Lean Six Sigma
Standard Business Roadmap

Implementation Manual

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Summary

A Lean Six Sigma transformation can enable operations to drive the overall business strategy, through the creation of many tangible business benefits. Quality may increase through improved process yields and reduce scrap and rectification costs. Cost improves through reduced conversion costs, improved cash flow, and higher return on assets. Delivery can improve through shortened production lead times which more flexible operations that can respond quickly to changes in customer demand.

Despite attempts, most businesses have not been able to capture or sustain the benefits of a Lean Six Sigma transformation. Lean Six Sigma represents a fundamental change and most businesses have pursued change in tactical, rather than a strategic manner. Most failed Lean Six Sigma transformations can be attributed to lack of true senior management commitment and understanding of the change process. Moreover, the methodology of many companies is to rely on a series of quick-hit approaches that deliver short term benefits, but aren't sustainable in the longer term. Add to this the reluctance of many companies to consider the business as a whole rather than just concentrating on operations or manufacturing and you have a recipe for failure.

The team at Beyondlean have recognised and experienced these potential pitfalls and have created a programme that can help lead a business through the change process. The Standard Business Roadmap (SBR) takes a narrow and deep approach by focusing on a model value stream. The SBR programme creates the Lean Six Sigma infrastructure to maximise the chance of sustainability. Ultimately, the SBR cannot guarantee the sustainability of the system if the Business is not willing to invest the required time, resource, and commitment to the change process. If a business is ready to embark on this Lean Six Sigma journey, then manufacturing operations can not only become a competitive advantage, but also deliver new strategic opportunities.

An Introduction to Lean Six Sigma

PURPOSE OF THE MANUAL

The purpose of the Standard Business Roadmap Implementation Manual is to guide clients through the Lean Six Sigma transformation process. Many organisations have attempted Lean Six Sigma transformations, and most have failed through several key pitfalls. The team at Beyondlean has recognised these pitfalls and developed the SBR programme to ensure maximum chance of sustainability for such a transformation. The basis of this programme is a structured and methodical approach to change while encouraging maximum knowledge transfer of Lean Six Sigma concepts to the Business through the application of the accompanying material. Ultimately, the SBR cannot guarantee the sustainability of the project. It takes significant effort to first maintain and then improve a system. The client must be willing to commit the required time, resource, and attention to ultimately succeed in a Lean Six Sigma transformation.

This document is not intended as a detailed self-led step-by-step implementation manual. It is more a guide for you to refer to as you progress through each phase of the programme, as each individual business will have different requirements and obstacles to overcome and will need to deploy different tools in order to achieve this.

STRUCTURE OF THE MANUAL

This manual has three main segments. The first introduces the principles of Lean Six Sigma and establishes some common themes, then presents SBR's Lean Six Sigma model.

The second gives an overview of the SBR programme, outlining the SBR's high level project approach to achieving and sustaining business benefits through the application of Lean Six Sigma concepts . This approach has five distinct stages, each of which you will pass through on your journey to becoming Lean. The amount of time and effort you will spend in each stage will depend completely on your individual business needs.

The third segment examines key success factors for Lean Six Sigma transformations, starting with the ten most likely causes of failure. An appendix provides a programme check list and a glossary of key terms.

PRECONDITIONS FOR A SUCCESSFUL LEAN SIX SIGMA TRANSFORMATION

There are a number of preconditions for an organisation to succeed in a Lean Six Sigma transformation. Your organisation must possess each of the following attributes before successfully embarking on a Lean Six Sigma transformation.

Will the top management on site:

1. Actively participate in Lean Six Sigma production activity on a regular basis?
2. Commit to no redundancies as a result of Lean Six Sigma production activity?
3. Modify shop floor payment methods, if necessary?
4. Modify roles and responsibilities of personnel?
5. Spend money on justifiable changes to the production system?
6. Allow production personnel involvement in Lean Six Sigma activity during normal production time?
7. Systematically review project activity on the shop floor?
8. Offer focused maintenance support in the pursuit of a model value stream creation?
9. Enforce company policy?
10. Provide appropriate resource for the programme?
11. Be willing to make sure company measures are compatible with lean?
12. Communicate the compelling need?
13. Encourage a cross-functional approach to designing systems rather than processes?
14. Commit to a long term programme of Lean Six Sigma?
15. Be prepared if necessary to make fundamental changes to organisational structure?
16. Fundamentally, will the managing director or most senior person on site be willing to change the way he operates, becoming a champion of change and drive in the transformation through active involvement in 'Go, Look, See' & Process Confirmation activities. Will he set up and chair a 'Steering Committee' to ensure best practice is transferred across all functions?

Many of these issues are perhaps best illustrated with the following quote from a study on UK Productivity.

> "The lower level of productivity (in UK manufacturing plants) is caused by a failure to implement fully best practice "Lean Six Sigma" techniques. Progress has been made, but not always enough, and the challenge for management in some companies will be to recognise this failure and act on it…In some cases…management does not realise the gap in knowledge that exists between what they think is Lean Six Sigma production and the reality. In some cases, however, management seems content with a level of improvement that is below both the possible and the necessary"

LEAN SIX SIGMA OVERVIEW

In 1910 Charles Sorensen and Henry Ford created the first moving assembly line as a way of reducing wasted motion and handling complexity in automotive assembly. Without question, the Lean system pioneered by the Toyota Motor Company has a common beginning with these early "work flow" improvements. However, this common heritage led to two very different manufacturing systems: mass production and Lean production.

The objective of mass production is to maximise economies of scale through high capital utilisation. At Ford, the emphasis on flow was limited almost exclusively to the final assembly line, while subassembly processes, suppliers and distribution operated on almost independent production schedules, resulting in large batch sizes and high inventory levels. Inventory at all points was accepted as a necessary buffer to survive schedule and output instability. Quality was inspected and projected into the system through mass inspection and inventory buffers. Capital was a solution to the relentless push for capacity. Finally, production was driven from forecasts, pushing material through the plant in anticipation of actual customer demand. The mass production system flourished in the high growth, boom phase of the automotive industry and was widely copied in other sectors.

The objective of Lean production is the elimination of waste through the efficient use of all resources. In 1945 the president of Toyota Motor Company issued an edict to the company to catch up with America in three years otherwise the automotive industry of Japan would not survive. At the time, labour productivity in Japanese factories was 1/10 that of US automotive manufacturers. Scarce capital and small, highly diverse "island" market did not support large-scale, mass production. Finding a solution to the challenge led to a fundamentally different "Lean Production" system, which ultimately triumphed over mass production during the 1973-4 oil crisis. At a time of global recession and slow growth, Toyota sustained profits and grew US market share while US companies lost on both counts.

A new paradigm

The lean production system pioneered at Toyota created a new paradigm for excellence in manufacturing. This paradigm is founded on the belief that cost reduction is sometimes the only viable mechanism for a corporation to increase profit; price is not always an effective lever. Today, some organisations are fortunate enough to determine their selling price by first taking the product cost and adding on a sufficient profit margin:

Profit + Cost = Price

A company can therefore increase profit by raising the price of its product. However, in a diverse marketplace, most companies do not have this advantage as consumers and market conditions largely determine price. In these markets, companies face the following equation:

Profit = Price – Cost

This is often referred to as the “cost-minus” principle because the company can only increase profit through cost reduction. Cost reduction in a manufacturing environment occurs through the elimination of waste. Waste can be defined as something for which the customer is not willing to pay; it is a non-value adding activity. The elimination of such activities shortens the lead time, so value is delivered to the customer faster and with less effort.

Six Sigma

The goals of six sigma:

- Improved Customer Satisfaction
- Defect Reduction
- Reduction in Variation
- Yield Improvement
- Higher Operating Income
- Improved Process Capability
- Target 6 sigma standards
- Constant measurement
- Defeat the Competition
- Breakthrough improvements

Six-Sigma Objectives Are Directly and Quantifiably Connected to the Objectives of the Business.

The many facets of Six Sigma:

- Sigma is a letter in the Greek alphabet.
- The term "sigma" is used to designate the distribution or spread about the mean (average) of any process or product characteristic.
- For a business or manufacturing process, the sigma value 6 is a metric that indicates how well that process is performing. The higher the sigma value, the better. Sigma measures the capability of the process to perform defect-free-work. A defect is anything that may result in customer dissatisfaction.
- With six sigma, the common measurement index is “defects per unit”, where a unit can be virtually anything -- a component, piece of material, line of code, administrative form, time frame, distance, etc.
- The sigma value indicates how often defects are likely to occur. The higher the sigma value, the less likely a process will produce defects.

As sigma increases, costs go down, cycle time goes down, and customer satisfaction goes up.

So where did Six Sigma start and who else uses it?

- Motorola (1987 First coined the phrase 'Six Sigma')
- Texas Instruments - (1988)
- ABB (ASEA Brown Boveri) - (1993)
- AlliedSignal - (1994)
- General Electric - (1995)

Why is this NOT a past tense statement?

Because this is a continuous process

We Are Not Pioneers, We Can Learn From What Others Have Done and the mistakes they have made.

The biggest lesson we can learn is that individually 'Lean' and 'Six Sigma' are very powerful tools – However, when they are used effectively, together, that power is exponentially increased.

ITEM	SIX SIGMA	LEAN MANUFACTURING	LEAN SIGMA
Origin	Evolution of quality techniques	Toyota Production System	Recent approach to use both together
Typical tools	DOE, FMEA, Multi-Vari Capability Studies, Process Mapping	SMED, Takt Time Analysis Cellular Mfg., Pull System, Process Mapping, 5S	All combined
Typical Resources	Black / Green Belts and team work activities	Coordinator and team work & Kaizen activities	Black / Green Belts and team work & Kaizen activities
Focus	Reduce Process Variation	Identify non value added activities	The combination provides an excelent and fast identification of opportunities and an accurate determination of variables
Outcomes	Breakthrough improvement	Waste elimination (inventory, transporting, flow, reworking, maintenance)	The combination avoids duality of efforts, increases the wideness of the improvement range, as well as assure under control process after improvement
Typical sub-project timing	6 months	1 month (Kaizen)	1 month plus the additional time to assure process under control
Management Skill Required	Project Management	Project Management	Project Management

The new paradigm of Lean Six Sigma transcends more than just a production system – it is a new way of thinking about organising the improving operations. Traditionally one often associates Lean Six Sigma with a collection of tools and techniques on the factory floor. However, there are several tiers in how the new thinking can be applied. At the highest level, the concepts of Lean Six Sigma can be successfully applied across any industry or sector of the economy, such as the construction, aerospace, and financial environments. At the next level down, the operating practices of Lean Six

Sigma need to be tailored to a degree, such as the high-level design of a pull system. On the most pragmatic level, the tools and techniques of Lean Six Sigma aim to identify and eliminate waste in the particular environment. These tools must be tailored to the particular environment, such as the particular types of kanban comprising a pull system. Figure 1 illustrate this diagrammatically.

Figure 1 – Tiers of new thinking

Key concepts

The key concepts of "Lean Six Sigma thinking" (as shown if figure 1) can be applied across any industry, and are described below.

Integrated approach

Lean Six Sigma aims to align all function with the common goal of reducing overall cost for the business, rather than each function attempting to reduce its own costs in isolation. Thus, the manufacturing system is inherently stronger than a traditional system where different departments pursue their own objectives independently of one another. A true Lean Six Sigma transformation necessitates that all functions understand the application of tools and techniques within the manufacturing system.

Elimination of waste

During the Lean Six Sigma transformation, all functions aim to eliminate waste in a manufacturing environment. Waste can be defined as anything above the minimum resources required to complete an activity. Wasteful activities only add cost to a product; they do not add value.

Hidden becomes obvious

As wasteful activities are eliminated from a manufacturing system, the true root causes of problems become visible. Previously, the waste hid these causes. As an example, a large amount of inventory after a process may have concealed the true problem of the process – long changeover times. These long change over times would have necessitated producing in large batches.

Order out of chaos

As problems become visible, the root causes must be solved to fully eliminate the problems. As problems are solved, then the manufacturing system becomes more consistent and predictable. Yet, many traditional organisations are often engaged in a "fire-fighting" mode because company systems fail in the face of variability. To react to this variability, such as a change in customer requirements, additional resources are often brought into processes to "keep the show on the road". However, a Lean Six Sigma system will adjust efficiently to this variability, helping to bring order out of the chaos.

Standardisation and continuous improvement

As a manufacturing system becomes more consistent, then standards can be developed to ensure that the improvements are maintained. Once standards are in place, they must be continuously challenged in a bid to make further improvements. Striving for continuous improvement is referred to as the Japanese word, *kaizen.*

Ownership

As standards are created, then ownership of particular processes can be transferred to those closest to the process itself. Experience has shown that a Lean Six Sigma system can only be successful if its ownership is devolved to the people who actually operate it.

SBR Lean Six Sigma model

The SBR Lean Six Sigma model illustrates the key concepts and operating principles for Lean Six Sigma.

Profitability

The SBR Lean Six Sigma transformation model starts with the most fundamental goal for any business – to make a profit. As indicated previously,

competitive markets typically set the sales price. An attempt to increase the price could reduce customer demand. Therefore, cost reduction is the only real option for a company in such a position. The best method to achieve this is through a Lean Six Sigma transformation, whose aim is the eradication of wasteful activities and reduction in variation.

Business need

In order to maintain a profit, a business must aim to function in an environment of:

- **Total quality.** All people are involved with "building quality into" a product.
- **Zero defects.** Defects are detected, contained, and rectified at their source.
- **Lowest possible manufacturing costs.** Resources are used efficiently at varying levels of demand.
- **Minimum order-to-delivery lead times.** Product flows through the value stream in minimum time.
- **Delivery reliability.** Low and consistent lead times ensure quick response to demand fluctuations.
- **Effective human resource management.** Employees feel empowered to take a proactive role in improving operations in the workplace.
- **Stable employee relations.** A company culture with long term job security fosters continuous improvement efforts.

Most organisations try to satisfy these aspirations through the creation of quality, operating and people systems. However, these systems are normally created and managed in isolation – often leading to inefficiencies. For example, an emphasis solely on improving operations by increasing output could have a detrimental effect on quality.

Enabler

The solution to this problem is the introduction of a Lean Six Sigma methodology that combines the three previously independent systems into a single, coherent system. Within the single system, the goals of the business systems are aligned leading to optimal benefits. This is enabled by maximising people contributions with the goal of eliminating waste.

Processes and effects

The Lean Six Sigma methodology comprises five key processes. Each of the five key processes aims to identify and then eradicate some of the seven types of waste. The five processes are:

1. **People** are at the heart of an organisation. The success and sustainability of the Lean Six Sigma transformation often depend on the organisation's ability to adapt to the people issues involved in managing change. This was achieved at Ford's (Jaguar) Halewood plant through the introduction of the 'Gateway' or 'Partnership' process

2. **Support systems** are necessary to provide operational stability. Examples of support systems include programmes such as workplace organisation and total productive maintenance.

3. **Flexible manpower systems** are a factory wide method for optimising labour productivity across varying levels of customer demand by moving people between flexible manpower lines.

4. **Autonomation** is the principle of stopping a manufacturing process when abnormalities are detected through either intelligent automation or manual means. Abnormalities are any form of deviation from a standard process.

5. **Just-in-time (JIT)** is often interpreted as conveying the right parts "on time". However, JIT is actually manufacturing and conveying the right number of parts at the right time, quantity and in the shortest possible lead time.

Each process breaks into a number of elements. For example, the support systems process is composed of workplace organisation, total productive maintenance (TPM), and process measurement & review.

Competitiveness

As new processes are fully implemented, waste should drastically reduce from the manufacturing environment. These operational improvements increase the business's ability to meet the specified business needs, leading to an increase in customer satisfaction. This helps to strengthen the overall competitiveness of the business.

Sustainability and continuous improvement

When improvements are maintained, the current state will quickly become the normal operating system. However, this normal operating system cannot be static. It should be continually challenged and then improved through the Lean Six Sigma methodology.

SBR Programme

The SBR aims to assist you in implementing sustainable Lean Six Sigma transformations in your organisations.
Our approach encompasses four distinct characteristics to maximise the probability of sustainable change:

- Narrow and deep
- Creation of a model value stream
- People-centred

The narrow and deep approach means applying many Lean Six Sigma tools and techniques across a small area of the business. By having a spike in one area, the has a benchmark and maximum exposure to Lean Six Sigma concepts to help apply them elsewhere across the business. Many companies attempt to achieve short-term gains through a broad and shallow approach by applying a few concepts across a large portion of the value stream. Based on experience. The likelihood of sustainability is dramatically increased with a narrow and deep approach. See figure 3.

Figure 3 – Narrow and deep approach

The narrow and deep approach is applied on a model value stream for a business. The model value stream itself may only be a segment of the customer's value stream, but serves as a benchmark for what is possible. The value stream represents all the activities necessary to deliver a product or

service to a customer. Consider the following model for delivery of value to the customer: The entire value stream for an enterprise encompasses product design, pre-production, production, distribution, and service. The value stream for the actual manufacture of the product encompasses the entire supply chain, from raw material to delivery to the customer. The value stream for the factory represents all the value-adding activities from receiving to shipping. Within this value stream lies the model value stream. Thereby, the concepts learned on the model value stream can later be applied across the entire value stream for the enterprise. See figure 4.

Level	Scope	Value Stream
Model	Assembly	___
Factory	Goods Receiving Manufacturing Despatch	_____
Supply Chain	Raw Materials Through Delivery	_____
Enterprise	Product Design Pre-production Production Distribution Service	_____

Figure 4 – The model value stream

The successful creation of the model value stream necessitates a people-centred approach. You will need to set up an implementation team in the area you have targeted. This team should ideally comprise:-

- A senior manager from the area (Ensures adherence to the processes implemented in that area)
- Team leader or equivalent with good product knowledge and knowledge of the area
- Members of support functions
- Operators
- Trade Union Rep if applicable

The team members will apply the deep knowledge gained during through the creation of the model value stream to other areas of the business, able to act as change agents with the flexibility to be seconded to any other part of the business to assist in the deployment of the changes. Again the size of this team will be wholly dependant upon the size of your organisation. If it is quite a small business, YOU may be the implementation team.

PROGRAMME OVERVIEW

The SBR is a five step, macro-level approach to the Lean Six Sigma transformation. However, each stage must be tailored on a micro-level to suit an individual environment.

The stages are shown in figure 5,

Standard Business Roadmap –

Figure 5 – key elements of the Standard Business Roadmap

- DIAGNOSTIC

The Diagnostic phase has one primary goal:

- To give you a clear indication of where you currently are

Before embarking upon the Diagnostic phase some preparation is required on your part in order to ensure success.

Preparation

The object of the preparation stage is to create the infrastructure required for the Lean Six Sigma transformation.

Heighten senior management awareness

The senior management team must first raise their awareness of Lean Six Sigma principles and their associated benefits. A good first step is to contact another organisation, which has already undergone a Lean Six Sigma transformation, to provide the management team with an overview that combines technical presentations, visits, and practical experience.

Secure agreement to proceed

After heightening the awareness, each member of the senior management team needs to make a commitment to proceed with the activity. Any doubts must be expressed in an honest discussion to eradicate fears or misconceptions.

Occasionally management members have difficulty in adapting to change even after exhaustive explanation and support. Where those managers are in a position of significant influence, serious consideration should be given to whether the success of the programme can be allowed to be jeopardised by their feelings or approach. If unable to adapt, they should be positioned elsewhere within the organisation where they can still make a valuable contribution.

Select the model value stream

Management then needs to select the model value stream, which will be the focus of the intensive period. Three factors apply. First, it is vital that the stream is a success because it will become a model of Lean Six Sigma for the rest of the business. To increase the probability of success, select a process that is of manageable size, highly visible to the business, and which relates to a single product or product type. Second, ensure the top management team is entirely committed to the selected project and is prepared to provide the necessary time and resource to achieve success. Third, select an area that will realise a significant, tangible business benefit.

Typically, the Lean Six Sigma transformation should start at the point closest to the customer (generally the last stage in the manufacturing process) and then proceed upstream through all the other processes. The reason for this is explained under 'Key Success Factors' later in the manual.

Select change agents

The Manager responsible or Implementation Team Leader should select change agents to work within the Implementation Team full time during the transformation period. The change agents will assimilate knowledge through the development of the model value stream, and will then be able to lead the change process during the subsequent roll out to other areas of the business. Proper selection of the change agents is vital because success depends on their motivation levels and ability to lead others. Being a change agent is worthy of the best talent the company has available. It is unlikely that any outsider could successfully assume this role because knowledge of the company and good communication links are essential.

It is important that the change agents have assumed different roles in the business. All must be freed from their current roles and dedicated full time to Lean Six Sigma transformation. One should be a production manager. This person will play a facilitative role in the transformation and will become the key player in the roll out plan. The second should be a process owner, such as a team leader. This person should be experienced and have previously been responsible for Quality, Cost, and Delivery requirements to the customer. Other Change Agents should be assigned according to resource available and current business pressures.

A blame environment between production management and the change agents needs to be avoided. Generally people find it difficult to accept that others can advise them on how to do their job better and more efficiently. If this occurs, a "them and us" environment may emerge and production personnel may desire the system to fail in order to discredit a colleague. The best way to avoid this situation is to ensure that one change agent is the production manager, the person with ultimate responsibility for the output of this process.

All change agents must also exhibit specific qualities. They must be enthusiastic about the change process and well respected at all levels of the organisation. They must be learners who can become teachers. They must have capable communication skills to disseminate Lean Six Sigma concepts throughout the organisation. Other attributes of an ideal change agent are given below in figure 6. However, there are several immeasurable attributes such as a genuine willingness to work hard and learn.

Attributes of a Change Agent

An ideal individual will fulfil many of the following criteria:

Profile

- Demonstrated, real interest in production engineering
- Ability to interface with people at all levels
- Potential to understand World Class Quality Systems
- Good team worker
- Flexible
- Good communication skills
- Highly analytical coupled with practical skills

Competence

- Able to train others implementation
- Good planning skills
- Able to lead and support as appropriate
- Appreciation of factory protocol and procedures
- Good organiser and time manager

Behaviour / Style

- Outgoing and persuasive
- People-oriented
- Assertive achiever
- Open-minded
- Able to lead by delegating and encouraging
- Committed to following through and persevering
- Quick-thinking and positive
- Disciplined and Hardworking
- Resolute and tough.

Commitment

- Prepared to work long and unpredictable hours.

Figure 6 – Attributes of a change agent

Communicate with the stakeholders

Top management must communicate with all key stakeholders prior to commencing the Lean Six Sigma transformation. A stakeholder is someone with a vested interest in the activity, such as production management, trade unions and the workforce. These stakeholders should be adequately

informed about all aspects of the Lean Six Sigma transformation. To address possible concerns, senior management should present a communication brief, showing that the Lean Six Sigma transformation is not just another initiative, but a fundamental change of company policy. A suggested agenda for the brief is presented in figure 7.

Contents of a communication brief:

- Introduction of personnel involved in lean Six Sigma
- The compelling need for change
- Commitment to no redundancies
- Overview of how to identify waste
- Overview of processes used to eradicate waste
- Where the project will start
- How it is likely to affect the way people work
- A request for flexibility and support from all involved

Figure 7 – Contents of a communication brief

Create a steering committee

A steering committee should be created to guide the Lean Six Sigma transformation and transfer knowledge through different functions in the business. The managing director or the most senior person on the site should chair it. The committee should consist of all departmental heads. See figure 8.

In most organisations, the various functional departments have different attributes such as metrics, motivations, objectives and understanding of lean. The misalignment of objectives within attributes can impede the progress of the Lean Six Sigma transformation. A cross-functional steering committee can polarise these attributes in accordance with the objectives of Lean Six Sigma. The alignment of objectives enhances the likelihood of sustainability for the transformation.

Figure 8 – Steering committee representation

The steering committee serves slightly different purposes for the short and long term. The committee monitors progress in the short term while the longer term objective is to facilitate a cross-functional organisational structure. To satisfy the short-term objective, the committee should meet frequently enough so the change programme does not stagnate or lose management support and understanding. A meeting each week is advisable. It is important that this is a working meeting and not just a one-way progress review. To satisfy the longer term objective, the steering committee should also be responsible for the planning, co-ordination and implementation of activities required to make Lean Six Sigma into “business as usual”.

A steering committee should only be used until the change programme is firmly established and sustained. True Lean Six Sigma should be self-perpetuating and require no extraordinary efforts to maintain. A steering committee , per se may only be required in medium to large businesses, where a large scale change program is being undertaken.

Institutionalise weekly reporting (See Training pack – A3 Reports)

The change agents and the Implementation team should create a weekly report to present progress to the steering committee, see figure 9. This document should be the basis for discussion at each steering committee meeting to ensure continued focus on the success of the transformation. To monitor the performance, the weekly report should track key Quality, Cost, and Delivery measures along with progress towards other targets for the transformation. It should also highlight the status of all activity carried out in prior weeks, planned activity for the next week and progress against the project plan. It should contain a problem resolution section to highlight issues that need to be solved by the steering committee.

Stakeholder Analysis

The Stakeholder Analysis will enable you to identify key stakeholders in the change process and more importantly assess whether they will need any work to bring them on board. If this is the case, the relationships they have with other people within the organisation could hold the key to more easily getting them on side.
(See Stakeholder Analysis .ppt Pack)

Understand the people, process, and product

The Implementation team, must first build their knowledge of the model value stream and the culture of the people who work there. The best way to accomplish this is for the team to carry out the Cultural Audit, Business Assessment and Current state Value stream analysis.
The Cultural Audit and Business assessment will give scores against which to track progress as well as recommendations to counteract deficiencies.

Complete current state assessment

The project team needs to first complete a current state assessment in order to capture a "snapshot" of the project area. The current state assessment is composed of analysing the key metrics and mapping the material and information flow.

Analysis of key metrics can include quality, cost, and delivery measures for the model value stream. Examples of these measures are shown in figure 10.

Example of possible metrics for current state assessment

Quality

Right first time
Rework cost/unit
Scrap cost/unit
Warranty cost/unit

Cost

Labour productivity
Inventory turns
Over time
OEE

Delivery

Lead time
On time, in-full

Safety

Time since last LTA
Number of minor accidents

Moral

Absenteeism
Turnover rate

Figure 10 – Key metrics

Material and information flow analysis is a tool that identifies the root cause of waste in a system. A material and information flow diagram, a pictorial representation of a manufacturing process, illustrates the flow of material between processes and the required information to convert material into final product. The diagram illustrates the big picture, not the individual steps, and can be used to improve the entire system rather than just optimising local processes. The project team can use a material and information flow diagram to develop a common understanding of the current state. See figure 11

This should be done as a team exercise in conjunction with the value stream analysis training pack.

Current State Diagram
Monthly orders
3 Month forecast
Company A
Supplier
Customer
Delivery List
Build Lists
1 Week
Cut
Weld
Assembly
Daily
x 2
m/c = 2 s
c/o time = 2 hr
Scrap = 10%
150
200
x 1
c/t = 2 min
c/o = 2 min
50
x 5
c/t = 20 s
Downtime = 5%
Scrap = 15%
500
Sub Assembly
x 3
c/t = 1 min
Scrap = 10%

Future State Diagram
Company A
Supplier
Customer
Daily
Cut
Weld, Subassembly, Assembly
Daily
PI
PW
PI

Figure 11 – Current and future state diagrams

- STABILITY

The primary purpose of the 'Stability' phase is to lay a solid foundation from which to build. At the conclusion of this phase you should have a certainty that the 'Ship has been steadied', Fire fighting is a thing of the past and 'Forward' is the only way to go.
Depending upon the outcome of the Diagnostic Phase some actions may be required immediately to prevent disaster. This is where the Stability phase and the Strategy phase often overlap.

There is no 'Right' or 'Wrong' order to carry out the following actions, it will be solely dependant on what you uncover in the Diagnostic Phase.
For example, if a major cause of your companies problems was down to poor deliveries due to lack of visibility of shop floor productivity levels, meaning you never know when your product is coming off the line. You immediately put in place measures or KPI's (Key Performance Indicators) to address this and give you that visibility.

This can be done very quickly while other things are being worked on – Put your customer protection in place IMMEDIATELY, this will give you some time to work on the long term countermeasure.

Scrutinise your business 'Terms of Payment'

This applies both to suppliers and from customers. A simple pictorial model demonstrates the ideal state you are aiming for in the Powerpoint presentation 'Terms of Payment'.

Tighten up the Discipline

Do you have a robust Disciplinary procedure in place? If not, get one and ensure it is adhered to.

Do you have a robust Sickness and Absence Policy in place? If not get one and ensure it is adhered to.
You need three things in place to give you a solid foundation from which to build:

- Get the people there.
- Get the people there at the time they should be there
- Get the people doing what they should be doing, when they should be doing it.

Introduce performance measures (See Performance Management System Training pack) Also KPI's, Visual Management Training packs and supporting Excel documents – All available with Lean Six Sigma Certification Package

Performance measures should be introduced before making any physical change, see figure 12. Performance measurement is a visual method to highlight
abnormalities that restrict the targeted production from matching output.

Performance Monitor				
Time	**Planned Output**	**Actual Output**	**No. of Defects**	**Comments**
07:00 – 08:00	25	25	0	OK
08:00 – 09:00	25/50	25/50	0	OK
09:00 – 10:00	25/75	14/64	0	Tool changeover 25 minutes (lost)
10:00 – 11:00	25/100	16/80	0	Tool breakage 20 minutes (lost)
11:00 –12:00	25/125	35/115	10	Problem with drill
13:00 – 14:00	25/150	35/150	5	Additional Operator to boost Output
14:00 – 15:00	25/175	25/175	4	OK
15:00 – 16:00	25/200	25/200	0	OK

Figure 12 – Example of a performance measure

The most effective performance measures are highly visual and are regularly updated. The performance measure provides advanced warning of shortfalls in production, allowing production management the opportunity to take remedial action.

Introduce an Issue resolution system (See Training Pack)

An Issue resolution system can be used to identify and eliminate the root cause of an issue. Resolving problems quickly is a necessity in a Lean Six Sigma system because the introduction of Lean Six Sigma principles boils out much "fat". Therefore, failure to resolve problems quickly could have an impact on production, which ultimately affects the customer.

An Issue resolution system is highly visual and normally located next to the process being improved. Everyone can see the current status of problems at a glance and can track them as they are brought to a logical conclusion. The solution must be sustained across all shifts for a sufficient period. In addition, appropriate audits need to be put in place to ensure effective use of the Issue resolution system.

Introduce *takt* time production (See 'Takt Time', 'Work Packages' & 'Line Balance' Training packs)

The next stage in gaining stability is to improve the flow of material through the introduction of takt time production. Takt time synchronises the pace of production to the pace of customer sales in the marketplace.

At this point, the team must verify what each process can – and does – produce according to takt. If this is not feasible, then either the cycle time will need to be reduced or additional working time is necessary for the particular process. In addition to the machines, all production operators need a total manual cycle time shorter than the takt time of the process. Otherwise, the customer demand will not be satisfied during the shift, and remedial action will be required to achieve specified targets.

Depending upon the size of the task in your particular situation, this step may be done immediately, or if a more detailed work study is required, completed during the 'Action' phase

- STRATEGY

Create a factory vision and design future Operating Principles (See Future State Training Pack & Operating Principles facilitated workshop Trg Pack)

A clear factory vision acts as a roadmap for the Lean Six Sigma roll-out. Recall that this methodology effectively integrates the previously independent quality, operating, and people systems. The senior management must prescribe this future state of the Lean Six Sigma methodology. The future quality and operating systems can be presented in a material and information flow diagram. The future people systems must be specified through a cross-functional organisation structure. Each function must provide adequate people, materials, methods and environment to support these goals.

Design the future state

The project team can then design the future state for the project area. They should first create a future state material and information flow diagram. The team can then break the future state into sizeable portions for implementation. They must also specify improvement measures and targets for the project, based on data collected during the current state assessment.

Set realistic roll-out objectives

When the factory vision is defined, to is necessary to identify specific objectives in order to attain that vision. A roll-out objective can be defined as a manageable portion of the overall factory vision. For example, an objective may be to increase productivity by 10% by the end of the year.

It is vital that each objective is realistic to ensure a sustainable Lean Six Sigma transformation. A company cannot expect the change agents to run multiple projects with multiple trainees simultaneously in order to grow the organisational knowledge in the shortest time. The expectation cannot be satisfied because the change agents have only gained a reasonable understanding of the approach while developing the model value stream. They do not yet have the experience of implementing change on their own. Overburden on the change agents can result in projects failing to meet their specified objectives. The failed initiatives can then permeate a general attitude from company employees: "Lean Six Sigma –we tried that and it didn't work!"

The organisation must recognise that it is investing for the long term when pursuing these objectives. Persevering with a structured and well-planned approach in satisfying the objectives can reap huge business benefits. But beware, most organisations that embark on Lean Six Sigma transformation are greedy for results, which ultimately will result in failure. The greediness comes from an organisation's belief that it can become Lean Six Sigma to a higher degree, faster and with less resource than anyone else. There are no short cuts to the Lean Six Sigma transformation. World class Lean Six Sigma organisations have taken many years to establish their position today. It takes time to catch up – so, please be patient.

The following analogy shows the importance of patience and developing a proper infrastructure to support the change. Two gardeners each plant a seed in some fertile soil. After six months, each seed has sprouted above the ground to a length of only four inches. One of the gardeners is concerned because the plant is not growing fast enough, so he removes the sprout along with its root and plants a new seed. The other gardener is more patient and understands that the sprout is still developing its foundations and has great potential, even though the growth hasn't been that great. Another six months passes and the patient gardener now has a plant that the growth hasn't been that great. Another six months passes and the patient gardener now has a

plant that sprouted to a height of two feet! This flower was able to grow so rapidly because it was nurtured early on an allowed to develop at its own pace. One the other hand, the new seed for the impatient gardener has only grown four inches again.

Effective Policy Deployment

The effectiveness of the Lean Six Sigma transformation for the entire organisation should be measured continuously. To enable this, the company's measures must first be compatible with Lean Six Sigma thinking. Each level of management should have its own performance goals that directly relate to the organisation's yearly objectives. Effective policy deployment allows people at all levels to genuinely understand their role in achieving the organisation's objectives.

An example of policy deployment can be seen in figure 13. At the highest level, company goals are set on an annual basis. From these goals, measurable should then be set for a factory. These factory goals can be used to set goals for individual departments within the factory.

Figure 13 – Example of policy deployment

Develop implementation plans (See Tactical Implementation Plans Training Pack)

The team can then begin to detail the tactical implementation plan to achieve the future state. Using the sizeable portions from the material and information flow diagram, the project team should focus on each portion progressively, starting at the point closest to the customer and working upstream. Specific objectives and goals for each portion of the plan along with an associated timing and resource requirements must be given. Key milestones that fall on the critical path of the implementation plan should be highlighted.

When creating the improvement plan, the project team should not be distracted by the opportunities of quick or hoc savings. The implementation plan should follow the stated structured approach of working backwards from The customer. The team must only apply Lean Six Sigma tools or techniques in the pursuit of improved flow. This will be explained in greater depth in section

Budget requirements should be considered on a project-by-project basis. Most improvements in Lean Six Sigma should be taken with a low cost/no cost approach, allowing maximum financial impact. See figure 14. Only justifiable cost should be incurred in the budget plans.

Likely Cost associated with a Lean Six Sigma Transformation

- Material handling devices
- Machine movement
- Re-programming of equipment
- New containers
- New tooling
- Overtime for production personnel

Figure 14 – Likely costs

Create a contingency plan

Whilst planning the project area change, it is necessary to build some from of contingency into the programme. The performance of some processes could

suffer during the change process. The most critical aspect is to ensure that the customer does not suffer as a result of the change programme because this could erode management support for the Lean Six Sigma transformation.

The three main components for a contingency plan are quality, volume and delivery performance. Examples of contingency plans for these components can be:

- **Quality**
  - Perform quality checks at greater frequencies.
  - Reconfirm capability of process at the earliest opportunity.

- **Volume**
  - Ensure sufficient flexibility to meet customer requirements through overtime, additional resource or weekend working.

- **Delivery**
  - Carry additional safety stocks.

Present to the steering committee

The current state assessment, future state design, improvement targets, and implementation plans should be presented to the steering committee. The purpose of the presentation is to create a vision of the Lean Six Sigma transformation and to obtain top management support for all the implementation initiatives. A possible structure for the presentation is as follows:

- Illustrate the location of the areas involved within the plant, describe the product and its purpose.

- Discuss the current state material – e.g., productivity, quality lead-time changeover times, distances, etc.

- Present the future state material and information flow diagram.

- Represent pictorially the people and process flow within the project areas.

- Illustrate examples of improvements and their likely impact.

- Present the implementation plan.

- Propose future reporting structure (weekly report and steering committee).

After the presentation, the steering committee should give their approval to the Lean Six Sigma transformation plan if the diagnostic satisfies their expectations.

Complete final preparations

Prior to commencing implementation, several major items need to be addressed:

- **Cross training.** It is necessary to develop a skills matrix for all employees to ensure they are adequately skilled to carry out any new assignments.

- **Update documentation.** Appropriate documentation must be in place so everyone affected by the change can perform at a high level of quality and efficiency.

- **Simulate the change.** Wherever possible, simulate the revised process before making any physical change to minimise the risk both internally and to the customer. This is best accomplished outside normal production time, but with the regular process operators, on their usual production equipment.

• ACTION

The 'Action' phase is where you really make things happen. The order of implementation will very much depend upon what you discovered in the diagnostic phase.
Included with the Standard Business Roadmap is a full Training Pack for each of these Lean Six Sigma Tools along with the ESSENTIAL Training Pack for Process Confirmation, without which the other Lean Six Sigma Tools are likely to fail

Identify resource

The resource necessary to achieve each roll-out objective must be identified at the earliest possible stage. Be sure there is no concern in having adequate support from these resources at the time of implementation. Lack of resource availability is a major reason why Lean Six Sigma transformations often fail, because the right people need to be in the right place to support the transformation.

Resource requirements do not only imply facilitation resource. They also include:

- Maintenance

- Human Resources

- Logistics
- Manufacturing engineering
- Quality
- Finance.

A matrix illustrating the particular roll-out objectives and functional departments can ease the difficulty in resource allocation. See figure 18. Note that the circle illustrates initials of the functional support person assigned to each roll-out objective.

Project and Resource Planner	Logistics	Human Resources	Manufacturing Engineering	Finance	Manufacturing	Etc
New material Replenishment system	JH	BB			RD	
Improve machine Reliability		HP	GB		MS	
Improve capacity Utilisation		BL		TT	TA	DH

Figure 18 – Roll out objectives

Cultural Change (See Culture Transformation Trg Pack)

If you feel a major cultural and behavioural change is required throughout the organisation, from senior management right down to the shop floor, please contact us at culture@beyondlean.com and we will be happy to put you in contact with a company that specialises in large scale cultural change. They are responsible for the cultural change programs in large companies such as 'Ford' and 'Airbus'.

Produce 'Key' HR policies or 'HR Handbook'

Compile your 'Key' HR policies into a user friendly handbook. Communicate these policies to all and adopt a zero tolerance approach to their adherence.

This should include policies such as your Disciplinary procedure, Sickness & absence policy, Grievance procedure, Behaviour at work policy and Capability procedure.

Design & roll out a robust Performance Management System (PMS) (See Training Pack)

Introduce Standardised work / Work Packages (See Training Pack)

This will be integrated with the Performance Management System as will other tools referred to in this section, particularly in respect to the process confirmation of them

Total Productive Maintenance (TPM) (See Training Pack)

Quick Changeover / SMED (See Training Pack)

5C / 5S, Workplace layout & design (See Training Packs)

Line Balancing (See Training Pack)

Introduce a pull system (See Training Pack)

Error Proofing / Poka Yoke (See Training Pack)

Andon (See Training Pack)

Six Sigma Tools (See full Lean Six Sigma Black Belt Training Material)

The goal of a pull system is to ensure that all stages of a production process are synchronised with customer demand. This means that the right parts should be at the right place at the right time. A pull system converts customer demand into kanbans and levels the demand onto the production system. These kanbans carry production instructions from downstream processes to upstream processes.

Process Confirmation (See Training Pack)

This is the glue that holds every successful 'Lean' organisation together. Even if you only manage to get one of the Lean Six Sigma tools partially in place due to production pressures, if you drive in Process Confirmation relentlessly and embed it as part of every day life, you will have changed your business more than anyone could have imagined.

I cannot stress enough just how important this is – Drive this in hard and don't accept ANY excuses for not adhering to it.

Audit the system

It is necessary to audit a system frequently after making a change. Auditing allows comparison of the observed condition against a desired condition. If differences do exist, there may be a number of reasons why people are not working to a standard process:

- They have found a better way
- The way as described is either not feasible or not desirable
- They have been given inadequate training

Some qualification is needed for the comment about people not working to the standard because they have found a better way. While input for new and improved methods of working should be encouraged, adoption of these methods in an uncontrolled fashion should not. Once a standard is set, each employee must work to that standard until it is formally revised or changed. Then, at that point, everyone switches to the new and improved standard.

Once the new system is stable, periodic audits should take place to continually ensure compliance. Management should also be involved to demonstrate continued support and commitment to the change process.

Hasten Issue resolution

A new process requires significant amount of support to resolve abnormalities. All functions must provide priority attention to ensure that the benefits associated with the change are achieved, maintained, and subsequently improved upon.

The river and rocks is an analogy that is often used to demonstrate the need for rapid Issue resolution. See figure 15. The water level on a river is quite high, concealing all the rocks on the river floor. The water level is a reflection of the “fat” or waste in the process; the rocks relate to the problems or abnormalities in the system. As the ”fat” or waste in a system is eliminated, the water level drops. This exposes more rocks. A company must tackle and eliminate each abnormality as it is exposed in order to strengthen its manufacturing operations. Management must avoid the temptation of reintroducing inefficiencies (“the fat”) in an attempt to conceal these abnormalities once again.

Figure 15 – The river and rocks analogy

Develop subconscious competence

Key to maintaining the model value stream is for people to develop a state of "subconscious competence". This means that people habitually conduct their activity in a way that supports the Lean Six Sigma methodology. This is not easy to achieve, and normally companies evolve several times before attaining this ideal state:

1	Subconscious Incompetence	-	They don't know what they don't know.
2	Conscious Incompetence	-	They do know what they don't know.
3	Conscious Competence	-	They know what they need to do and try hard to achieve it.
4	Subconscious Competence	-	They habitually achieve a desirable condition.

An example of the evolution states is learning to ride a bicycle. Most people can probably now ride a bicycle without even thinking about it – they are subconsciously competent. But to get to this stage one progressed from having tried to cycle and not being able to – conscious incompetence – to being able to ride only by fully focusing on task – conscious competence. See figure 16.

Figure 16 – Subconscious competence model

The most difficult transition is to evolve from subconscious incompetence to conscious incompetence because one must in effect recognise there is a better way of completing a task. This is really only achieved through clear communication aligning the whole workforce in pursuit of the desired goal.

Conscious competence comes once people recognise that there is a better way and try hard to achieve that state. During this stage it is very important that non-standard situations are not tolerated. Should they be tolerated, then this becomes the new standard, and inefficiencies start to creep back. Thus one fully attains the state of subconscious competence by maintaining the high level of discipline for a prolonged period of time.

Institutionalise regular reporting

The process owner for the model value stream should continue to present regular written and verbal reports to top management even after completion of the pilot project to ensure the sustainability of the changes. These reports should cover performance measures such as quality, cost, and delivery. At the first sign of deterioration the senior management must first question why there is deterioration. Then, an effective countermeasure must be introduced to avoid recurrence.

In addition to the submission of reports to top management, continued emphasis should be placed on the value of the management team's visibility on the floor by adopting a "Go Look See" (GLS) approach.

Establish a forum for formal review

A regular, formal review of progress on the timing plan should be made at a cross-functional forum. This should take the form of a monthly meeting chaired by the most senior person on the site, where the change agents present their performance against the timing plan. If actions are continually lagging behind plan, then the forum must question and understand the situation. The forum should identify the root cause of the problems and determine an appropriate countermeasure.

A significant part of making "lean" business-as-usual is for the people who are Involved in the transformation to gain recognition for their individual efforts in making the change a success. A selection of these people should present their improvements in a before/after format to the top management on a monthly basis. After the presentations, the chairperson should then visit the process to observe the improvements first hand. This action is vital for instilling a continuous improvement culture in the organisation.

- EVALUATION

Review project effectiveness

A meeting should be held at a suitable point in the project (Usually around one year in but this can be moved to suit your individual company) to review the previous 12 months of activity and discuss important issues for the future. The meeting should discuss:

- Positive and negative aspects of the project
- Opportunities for transferring Lean Six Sigma from the model site to a model Organisation
- Requirements for the appropriate organisation structure to gain further benefits from lean
- Possibility of supply chain integration.

Create new performance targets

Now that the targets have been achieved and maintained in the model value stream, new targets must be set for the system. This is an important stage of creating a Lean Six Sigma transformation, and yet it is usually overlooked. Targets must become dynamic rather than static measures in order to ensure robust continuous improvement efforts. New targets in terms of quality, cost, and delivery must be set. See figure 17.

Examples of appropriate targets

Quality	Cost	Delivery
Right First Time quality	Labour Productivity	Lead time
Delivered PPMs	Floor space	On time, in full
Rework cost/unit	Inventory turns	
Scrap cost/unit	Machine downtime	
	Overtime	

Figure 17 – Targets for “lean Six Sigma”

Many organisations believe that once they have gone through a Lean Six Sigma transformation and driven out the vast majority of waste, they’ve reached the end of the project. However, this is not the end, but the beginning.

Full Circle

As part of the evaluation process on the area, carry out the original steps from the diagnostic phase once more i.e. Current state analysis, business

assessment, Cultural audit etc. This will give you a very accurate picture of exactly how far you've come. This is also the first step in moving through the cycle again in that area, continuously improving as you go and applying the knowledge gained on the previous project. This will include the next future state map and Tactical Implementation Plan for the new journey ahead.
If you have other areas in your business that you are keen to apply this process to, don't just transfer all the change agents from the original area to the new one to start a new project. Ensure there are sufficiently knowledgeable people remaining in the original area to maintain and improve upon the gains already made.

Other key points to consider when looking at the next area to target:

Define new roles for change agents

New roles must be defined for the members of the implementation team as they re-create the same approach and transfer their knowledge across other areas of the business. Thus, they should no longer be accountable to just their original function, as they will be influencing many different departments and functions.

Priorities objectives

The roll-out objectives must next be prioritised to give a clear definition of the path to the future vision. When determining priorities for the roll-out objectives, there are many possible areas where the company could start, but only a few where it should start. There are four considerations in assigning priority to roll-out objectives.

1 **Take the same approach as in selecting the model value stream**. Rather than trying to change the whole environment overnight, be sure to start small, take a narrow and deep approach to improvement, and identify a single product and its associated processes.

2 **Start with an established manufacturing process** rather than one that is due to enter production shortly. During the early stages of lean, it is necessary to build confidence in the structured approach by visually demonstrating success. Only focus on new production preparation processes after securing a genuine level of commitment from all line management fostered by a significant level of success on existing production lines.

3 **Identify areas of similarity with the model value stream in the factory.** The change agents can save valuable time and develop their own confidence by applying the same concepts in similar areas.

4 **Select areas with positive-minded management teams** to ensure the objective's success. Good managers always smooth the introduction of the Lean Six Sigma methodology.

Identify remaining knowledge gaps

The change agents and management team should identify any remaining knowledge gaps. They should fill them appropriately with the relevant training to maximise the likelihood of sustainability.

Enhance knowledge of lean Six Sigma

The change agents must continue their development of Lean Six Sigma knowledge. It is critical that the change agents realise their knowledge of Lean Six Sigma must expand beyond those tools and techniques applied on the model value stream.

KEY SUCCESS FACTORS IN LEAN SIX SIGMA TRANSFORMATIONS

The following section discusses eight key success factors for a Lean Six Sigma transformation.

DEVELOPING AND MAINTAINING SENIOR MANAGEMENT COMMITMENT

Senior management commitment and understanding of the change process is the single greatest predictor for the sustainability of a Lean Six Sigma transformation. As mentioned earlier, the business must be willing to commit the required time, resource, and attention to ultimately succeed in a Lean Six Sigma transformation. Nature says there is a tendency to progress from order to chaos without outside intervention. Thus, it is critical that the managing director or the most senior manager on site fosters true commitment and understanding from colleagues about the Lean Six Sigma transformation.

Figure 19 lists the 10 top reasons for failure of a Lean Six Sigma transformation, based on our experience.

Lean Six Sigma transformations – 10 reasons for failure

	Reason	Responsibility
1.	Lack of available resource	Management
2.	Lack of commitment to make changes happen - managers have to manage	Management
3.	Company measurement methods incompatible with Lean Six Sigma	Management
4.	Lack of knowledge and understanding	Management
5.	Poor communication	Management
6.	Initial project scope was too large	Management
7.	Poor change agents (ability, availability, position)	Management
8.	Payment issues	Management
9.	Greedy for results	Management
10.	No top level guidance or performance review	Management

Figure 19 – Top 10 reasons for failure

Clearly, a Lean Six Sigma transformation will only be successful if senior management is totally committed to realising the change. Senior management must also:

- Demonstrate the compelling need
- Plan the change appropriately
- Train and develop people at all levels
- Lead and support people through the change process
- Balance expectations of both workforce and management.

Demonstrate the compelling need

Senior management must both understand and effectively convey the compelling need – the reasons whey the company is embarking upon the "Lean Six Sigma journey" – to all levels of the organisation. These reasons should include the:

- Requirements of the customer
- Company's position relative to the competition
- Current performance of the company
- Need to grow and develop as an organisation

Plan the change appropriately

The change agents should plan all activities, assign responsibilities to individuals, and agree on completion dates. Senior management must first approve the plan for the change programme and then develop a system that reviews progress.

Train and develop people at all levels

People from all levels of the organisation need to understand lean. They should be able to practice the process of implementation and maintenance. This process starts with the senior management team and cascades downwards, hopefully obtaining genuine acceptance and understanding from all levels of the organisation.

Lead and support people through the change process

A people-centred approach is necessary for a successful Lean Six Sigma transformation. Senior management must be seen to lead through being actively involved in change activities. Employees need time to become accustomed to new ways of doing things, so significant time will be required to explain the reasons for change and its potential benefits.

Balance expectations of both workforce and management

Senior management must carefully balance their expectations for the change process with the expectations of the workforce to ensure sustainable change . See figure 20. Conflicts can arise quickly if there is a mismatch between the expectations of one party and the provision of the other.

Figure 20 – Balancing expectations

CREATING A STRUCTURE THAT SUPPORTS LEAN SIX SIGMA

A Lean Six Sigma structure is one where people are organised in a way that promotes maximum effectiveness during the Lean Six Sigma transformation. This typically is realised through cross-functional ownership of the production process. There are two stages of evolution in creating this ownership:

- Steering committee guidance
- Progressive organisational structure

Steering committee guidance

The creation of a steering committee is a minimum requirement for the initial introduction of Lean Six Sigma in medium to large change programs. A steering committee is composed of a number of functions and meets regularly to assume ownership for the Lean Six Sigma transformation. If the committee fails to meet on a regular basis, then there is a high likelihood of lost focus or momentum for the Lean Six Sigma transformation. Therefore, the key members of the steering committee should not be permitted to send deputies on a regular basis.

Progressive organisational structure

A Lean Six Sigma transformation can only be successful if it is self-sustaining. This requires a fundamental change in the organisation. The organisational structure should be changed from functional orientation to value stream responsibility, as illustrated in figure 21. A single manager should be accountable for the value stream, and manage all functions for that product. The value stream structure allows sustainable change to be conducted rapidly and as part of normal business practice. When managing the transition from a functional structure to a value-stream structure, it is necessary that standard systems and procedures are maintained because full autonomy could result in major disruption for each value stream manager initially.

Functional Structure

Value Stream Structure

Figure 21 – Progressive organisation structure

IMPROVING THE WORKING ENVIRONMENT

A Working environment is the collection of conditions under which a person is expected to operate. It is desirable to improve the working environment as much as possible to ensure maximised people contributions in the elimination of waste. Several key steps can be taken to improve the working environment:

- Improve the communication channels
- Obtain union support
- Ensure payment methods are compatible with lean
- Optimise health & safety

Improve the communication channels

Effective communication between all levels of the organisation is vital to ensure full co-operation in the Lean Six Sigma transformation. The transformation cannot just be a "one-way" management to workforce event. There must be continual two-way communication between the parties. In communication sessions, it is essential that all observations/comments are accurately captured and followed up immediately. This avoids bad feeling from the workforce claiming "I told management and they did nothing about it". Examples of communication subjects for the management and work force are:

- Overview of the change programme, detailing the compelling need, the approach to be taken and the likely outcomes of change.
- Appropriate training in the Lean Six Sigma philosophy for those who are directly involved.
- Regular discussion between the implementation team and the workforce to capture problems or suggestions for improvement
- Regular meeting between the implementation team and the Lean Six Sigma steering committee
- Annual reports to shareholders / Workforce on progress to date.

Obtain union support

The support of the trade unions is important from the outset because they play a major role during the introduction of "lean". Trade unions may initially take a belligerent stance initially against the implementation of Lean Six Sigma. The following quote illustrates the unions initial perceptions of lean:

> "Whether through benchmarking, teams, or clandestine kaizen, the outcome of management-by-stress is job reduction, on the one hand, and speed-up and job loading, on the other. Interviews and case studies in many countries all revealed an identical tale of what happened when Lean methods were introduced: substantial job elimination, with or without new technology; faster and harder work pace; and increased difficulty in handling grievances related to production or working conditions."
>
> Kim Moody, Workers in a Lean World, (Verso, 1997)

In initial discussions with the trade unions, it is vital that management and unions alike recognise the cost of not introducing a Lean Six Sigma system – a potential loss of market share and customers' requirements continuing to be unsatisfied. It is also advisable to discuss the positive benefits that Lean Six Sigma will have on the general workforce. These benefits improve the work environment, resulting in:

- Increased health and safety
- Cleaner, more straightforward working environments
- Clear work standards and responsibilities
- Minimised rework
- Quick and efficient eradication of abnormalities

Unions understandably become nervous when companies begin to mention improving labour productivity. To the unions, this translates as "producing the same, with fewer people," implying a reduction in jobs! This is one possible outcome, but there are alternatives to avoid this certain conflict. Available options include:

- Workforce reduction through natural turnover
- Recruitment freezes (sometimes targeted at particular groups)
- Short-time working, overtime reductions or bans
- Re-examination of temporary staff and contractors
- Redeployment and retraining
- Early retirement
- Voluntary redundancy programmes.

It is necessary to consider the long term consequences before using an alternative because some will not be sensible in all circumstances. To avoid a potentially sensitive situation, management often issues a "no compulsory redundancy" policy as a result of the improvement activities.

Ensure payment methods are compatible with Lean Six Sigma

Shop floor payment methods should comply with the Lean Six Sigma methodology enabled by maximising people contributions. An example, piecework is not an acceptable payment system because it:

- Complicates introduction of a robust quality system as it works against the principle of stopping a process when an abnormality occurs
- Encourages overproduction and all other associated types of waste
- Eliminates the ability to synchronise stages of production with customer demand, as people work at different rates.

A better alternative to piece work is a standard weekly salary, yet many organisations have attempted this change and quickly reverted back to piecework. The shift in policy is usually due to a drop in productivity after implementation, which is inevitable unless new systems and procedures are put in place to monitor performance. Piecework is an easier system to manage because output is controlled by the individual employee's motivation level. Managers must be prepared to manage, by resolving non-standard situations such as poor output, absenteeism and general lack of contribution as soon as they arise if the new payment system is to be successful.

Optimise health and safety

Employee health and safety should always be paramount on any company's agenda. Lean Six Sigma methods support this in the following ways:

- Focus on the shop floor worker to improve workability of the product
- Conduct job rotation, possibly avoiding repetitive strain injuries through multi-skilling
- Improve shop floor worker ergonomics, e.g., transforming a sitting or standing person into one that is continuously walking.

CREATING A CONTINUOUS IMPROVEMENT CULTURE

A continuous improvement culture motivates all employees to constantly improve their own working areas. A continuous improvement culture can be created through several steps:

- Make teamwork the norm
- Maximise opportunities for workforce involvement
- Ensure contributions are recognised and valued.

Make teamwork the norm

The benefits of teamwork are well documented, and the Lean Six Sigma activity goes even further to maximise people contribution through eliminating all forms of waste from the manufacturing process. This objective is further enabled due to the typical small team sizes in Lean Six Sigma environment, and the wide spectrum of responsibility for the team leader.

Maximise opportunities for workforce involvement

Management must harness the power of teamwork in order to truly maximise people's contribution in the workplace. The workforce should be given the opportunity to contribute through:

- **Focused team improvements.** Allow time within normal production hours to observe and improve the manufacturing process
- **Daily team meetings with standard agendas.** The meetings should last no longer than ten minutes and allow two-way communication to discuss items such as daily targets, problems and general communication.
- **Employee suggestion system.** This system serves as another source for continuous improvement efforts.

Ensure contributions are recognised and valued

Senior management must recognise and value the improvement efforts of the workforce. Without recognition, the workforce may begin to revert to a more comfortable method of manufacturing by tolerating inefficiencies. Senior management must have a visible presence on the shop floor and observe improvements first hand. This helps foster a continuous improvement culture because people feel great pleasure from showing off their improvements. Recognition in many cases is more valuable than actual reward.

Senior management must also create a blame-free and no-judgmental attitude with people for a Lean Six Sigma system to be successful. Lean Six Sigma aims to cut all of the "fat" out of a process by its very nature. So, the system is intolerant towards any abnormality. The system demands immediate corrective action whenever abnormalities are highlighted. Management should be appreciative that the workforce highlights problems so that they can be solved at their source. In a blame culture, the workforce would be encouraged to conceal these issues to avoid a possible reprimand.

CHANGING SYSTEMS AS WELL AS PROCESSES

When implementing a change to a process, one must also examine how it will affect an entire system to ensure maximum sustainability. This is undertaken through:

- Understand manufacturing flows
- Focus on improving flows, not techniques.

There are generally three types of flow in manufacturing. These are:

- People and process flow (Process Change)
- Material flow (System Change)
- Information flow (System Change)

The people and process flow is the interaction between operators and the machines. The material flow represents the flow of the product between processes. The flow of information controls the production of all processes. Lean Six Sigma aims to harmonise all three flows. However, most organisations have only recognised the need to improve people and process flow, creating a major misconception of Lean Six Sigma. Improving people and process flow in isolation leads to only localised benefits.

Global benefits can only be attained through system changes involving material and information flow. Improvements in material and information flow eradicate product stagnation between processes and synchronise production of each process in accordance with the customer requirements. Figure 22 illustrates the differences between process and system changes.

Comparator	People and Process Flow	Material and Information Flow
Scope	Tends to focus on a single process	Gets a complete perspective on a product. All processes are involved
Waste Awareness	Reasons for waste are disguised due to cause being upstream	Helps you see the source of waste as well as the waste itself
Approach	Allows cherry picking	Ties Lean Six Sigma concepts together to avoid cherry picking
Stability	Deteriorates due to being an isolated island of activity	Forms the basis of Lean Six Sigma introduction plans through its integrated approach
Measures	Provides a quantitative measure but does not tell you how to improve	Provides a qualitative measure of how your factory should look and how you are going to do it

Figure 22 – Differences between and process and system changes

Focus on improving flows, not techniques

To make system changes, one must improve the three flows in a systematic manner. System changes should be based on needs identified from the current manufacturing condition. The improvement team cannot focus only on areas where they can apply clever techniques.

To improve flow, it is typically best to start at the point closest to the customer (end of process) and then seek improvements upstream. It is necessary to secure a low and consistent lead time in each process before moving upstream. There are two reasons for this. First, controlling work-in-progress inventory at downstream operations significantly reduces the variability in demand for the upstream process. Second, information flows upstream inmost pull systems. Thus, subsequent parts of a pull system can be implemented as flows are improved from downstream operations to the upstream operations.

SETTING DEMANDING TARGETS WITH REGULAR REVIEW

A company must set demanding, yet realistic targets and then review progress regularly to make sure changes are sustained. To maximise the change of sustainability, management should:

- Set new targets at the end of each project
- Review progress on a regular basis.
- Set new targets at the end of each project

Improvements should not halt when a team achieves a target condition. Rather, new targets must be set to ensure continuous improvement. These targets should be realistic, achievable and agreed by the person who is expected to deliver them.

Review progress on a regular basis

The improvement teams should present status reports to senior management each week in order to maintain their focus and interest in the improvement activities.

The status report should contain the following information:

- What happened this week
- What is planned for next week
- What is the performance of the process
- What concerns have been raised
- What countermeasures have been taken.

Senior management should take a genuine interest in the content of these reports and request clarification if any information is blurred. The senior managers should be responsible for the receipt of reports from all improvement teams on a weekly basis. If one report goes un-submitted and the team is not asked for it, they may not create a report in future. The lesson: If you accept a non-standard situation, it becomes the new standard!

TRANSFERRING LEAN SIX SIGMA

The Lean Six Sigma methodology must be extended to other areas and functions in the organisation. These other areas and functions can then gain an appreciation for the Lean Six Sigma methodology, helping to ensure its sustainability. There are three elements to this transfer:

- Transfer to new production preparation

- Develop a model organisation
- Extend to the enterprise.

Transferring to new production preparation

When a company has become competent in Lean Six Sigma, the thinking should be transferred to production preparation. By focusing on new products, waste can be designed out from the outset, resulting in cost avoidance and built-in quality.

Develop a model organisation

As experience grows within an organisation, the concepts learned in the model value stream can be applied to create the model factory. The concepts learned to create the model factory can then be applied to create a model organisation. This is not simplistic and will require many years to complete. Lean Six Sigma should only be transferred to additional areas at a rate that the organisation infrastructure can support. See Figure 23.

Extend to the enterprise

At an appropriate point in the transformation process, consideration should also be given to developing the supplier base. The goal is to move from a model organisation to a model enterprise – encompassing the entire supply and delivery chains. Experienced personnel should be used to transfer the learning to key suppliers through a standard approach.

Figure 23 – Extending to the enterprise

UNDERSTANDING BUSINESS BENEFITS

It is very important that senior management recognises the business benefits of Lean Six Sigma and how they relate to the overall business strategy. Depending on a particular business model, excellence in operations can be either a driver for business strategy or a prerequisite for that strategy, see figure 24. Lean Six Sigma is a driver for business strategy when acquired excellence in operations produces a strategic advantage. An example can be in a mature market where one company develops the capability to manufacture and convey a product Just-in-Time. This gives the company a distinct advantage over its competitors, so a strategic advantage may result for the company. Lean Six Sigma is a prerequisite for business strategy if excellence in operations is required for a company to maintain its competitive position. An example is a firm that draws its demand from internet sales and has little forward visibility of customer demand. Thus, the manufacturing system must be as Lean Six Sigma and flexible as possible to satisfy the customer demand.

Either acquired or necessary, excellence in operations enhances overall business strategy and helps increase the overall profitability of the business. The profitability increase is realised through:

- Tangible business benefits
- Intangible business benefits

Figure 24 – Business strategy and operational excellence

Tangible business benefits

The tangible business benefits of the Lean Six Sigma transformation can be grouped into Quality, Cost and Delivery. See figure 25.

Figure 25 – Tangible business benefits

- Quality
  - **Increased yield from processes.** Defects are detected and solved at their source, rather than just being detected at downstream processes.

  - **Reduced scrap and rectification costs.** Material and labour requirements are limited through increased yields of individual processes.

- Cost
  - **Higher return on assets.** Asset intensity is reduced as space and transportation requirements should diminish. Also, equipment is "right-sized" to maximise value-added work, often extending the life of the investment beyond its original "book value".

  - **Improved cash flow.** The number of inventory turns should increase through the introduction of a pull system, which prevents overproduction and links production to actual customer demand.

- **Reduced conversion costs.** Improved yields and a continual focus on increasing value-adding work for an operator reduces these costs. Also, the number of indirect or peripheral activities necessary for production should diminish.

- Delivery
  - **Shortened, more consistent Production lead time.** A Quicker response to changes in customer demand and the ability to guarantee delivery schedules.

  - **Increased flexibility in operations.** The efficient use of manpower can easily adapt to changing volume and product variety fluctuations.

Intangible business benefits

- Increased rate of continuous improvement
  - The company should become committed to the ongoing identification and elimination of waste as a way of life, consistently reducing product cost.

- Strengthened problem solving skills
  - Previous recurring problems should be eliminated as the company begins to attack the root cause of problems.

- Improved customer satisfaction
  - The greater fulfilment of Quality, Cost and Delivery benefits can help foster customer loyalty.

APPENDIX

PROGRAMME CHECK LIST

The purpose of the check list is to act as a guide for management leading the Lean Six Sigma transformation.

Progress from one stage to the next in the Lean Six Sigma transformation can only be made when all items in the stage have been satisfied.

- Preparation

- Have all appropriate management had an overview of the project?

- Have senior management clearly demonstrated their commitment to proceed with Lean Six Sigma transformation?

- Has an appropriate pilot project area been identified?

- Has a steering committee been created (Where applicable)?

- Has a cross-functional implementation team been identified (Where applicable)?

- Have the cross-functional team been communicated to & trained?

- Have all of the following been appropriately communicated with?
    - Management
    - Unions
    - Shop floor
    - Support functions

- Has a standard weekly report format been agreed and introduced?

- DIAGNOSTIC

- Has a current state material and information flow diagram (Value stream map) been created?

- Has a future state material and information flow diagram been created?

- Has a Stakeholder Analysis been carried out?

- Has the cultural audit been carried out?

- Has the business assessment been conducted?

- Have the material and information flow diagrams, performance metrics, implementation plans, detailed layouts and budget been presented to senior management?

- Has the proposal been presented to:
    - Other management?
    - Support functions?
    - Shop floor Workers?

- Has a contingency plan been developed to preserve quantity and delivery?

- Have the management team indicated that they are happy to proceed?

- STABILITY

- Have the recommendations from the Diagnostic phase been followed?

Further actions in this phase will depend upon the outcomes from the Diagnostic phase

- STRATEGY

- Has a functional vision for the business been created?

- Have the detailed Tactical Implementation plans been created?

- Has a list of priority improvement areas been created?

- Has adequate resource been identified to fulfil the requirements?

- Does a detailed timing plan exist specifying start and finish dates for future projects?

- Have the future project activities been budgeted for?

- ACTION

- Has a forum for programme review been created, dates assigned and service managers committed to attend?

- Has the organisation adapted its Performance Management System to Lean Six Sigma production activity?

Other actions carried out in this phase will be dependant upon the business involved.

- EVALUATION

- Has a detailed evaluation of progress to date been carried out, including Current State Map, before and after photographs etc.?

- Has the success so far been communicated and celebrated?

GLOSSARY

TERM	DEFINITION
Abnormality	Any from of deviation from a standard process.
Autonomation	The principle of stopping a manufacturing process when abnormalities are detected through either intelligent automation or manual means.
Change Agents	Representatives from business who will roll-out the Lean Six Sigma transformation through the entire company. Knowledge of Lean Six Sigma developed through work on model value stream.
Continuous Flow Processing	Producing using a batch size of one.
Cost-Minus Principle	Belief that cost reduction is the only way to increase profits: = Price – Cost.
Flexible Manpower Systems	A factory-wide method for optimising labour productivity across varying levels of customer demand by moving people between flexible manpower lines.
Improvement Team	Comprised of representatives from each function within the organisation (e.g. personnel, quality, logistics, manufacturing, etc). These team members are not required to be fulltime, but should be ready and available to provide support to change agents.
Just-in-Time	Manufacturing and conveying the right number of parts at the right time in the right quantity – and in the shortest possible lead time.
Kaizen	The Japanese word meaning continuous improvement.
Lean Six Sigma	Aims to deliver value to the customer with the lowest cost, highest quality and shortest

	possible lead time. Accomplishes this goal through eliminating wasteful activities.
Material and Information Flow Mapping	A pictorial representation of a manufacturing process that illustrates the flow of material between processes and the required information to convert material into final product.
Model Value Stream	Small part of overall value stream which is the focus during the intensive support period. Will serve as a model for what is possible over the entire value stream.
Pull System	Synchronises all stages of a production process with customer demand. This means that the right parts should be in the right place at the right time.
Steering Committee	Cross-functional forum composed of department heads. Aim is to develop a business-wide, cross-functional understanding of Lean Six Sigma.
Support Systems	Necessary to provide operational stability. Examples of support systems include programmes such as workplace organisation and total productive maintenance.
Takt Time	Synchronises the pace of production to the pace of sales in the marketplace.
Value	Something that meets a customer's needs; it is created by a producer.
Value Stream Organisational Structure	A single manager for an entire value stream.
Waste	Anything above the minimum resource required to complete an activity.