

Cycle Time Reduction in the Pharmaceutical Industry

ISPE
Copenhagen
Dec 1st 2003

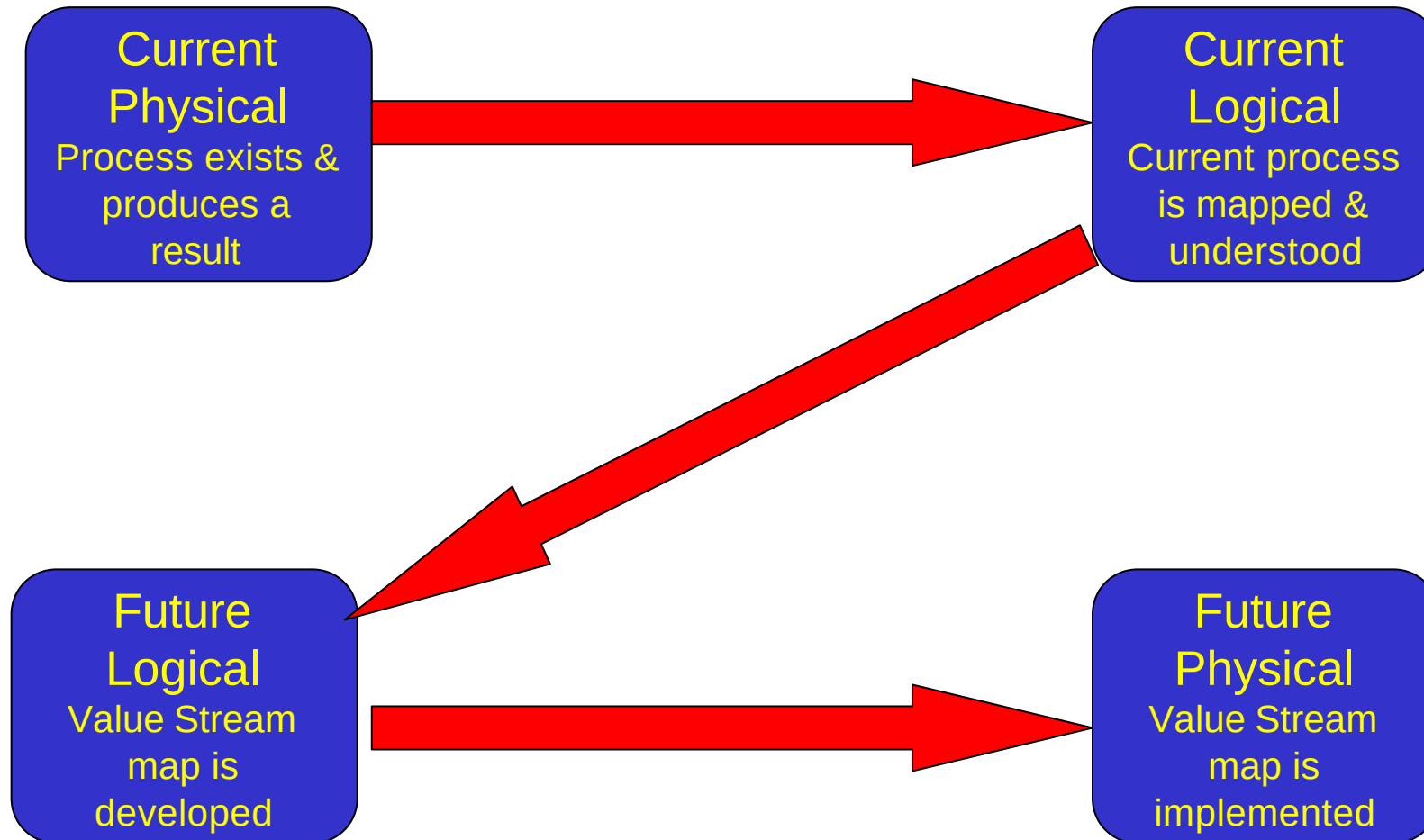


Contents

- Methodology used
- Case Study 1 → Cycle Time Reduction in API operations
- Case Study 2 → Cycle Time Reduction in Sterile Fill/Finish operations



Methodology used



Methodology used

**Current
Physical**
Process exists &
produces a result

- The process exists and produces a result, but there may be very little overall understanding of
 - what exactly happens
 - when it takes place
 - how it occurs
 - who undertakes the activities or even how well they are carried out.

All the understanding of the process is 'hard-wired' into people's jobs, machine programs, plant layout etc. There is little or no understanding of the history of the process in its current format

Methodology used

Current Logical
Current process is
mapped &
understood

- The process is mapped out
 - Everybody can see exactly how it works currently.
 - The flow of activities, and how they are resourced and controlled is understood.
 - The performance (time taken, number produced, yield rate etc.) and the variability in that performance is documented.

All personnel involved in the process are engaged. This delivers common understanding of current process and helps highlight the need for consensus and improvement

Methodology used

Future Logical
Value Stream map
is developed

- The Current logical map is considered for
 - weaknesses
 - inefficiencies.
- These are addressed by changing
 - work flows and activities
 - resources
 - control mechanisms.
- A new map is then developed to show how the process could be → Future Logical

New process is developed by team and achieves 'built-in' credibility thus guaranteeing ownership and success

Methodology used

Future Physical
Value Stream map
is implemented

- The changed map is implemented through changes in
 - procedures
 - re-training
 - machine re-design
 - new control systems
 - education of teams.

This cycle can then be repeated to leverage another phase of reductions

Process Improvements That Can Be Achieved

- Cycle Time
- Yield
- Quality
- Safety
- Ergonomic



Methodology used cont'd

- The logic of Process Redesign is that if you can determine exactly what all the bits of the process should be doing, then refine them and develop them into a repeatable robust process - the output of the process will look after itself



Current Logical Definition

- Involve all personnel at all stages of process
 - Develop project timeline and ensure adherence
- Educate and explain why the business needs improvement and the targets that need to be achieved and why
 - Knowledge management
 - Interview
- Relate the improvements to improvements in their work and roles
- Invite input from all in relation to where the issues lie
 - Discussion
- Understand the process
 - Develop current state map
- Establish a means of collecting meaningful data to help highlight issues with the process
 - Identify issues adversely affecting process performance



Value stream mapping

- Train personnel in tools and techniques
 - Process mapping methodology
 - Problem solving techniques
- Identify the NVA (non value adding steps) and the NNVA (necessary non value adding steps)
 - Work the process
 - Develop future state map
- Reduce and eliminate as many NVA steps as possible
 - Address easily fixed issues first
 - Utilise project teams to address other identified issues



Defining the Future Logical

- Develop a new process timeline
 - Single batch
 - Campaign models
- Establish most suitable shift pattern
- Establish resource requirements
- Utilising the above develop the best fitting campaign model

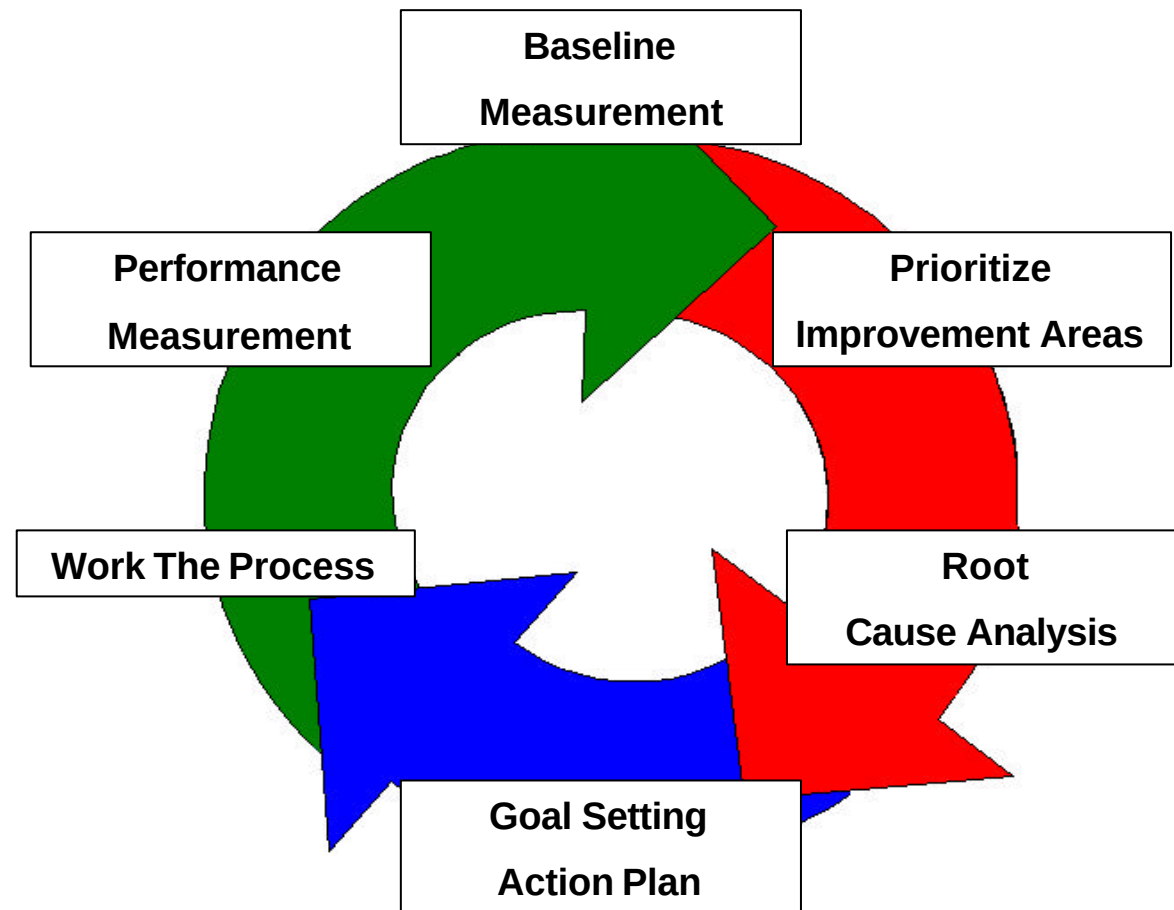


Implementing Future Physical

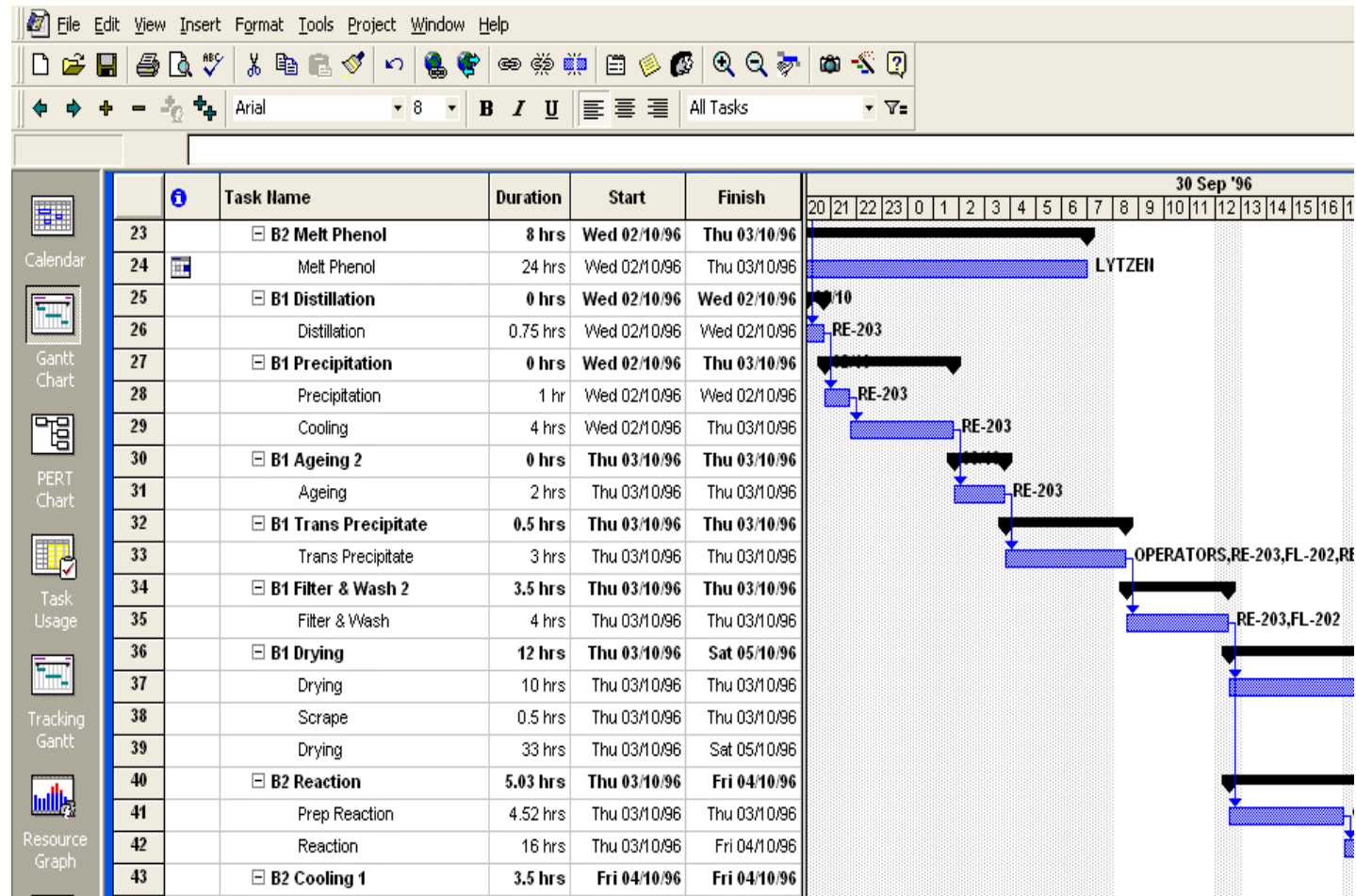
- Trial new process
 - Defined period
 - Agreed success criteria
 - Implement agreed improvements
 - Work the new process campaign model
- Agree new process
 - Develop multifunctional work practices
- Update procedures
- Establish standards and KPIs
- Train & Educate all personnel
- Monitor performance
 - Monitor process steps and address issues
- Repeat process



Ideal Improvement Process



Manage the Critical Path



Use timeline to plot and manage critical path of process

Case Study 1 → API cycle time reduction



Cycle Time Reduction Cycle Time Reduction & API's

- API process has 2 components
 - Chemical process (fermentation, sterilisation, reduction etc)
 - Validation implications for changes
 - Logistical process to move the materials and people during the phases of production. This defines the overall cycle time.
- One of the main challenges in API development is determining when a 'manufacturing emphasis' can be placed on the development of a new product process
- Focus is usually on the reaction steps and the complete manufacturing operation is reviewed almost as an 'afterthought'
- Thus consideration of the most efficient means of operation usually only occurs when the product is ready to go into production



Cycle Time Reduction Cycle Time Reduction & API's

- A client was processing one batch every 21 weeks.
- Forecasts for this product were showing a requirement of 12 batches over the next 12 months
 - One batch every 4 weeks
- Location and layout of facilities prevented expansion of production facilities
- Increased capability required in short period → 3/ 4 months



Challenges Encountered

- Established workforce
 - 10+ years with company
 - Closed way of thinking → ‘This is the way we have always done it!’
- Fear of increased workload
 - ‘Work hard to make more’
- Management resistance to engage workforce in change process
 - ‘No valuable input’
- Poor use of SCADA system for report generation
 - Little or no information about events during process
- Frequent equipment breakdown
 - Poorly maintained equipment
- Lack of experienced personnel
- Process appeared not to be robust
 - Repeatability of process steps



Resolving the Issues

- Created a project team
 - Management
 - Engineering
 - Operators
- Engaged the operators in
 - Defining the current process
 - Explaining the problems they currently had that made the job harder
 - Resolved their initial difficulties
- Reviewed the process graphically with the team
 - Used MS Project to create a timeline of the process to show critical path
 - Showed where the existing process meant 'Working Harder' and where we could 'Work Smarter'
 - Created an environment where all ideas could be voiced



Resolving the Issues

- Leveraged the data & controls in the SCADA system for report generation
- Overhauled the facility and implemented effective maintenance regime
- Revised the training material and re-trained all personnel to the same standard



Results

- Single batch in 10 weeks
- Campaign of 3 batches in 14 weeks
- Yield per batch increased by 20%
- Downtime reduced by 60%
- Multi tasking being undertaken
- No capital expenditure
- PM planned
- Environment of Continuous Improvement established



Lessons learned in this assignment

- Begin process cycle time improvement at a much earlier stage
 - Original process focused on 'inside' the reactor
 - The value stream should be identified as part of development
 - Shift patterns should be matched to process
- Process registration should be as broad as possible
 - Need to be careful to only register what is really required.
- Process teams should be multifunctional
 - A key issue in the process was waiting for maintenance personnel
 - API processing needs to be multi-functional where possible
- Systematically question every aspect of the process
 - Operators should be trained in process mapping and root cause analysis
- Ensure any linked processes are also included in the program
- Be scientific in selection of process teams



Things we improved

- All events not required on the critical path were moved off it
 - Breaks
 - Material supply and collection
 - Cover on shift handovers
 - Material preparation
- Human intervention and observation was planned and non critical events were managed around these needs
- Implemented Preventive Maintenance to reduce breakdowns
- Multiskilled operators



Case Study 2 → Fill/Finish Improvement

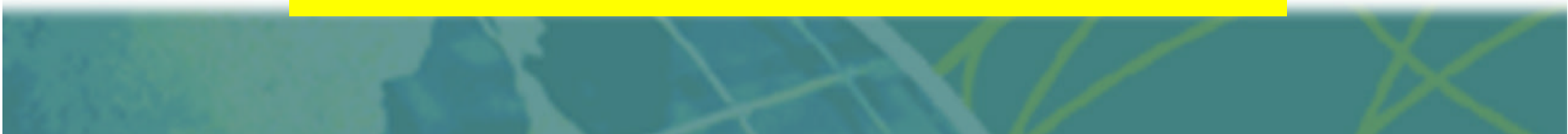


The Opportunity

- The client, a multinational pharmaceutical company engaged in the manufacture and packaging of a range of topical products was experiencing increased sales that was driving a requirement for additional capacities of both the bulk manufacturing area and the packaging hall.
- The topical business was expected to grow by 60% -70% over the next five years with existing utilisation of the area seen as being stretched to the limit of its capabilities.
- There was also a standardised batch time of 8 hours for every batch regardless of product

The initial reaction was

WE NEED MORE RESOURCES!!!!



Challenges to be overcome

- There was an overwhelming belief that it was not possible to get more available capacity from the current equipment
- This generated resistance to change and a reluctance to try new ideas
- In addition there were concerns over the validation and compliance impact of changes to the process.



Overcoming the concerns

- This project needed strong Champion within the organisation. One who could make decisions and obtain buy in from the other functions. In order to make this project effective emphasis was placed on
 - Effective Project Management
 - Change Management → using a multi functional team with clear scope and mandate
 - Knowledge Transfer → defining the standards and constraints on the project and the tools to be used
 - Team Working and Education
 - Process Capabilities → leveraging process development capability to ensure process remained robust



Overcoming the concerns

- Differentiating between

- Lead time
- Process time

So that the team could understand where the validation and compliance issues really were

- Reviewing the capacity requirements by taking into consideration

- Processing times
- Yield
- Unit cost
- Ancillary services



Process used

- PRIORITIES:
 - Project Champion
 - Agree project scope and deliverables
 - Ensure all stakeholders are informed and involved in the improvement process
 - Invite input from all involved with the process
 - Ensure enablers are in place



Process used

- Goal Directed Project Management was used to define
 - Project Charter
 - Task
 - Responsibilities
 - Scope
 - Deliverables
 - Standards
 - Resources
 - Goals
 - Milestone plans were developed
 - Activity schedules were created for each section of the project



Process used

- Establish a base model
 - Identified in detail all the process steps
 - Highlighted the Non value adding steps (NVA) and all the Necessary Non value adding steps (NNVA)
 - Identify inside/outside tasks
 - Highlight all factors effecting the efficient processing of product
 - Introduce OEE (overall equipment effectiveness) as a base measurement



Process used

- Investigate all the NVA and NNVA steps with a view to eliminating as many of these steps as possible
- Eliminate as many outside steps as possible
- Ensure accuracy of OEE information



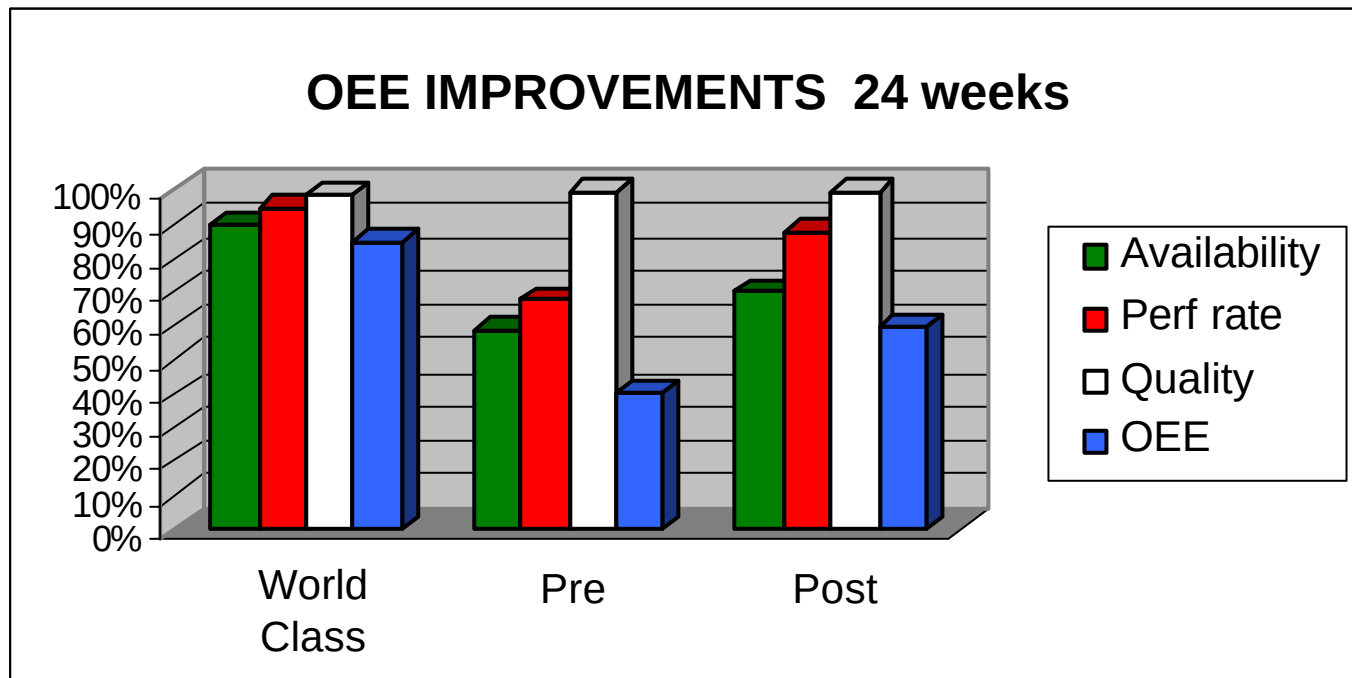
Results

- Process times reduced from 16hrs to 10hrs
- Repeatability built into process
- Overtime eliminated
- Feasibility study undertaken to allow for further expansion.
- Future campaign models generated to support feasibility study
- New storage means of bulk materials developed
- Automation of manual steps



Results

- Made available and additional 3 million units
- OEE increased by 25%



Lessons learned in this assignment

- Engage all functions from outset
(maintenance were slow to come on board, this hindered initial progress)
- Ensure full time facilitator available
(those work teams with a full time facilitator progressed more quickly)
- Allocate additional time to developing work teams
(more time should have been spent up front in developing all work teams)
- Involve work teams in any FAT's of new equipment
(gain operator input re: operational and ergonomic issues)



Lessons learned in this assignment

- Ensure meaningful performance data is readily available
(if you don't know where your going, how do you know when you get there)
- Provide adequate time and resources to work teams to allow them to pursue improvement activities
(improvements can stall if sufficient time to resolve is not allocated)
- Address peer pressure issues early on
(initial pressure not to partake in improvement process)
- Prominently post shift results
(some competition can be a good thing)



- Re-arranged shift patterns in manufacturing to minimise conflicts between breaks and shift handovers with process steps

[illegible]

KEY:

M	mornings
A	afternoons
N	nights
*	cover/off
Blank	rest days

Things we improved

- Roles and responsibilities of the teams and supervisory staff were re-defined in the packing hall
 - Key tasks
 - Multi-skilling
 - Integrate maintenance into teams more
 - Dedicated supported
 - Introduced SMED (Single Minute Exchange of Dies) methodologies during changeovers and built this into roles and responsibilities
 - Used teams to review data from OOE analysis tool to identify root cause of stoppages and eliminate
 - Component improvements
 - Repairs to machine
 - Enhance feeder mechanisms



Things we improved

- For the bulk area
 - Mapped the critical path for each product and established the true processing time for each product type
 - Defined and agreed standards based on these
 - Leverage the control mechanisms on the process equipment to automatically monitor key events thus eliminating need for operator intervention and reducing BMR entries
 - Revised documentation to speed up the entry process and reduce errors

