line capacity, hence stocking finished good inventory of 240 axles excluding the safety stock.

The axle line capacity is 20JPH, while for exhausts the capacity is 12/15JPH and presently, there are no systems in place for production. Production is as per the capacity and the 3-day trim plan shared by ABC

XYZ Motors is following a push strategy and making to stock, as he operates only for 12 hours (1 shift) daily. Thus, he currently keeps finished goods inventory and safety stock of up to 1.5 days i.e. 240 in quantity. Hence, there is added manual handling of material for the purpose of storage in the inventory area and then again while sequencing for dispatch from the dock.

Presently the plant is producing more than ABC's capacity and thus, stocks inventory. However, when new products will be introduced and demand for axles and exhausts will increase, then XYZ cannot afford to stock inventory, as space will be a constraint. As there are dedicated assembly lines for each product type, when a new product is introduced XYZ is expected to construct a new assembly line for the same. However, the space for the finished good inventory and safety stock will shrink. Hence, he will not be able to continue with the MTS strategy.

Fig.13: Cycle Time for LTV and MPV Vehicle Manufacturing

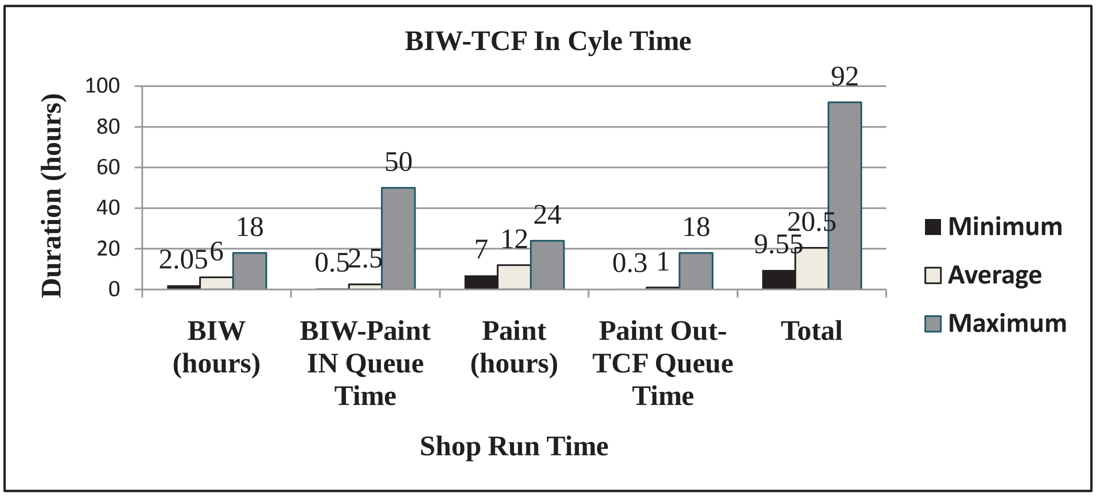


Fig.14: XYZ Motors Present Layout

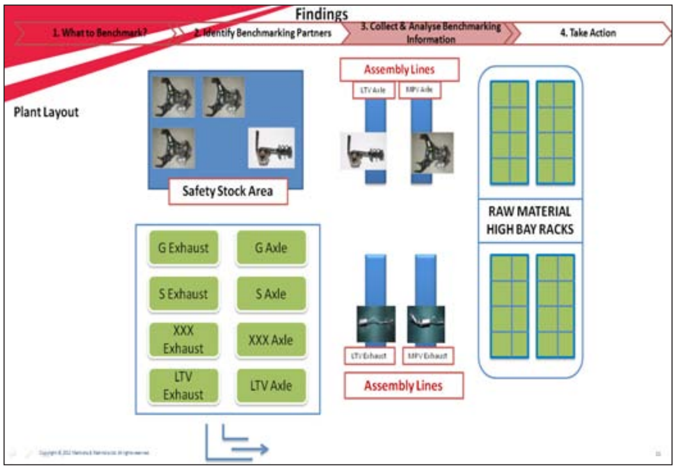
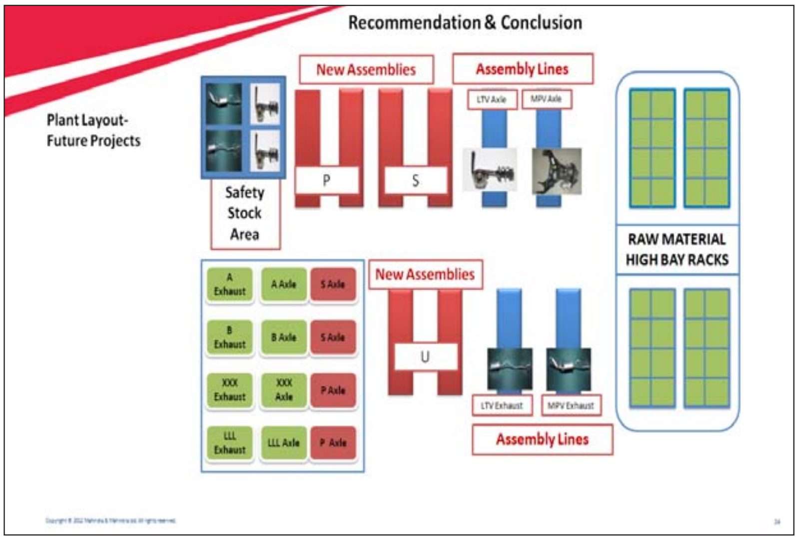


Fig.15: XYZ Motors Future Layout if Continued with the Present Strategy



As depicted in the following diagrams, the present layout provides a space constraint and is thus unsuitable for future product lines.

Hence, the present manufacturing strategy needs to be changed so as to accommodate new assembly lines and reduce stocking of finished goods.

Conclusion

Lead Time

In the case of PQR Corporation it is observed that batching occurs. This thus has a cumulative effect on the manufacturing lead time.

The gap between the manufacturing lead time and the customer lead time needs to be increased which will thus increase the safety lead time.

Information Flow & Supplier Network Collaboration

Since seat requirements are not communicated at the desired frequency, batching occurs and hence to eliminate this situation real time visibility of information flow is required.

There are situations when the supplier has to wait for these triggers while his line would be empty. If information is not shared on a timely basis then supplier's lead time increases. This ultimately leads to material shortages. It is important to note that such shortages occur when there is an amplified demand requirement & this demand is not communicated at an appropriate time specially when there is a shortage of painted BIW in trestle.

To minimise the supplier lead time smooth flow of information is thus required, by means of real time visibility of demand and sharing of ABC's production plans with the supplier.

Manufacturing Strategy

For XYZMotors the manufacturing strategy needs to be changed from MTS to ATO and plans need to be shared at a real time basis so as to reduce the amount of inventory and maximise the space utilisation for future projects. With the aid of IT support, triggers will enhance the production as per the requirement and eliminate the additional manpower for material handling at the time of sequencing for despatch.

Observations and Suggestions

On the basis of the data analysed, it is observed that the lack of effective systems is a reason for the shortages and excess inventory in PQR and XYZ respectively. Hence, it is suggested that the following system be installed:-

1. IT support to send triggers at a real time basis to the supplier
2. Share WIP plans every day with the supplier

For PQR the improvement observed is as shown in Fig. 16.

The trigger is instantaneously sent to the supplier once the body leaves the paint shop and seat production commences. Since, the initial queue time is reduced, this additional time is added towards the safety lead time i.e. 220 minutes as compared to the prior 125 minutes. Thus, leaving PQR with more time to plan, procure, produce and despatch. In the situation of any unforeseen emergency, there is sufficient time for PQRto send the seats on time.

Thus, the increased safety lead time ensures material availability on time.

Using PQR's improvement as a benchmark, a similar suggestion of real time data leads to the safety lead time to 10 hours (Fig. 17).

A live trigger is sent to XYZ as soon as the vehicle enters the BIW shop. This gives the supplier more than 7 hours for axle production and its despatch. Hence, changing the manufacturing strategy from MTS to ATO, hence reducing the manufacturing lead time to 4 hours. Additionally there will not be high inventory and hence the space can be used for upcoming product assembly lines. Hence it is suggested that a system be introduced to send demand requirements at higher frequencies and the WIP should be shared with the supplier to enhance visibility and ultimately leading to a smoother process. The expected improvement is tabulated in Table 4, assuming the other parameters to be a constant.

Fig.16: Improved Process Flow of Vehicle and Seat

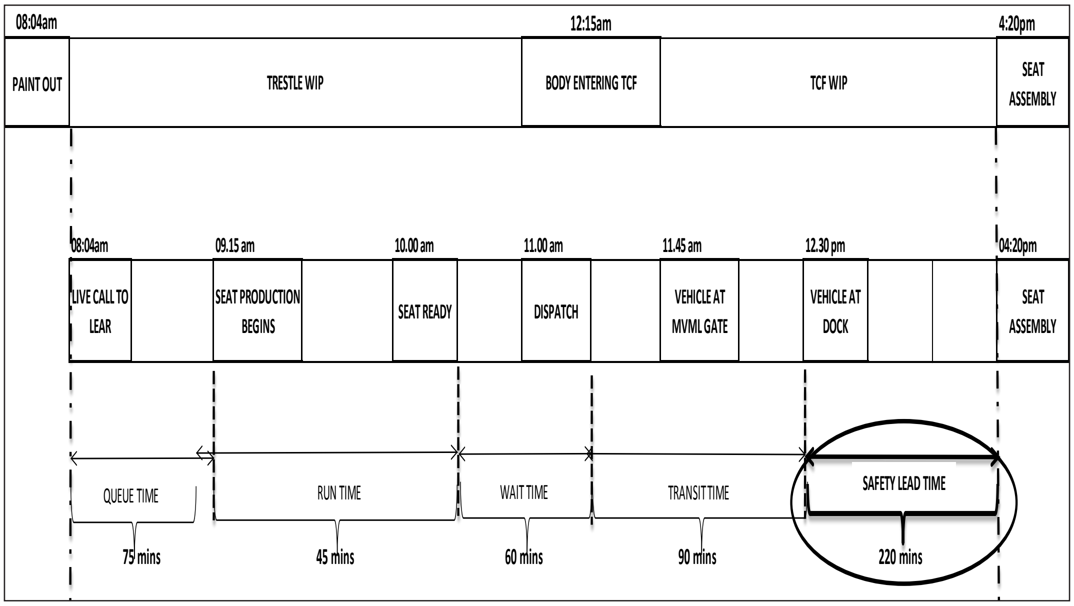


Fig.17: Process Map – Average Time

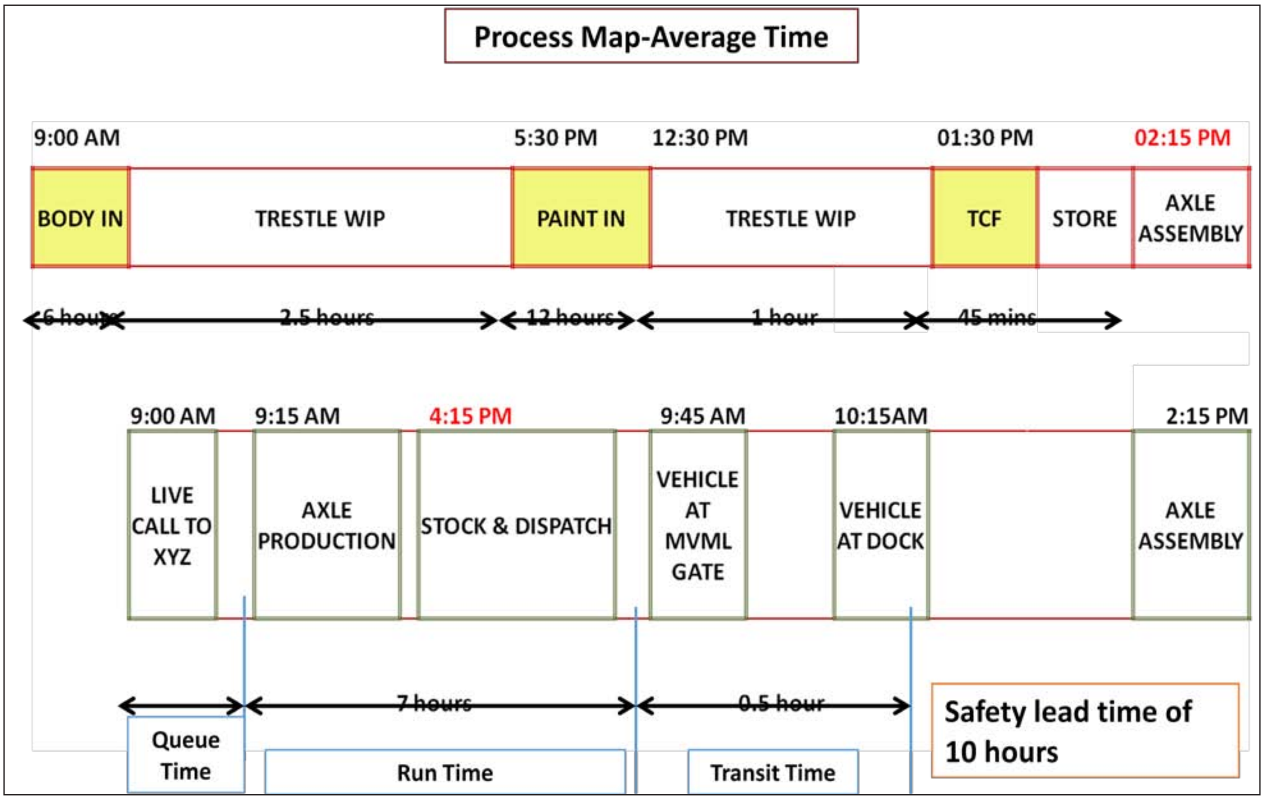


Table 4: Expected Performance Improvement Depicted by Weights Assigned

Parameter	XYZMotors	Weight Assigned	Weight Assigned after Expected Improvement
Manufacturing Strategy	Made to Stock	1	3 (Assemble to Order)
Planning	As per plan shared by ABC	2	3 (Real time data)
FG Inventory (duration)	24 hours	1	2 (5 hours)
Amt. of FG Inventory	240	1	2 (100)

References

Anderson, D. L., & Lee, H. (1999). Synchronized supply chains; the new frontiers. *Achieving Supply Chain Excellence through Technology*, Montgomery Research, Inc., San Francisco, CA, pp.12-21.

Angerhofer, B. J., & Angelides, M. C. (2006). A model and a performance measurement system for collaborative supply chains. *Decision Support Systems*, 42, 283-301.

Barratt, M. (2004). Understanding the meaning of collaboration in the supply chain. *Supply Chain Management: An International Journal*, 9(1), 30-41.

Camp, R. C. (1989). *Benchmarking: The search for industry best practices that lead to superior performance.* Milwaukee, WI: Quality Press.

Introduction to Materials Management by Tony Arnold

Lummus, R. R, & Vokurka, R. J. (1999). Defining supply chain management: A historical perspective and practical guidelines. *Industrial Management and Data systems*, 99(2), 11-17

Sahay, B. S. (2003). Supply chain collaboration: The key to value creation. *International Journal of Productivity and Performance Management*, 52(2), 76-83

Spendolini, M. (2003). *The benchmarking book.* New York, AMACOM