HOW TO ENSURE QUALITY, REDUCE CYCLE TIME, AND CONTROL COSTS

L&T case study

1. THE COMPANY

1.1 Process-driven, forward-thinking

LTM Business Unit of Larsen & Toubro Limited formerly L&T McNeil Limited (LTM) is a market leader in the tyre curing press business in the domestic market and is a significant player in the export market. LTM gained acceptance from most tyre majors, who control 70% of the tyre industry global turnover. Established in 1972 as a Joint Venture between L & T Limited and McNeil Akron Inc, USA, the company today has experienced steady growth over the past decade, with exponentially increasing domestic and international sales figures (see fig 1)

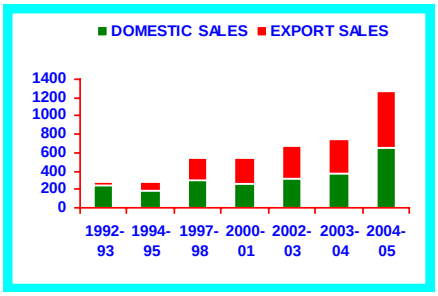


Fig. 1: Sales Figures

2. THE NEED

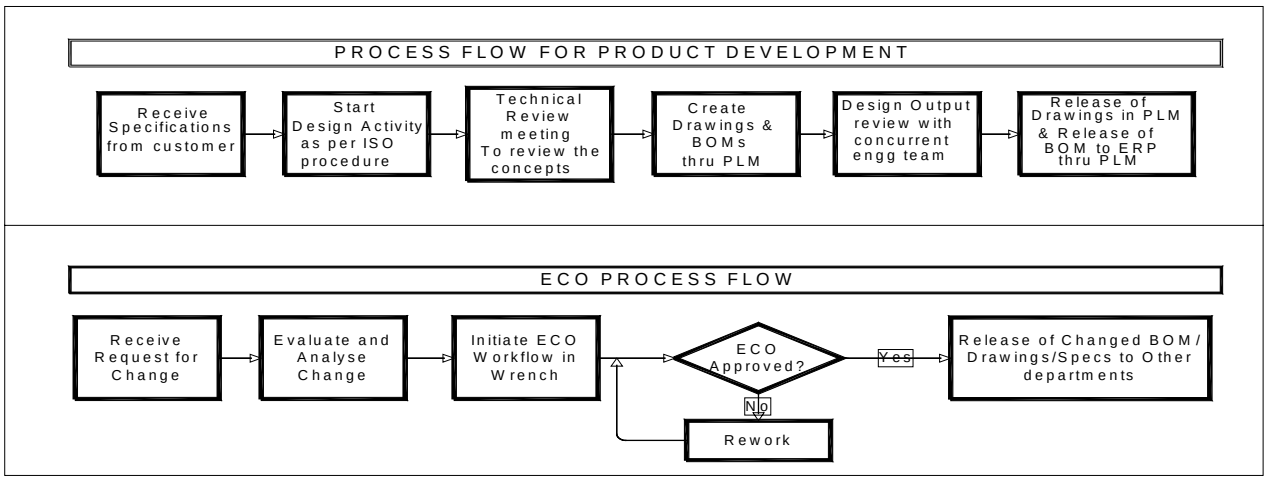
2.1 Increasing pressure = decreasing efficiency

In recent years, external pressure and foreign competition forced LTM to re-assess their performance. This eventually led to a detailed study of their engineering operations and product development cycle. Several key issues were identified that had either been ignored or had become accepted with repeated usage. In the absence of viable solutions, a surprisingly large number of errors (resulting in rework and scrap) were due to the random/manual work methodologies. There was an urgent need to lower development costs and speed up development time cycles.

2.2 New Product Development Process

The new product development process falls into following categories.

- Products with new concepts
- Products variants to customer needs resulting in major design modifications to existing products
- Product configurations to meet customer various customer requirements



Here is a typical process flow:*(fig 2)*

2.3 Challenges

As tyre technology evolved, (including the development of radial tyres for high-speed passenger cars), domestic and overseas customers began demanding high accuracy and special features on tyre-manufacturing equipment. However, customer requirements were not uniform because everyone started the development activity independently. Also, the various process improvement methodologies adopted in each of these industries like ISO 9000, TQM, TPM, KAIZEN, SIX SIGMA, SAFETY Standards, ISO 14000, catalog-item standardization, waste elimination, etc. demanded major changes on equipment.

LTM was following a mixture of manual and semi-automated processes to implement the above process. These manual processes had evolved over the years, and while they worked after a fashion, they were prohibitively expensive in terms of

manpower. They also meant a lot of time wasted in routine, repeated activities like coordinating and firefighting at the last minute to overcome errors.

In a bid to streamline the complex mass of processes, tasks, activities and documentation that comprise a typical NPD cycle, LTM made a brain storming of the specific problems they encountered:

2.3.1 Process monitoring: *Problems in follow-up of individual/group deliverables, project status and assessing overall progress.*

- Complete dependency on individuals during design and development process. Human error was high.
- 30% time wastage in searching for required data (files + referenced material, files associated with other files etc.)
- Status of a project in terms of release of drawings and Bill of materials (BOM)

2.3.2 Document management: *Problems in creating, storing, and retrieving files/drawings*

- Part & BOM information was not easily available to designers due to the limitations on number of ERP licenses. This meant that although data did exist in digital form, getting access to it was difficult and lot of time wasted in waiting for somebody to log out.
- Extensive reworking/ scrapping caused by mismatched revision numbers between ERP data and actual (hard copy) drawings
- Delay in issue of drawing prints to user departments due to manual print requests.
- Issue of drawing prints for manufacturing/purchase was uncontrolled.
- No link between drawings and BOMs and manual entry of BOM in MRP system.
- No control over multiple copies of the same drawing.

2.3.3 Change management: *Problems in revising drawings, and in updating all associated documentation.*

- No common system to prevent usage of drawings to old revisions.
- Change management was manual and not communicated to end users in time.
- Change history and reasons were not captured - known only to individuals.
- No way to communicate changes with all concerned personnel on time
- All changes had to be updated manually to linked documents
- Product history not captured and maintained systematically

2.3.4 Data security & reusability: *No way to reuse data and protect intellectual capital*

- Lack of security on intellectual data being copied out.
- Most of the learning's/design calculations during product development were lost.
- Duplication of work as the previous records are not captured and linked to respective parts/BOMs
- Impossible to keep track of sensitive data
- No accountability with respect to data access/retrieval and outbound communication

2.3.5 Collaboration & concurrent engineering: *No cost/time-effective way to review /share data across multiple groups and locations*

- No collaboration among cross functional departments during product development
- No sharing of massive volume of digital product data available with different departments like Engineering, Marketing, Purchase, Manufacturing, Service, Quality, etc.
- No participation of experienced personnel during development process.
- Poor visualization of products for the users as there was no tools to access the 3D solid models created by design department.

2.3.6 Customer interaction: *Issues that compromised customer satisfaction*

- Changes to the customer specifications not linked to the Machine
- Feedback from customer not captured and linked to relevant documents.

2.4 Wish list.

In the final analysis, what LTM wanted was a way to **resolve ALL the above issues simultaneously.** Patch solutions, they had learnt from experience, would only create a new set of problems, as well as adding to costs. In short, LTM needed a way to:

1. **Ensure Quality of output to its customers.** By producing first time right product to meet all the customer's specification.
2. **Deliver on time.** By drastically reducing time taken for product configuration. Also by eliminating the high ratio of errors in product configuration resulting in need for multi-stage reworking – which in turn led to huge time wastage.
3. **Control costs** - If redundancies and rework / scrap could be eliminated, huge savings could result from this alone. By reusing the already proven concepts and designs thus eliminating the cost of design and prototype development.

HISTORY: Past Ad-hoc solutions
In an bid to control costs, L&T first tried to solve specific issues on a case-by-case basis.

These included:
- a 'Print request' program
- a Centralized storage of drawings with defined File naming procedure
- 'View access' for cross functional departments for drawings stored in R&D server.

This broad 'triangular' wish list was further broken down into tangible ways to create the ideal working environment.

2.5 The Ideal Product development environment

Designers should have:

- 3D solid modeling at concept stage
- 3D solid model directly associated with 2D diagrams for more accurate visualization
- 3D Assembly based on constraints to check various configurations.
- All documents in electronic form
- Viewing and printing facilities at user end instead of manual print requests and collection of prints from design department.
- BOMs automatically associated with assemblies
- Changes automatically and associated with 3D assemblies
- Quality plan associated with part / assemblies
- Design data/calculations/FEA automatically associated with parts and assemblies
- Immediate access to cost data during development
- Single window access to eliminate switching between multiple programs and terminals
- Concurrent engineering in the main stream
- Schedule for prototype at concept
- Online costing of new tools made available to facilitate faster decision-making
- Monitoring of project status during development

3. IMPLEMENTATION

3.1 Finding a software solution

Having clearly defined what they wanted from their ideal solution, LTM evaluated various options available in the market, and finally chose an indigenous solution, which seemed to be a good match on paper at least. The solution, WRENCH, claimed to be an vertical-specific IT product that was built specially for engineering enterprises.

Evaluation criteria included:

- Meeting the requirements as per the vision statement
- Seamless interface with the existing MRP-II system
- Customization skills to provide a PLM without forcing changes to existing good practices already in place
- Cost of implementation and maintenance
- Possibility for future upgrades / addition of new modules

HISTORY: **Eye on ERP**

LTM had implemented ERP 10 years back

HOWEVER, THEY LEARNED OVER TIME AND SEVERAL PRODUCT CYCLES THAT GENERIC ERP SOLUTIONS COULD AT BEST, STREAMLINE ISOLATED GROUPS OF FUNCTIONALITY AT A MORE CORPORATE LEVEL. ANY

3.2 Implementation process

The implementation of WRENCH took five months to complete after completing the groundwork of organizing the legacy data for nearly six months. The process started with a complete overhaul of all the systems and processes in use. Since this was the first time such an in depth, enterprise-wide solution had been attempted, several key issues surfaced at this and later stages which had to be resolved immediately. For example:

- How to build a robust and **workable 'single window access system'** which had been asked for by the design groups. Extensive brainstorming was needed to list out all the requirements and create a viable solution for this.
- How to ensure loss-less digitization of **Legacy data** (built over many years, in multiple formats and storage media).
- How to interface with the existing **MRP-II system**. The WRENCH team devoted several days to understanding this system before attempting the integration.
- How to get senior engineers to adapt to what were sometimes seen as '**revolutionary new concepts'** …and also to sell these same concepts to traditionalists within the organization
- How to ensure that all groups had a **smooth transition** to the new system. This was achieved via goal-oriented training.

4. BENEFITS

In the 3 years since implementation of WRENCH, the following benefits have been measured across 200 number of product development cycles.

4.1 Reduced Cycle Time: 50% faster product development*, due to:

- 15 times faster product configuration. The BOM variant concept allows for a catalog-based approach. Designers start with a base product configuration, and have instant access to all variants of all components
- Data reusability – Designers have access past project data/product configurations to avoid 're-inventing the wheel'.
- 100% accuracy in engineering data. Which means no unnecessary rework due to erroneous data.. Now that data is no longer manually keyed in, both human error and accidental duplications have been eliminated.
- Single window access for design engineers which increases their efficiency by 30% since they no longer have to walk down and wait for accessing ERP data.
- Faster change management with immediate flow of changed data plus automatic tracking of change process with work flow
- Quick review of project status due to color coding for drawing and BOM status in configuration

4.2 Assured Quality: all **quality assurance** processes as defined by ISO are now enforced automatically across the organization. At the same time, managers have enough flexibility to enable special-case bypasses for certain steps. Specific improvements include:

- Online tracking of deliverables for managers
- Linking of Design calculations, FEA, layouts drawings & other related documents to part master/work orders.
- Instant access (online) to the latest drawings for the user – no chance of error/old data which leads to rework/scrap. At the same time, security is maintained based on logins. In this case, access to the latest drawings can be limited to viewing and red-line marking only.
- Automatic work flow management for Draw/Check and Approval process
- Linking of customer feed backs / Moms to the concerned work orders.
- Linking of manufacturing data to drawings
- Linking the part history/field test results to the concerned work orders
- Link between the reference/collaborator drawings and the final drawings
- Sharing of information between the user departments
- Ability to view and mark 200+ file formats without installing the originator software including Mechanical desktop, Inventor and ProE files
- Better visualization of the part by shop/supply groups by viewing the solid models

4.3 Controlled costs – Apart from the obvious cost-saving stemming from faster delivery and quality output, overall productivity has also increased. Also, many operational problems were resolved which has led to indirect, but significant cost savings, like:

- Immediate access to JDEdwards ERP data from a designer's desktop without consuming the license of ERP package. Considering that the cost of each ERP license, this works out to a saving of more than the cost of implementing PLM!!!
- Concurrent engineering during design stage. Online collaboration ensures cost and time-effective reviews and discussions on value engineering.
- 40% Reduction in number of drawing prints
- Automatic printing and mailing with approved stamp & electronic signatures - efficient and much cheaper, no rework/scrap.
- Complete security for design data in server – no costs linked to mistakes or damage control in case of leakages.

5. NEXT STEPS

Today, 3 years after first implementing the new enterprise system, LTM is planning to add a new module for: "ISO NON CONFORMITY MANAGEMENT AND CLOSURE".

Projected functionality includes:

- Online access of NC registers to design engineers
- NC disposal / corrective and preventive action through automatic workflow management
- Past history of the part is captured as knowledge base for further analysis and review
- Complete history of each work order including field performance/complaints for analysis and review]

** All figures ,percentages, dates etc. are calculated from actual data in our archives and are based on at least complete product development cycle.*