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## SIRFrt METHOD: ASSESSING AND IMPROVING MAINTENANCE RELIABILITY

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### ABSTRACT

The focus of this paper is to assess ways to improve plant availability of an organisation in order to reduce its reactive maintenance from its current level of 30%. The pharmaceutical products the organisation (name withheld) produces are in short supply. It is vital the equipment that produces these products are reliable and produce quality products all the time. Loss of one batch due to equipment malfunction not only equates to loss of revenue but also the loss of vital medications which could jeopardise patient safety. This paper solely focuses and reports on the SIRFrt method to assess plant reliability in order to achieve maintenance excellence. There are seven elements that can impact maintenance excellence, however the focus of this paper is on reliability improvement since the audit scores were low in comparison to the other elements considered under the SIRFrt method. As a result of using feedback gained through the SIRFrt method assessment, it is anticipated that reactive maintenance will reduce below 10%.

**Keywords** - SIRFrt method, maintenance excellence, reliability-centered maintenance, asset management, risk assessment, maintenance management.

## 1 INTRODUCTION

The approach to maintenance management has changed over the past few decades. Effective maintenance management requires a multi-disciplinary approach where maintenance is viewed strategically from a business centred perspective. These include the integration of technical and commercial issues and a quantitative approach involving mathematical models, the use of all relevant information and continuous improvement in maintenance management (Kobbacy & Murthy, 2008).

Maintenance excellence focusses on maintenance efficiency and effectiveness of processes. It aims to ensure that practices are consistent, sustainable and replicable. Maintenance excellence is not about fixing things when it breaks, it is about delivering value for money and improving plant and equipment performance (Afefy, 2010). It is also about aligning engineering goals with corporate goals (Plösch, Pomberger & Stallinger, 2011).

The challenge that confronts most organisations is to be leading maintenance organisations and develop and follow performance standards as a part of continuous improvement program. In this pursuit and in order to meet production targets, organisations often neglect scheduled maintenance and this contributes to poor maintenance performance (Tomlinsong, 2006). The motivation for implementing maintenance or reliability excellence within an organisation is to optimise manufacturing assets' health and processes, maximise production at the lowest unit cost, improve product quality and improve safety (Dhillon, 2006; Bakhshi et al., 2011; Moubray, 2012). Maintenance of equipment is a significant fraction of the total operating cost in many industry sectors.

If maintenance and manufacturing functions are not clear on the definition of reliability, it is possible the desired outcome of plant reliability will not be achieved. Hence it is vital that definitions of reliability are correctly understood by the maintenance team. Kleine (2009) has provided three paradigms where the definition of reliability takes on a whole new meaning.

Paradigm one changes the mindset from reliability being fewer breakdowns to less interventions. This argument is based on having increased condition monitoring tasks, which allow Engineering Department (ED) to intervene and carry out repairs outside manufacturing hours. Although this is good from a manufacturing perspective with regard to fewer breakdowns, it is still not the best outcome for maintenance due to the high cost of labour and material.

Paradigm two is about shifting the focus that reliability is used to determine equipment performance, to determining the performance of all activities. This involves taking the holistic view that there are many other issues that can impact the business other than equipment reliability. This involves environmental, health and safety, planning & scheduling and training. There is very little value to the business if the focus is only on the equipment while the majority of the management resources are spent on occupational health and safety and environmental issues.

Paradigm three challenges the notion that reliability belongs to the shop floor compared to the board room. There have been many examples when improvement programs have never really taken off due to the lack of commitment from senior managers. There is a good chance of an improvement activity succeeding if it has the commitment of senior management. ED's strategic plan along with its objectives has to align with the organisational strategic plan.

Hence, it is necessary to focus on reliability problems and identify the major contributors to loss and equipment malfunctions. In order to provide successful maintenance operations, it is crucial to implement a systematic approach for assessment and improvement. One such systematic approach is promulgated by SIRFrt. SIRFrt organises the Australasian Maintenance Excellence Awards (AMEA) annually (SIRFrt, 2013). As part of the AMEA audit, organisations are recognised for their commitment to maintenance excellence.

The SIRFrt Australasian Maintenance Excellence Awards (AMEA) audit focuses on the following seven elements (SIRF Roundtables, 2013) in its journey towards maintenance excellence:

1. Leadership: This element focusses on assessing the role of corporate executive leadership in creating and promoting a culture that supports continuous improvement in its maintenance program. The executive leadership is examined for its dedication to a planned and reliability culture.
2. People: This element focusses on assessing the extent to which people at different levels in the organisation are committed and appropriately trained to safely and effectively achieve the maintenance goals and objectives of the organisation. This element also aims to assess

the management and evaluation of the contribution of its staff in achieving organisational objectives.

3. **Planning and Scheduling:** This element evaluates how the organisation builds, controls and improves planning and scheduling of its maintenance work. This category encompasses how the organisation develops its overall maintenance plans. It also looks at how well the organisation incorporates its maintenance plan with the production plan and finally with its business plan. This is the key for improving wrench time.
4. **Maintenance Process and Practices:** This element evaluates the way the organisation selects the best maintenance strategy for its equipment. This element focusses upon methods and processes carried out to implement, monitor and improve maintenance processes and practices. Data and methods to predict appropriate maintenance goals form an important part of this assessment.
5. **Reliability Improvement:** This element focusses on assessing how an organisation achieves reliability at the lowest costs. The key focus is to assess reliability improvement processes and identify whether adequate preventive and predictive maintenance techniques are being used.
6. **Resource Management:** This element focusses on assessing the processes used by the organisation to efficiently allocate and utilise its materials and resources for carrying out maintenance activities.
7. **Business Performance:** This element aims to assess the extent to which the maintenance operation demonstrates sustained improvement and its integration and contribution to organisational goals.

This paper solely focuses on the SIRFrt method to assess and improve maintenance excellence. The remainder of the paper is organised as follows. The next section outlines the research methodology adopted for this study. Section three outlines the problem faced by an organisation in their maintenance excellence journey. Section four presents the discussion and key findings with key emphasis on the elements used to evaluate maintenance excellence. Finally in the conclusion, the key premises of the paper have been summarised and the limitations of this study are explicitly stated with an outlook for possible future research.

## **2 METHODOLOGY**

This study is based on the current maintenance practices of an Australian pharmaceutical organisation that specialises in the manufacture of specialised pharmaceutical products. The name of the organisation explored as part of this study has been withheld for confidentiality reasons and the pseudonym XLean has been used instead. The analysis applies to only one plant of XLean as it operates in multiple locations. The engineering group at the site consists of the ED and the Projects department.

An exploratory case study method helps to investigate a ‘contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used’ (Yin, 1984, p.23). Therefore case study research method was chosen as it provides clarity and in-depth understanding of complex matters and adds strength to what is already established through previous studies.

With all the progress XLean has made in the past two decades in the areas of research and development, new products, acquisitions and innovations it has a long way to go before being the best in the world when it comes to carrying out maintenance of its plant and equipment. The next section outlines some of the problems that confront XLean.

### 3 THE ORGANISATIONAL PROBLEM

Due to increased production demands, the manufacturing cycle of different products in XLean has reduced from 7 days to 5.6 days since July 2010 and then down to a 5 day cycle since January 2011. This reduced cycle time meant that the available time to carry out maintenance in between the cycles is less and hence overall maintenance time is reduced. Plant reliability cannot be maintained with less ‘windows of opportunity’ to carry out maintenance. This has resulted in an increased level of reactive maintenance which is currently at 30% of all maintenance work. The way forward is to revisit and challenge the current maintenance practices.

The organisational problem challenging XLean is the reduced manufacturing cycle times cannot be sustained with poor equipment reliability. Reduced cycle time also means the maintenance resource structure should be able to respond to ‘windows of opportunity’ at a short notice. This problem cannot be resolved at the current rate of reactive maintenance being undertaken. Reactive maintenance includes breakdowns and non-scheduled work that breaks into the weekly schedule. Plant availability is measured as part of the current key performance indicators.

XLean, similar to other companies, has difficulty in seeing asset reliability initiatives in the same light as safety improvements. Most companies are proud to publish that safety comes first but not many companies proclaim that asset reliability is top priority. During difficult times the first process to be cut will be continuous improvement activities which would result in reduced asset reliability. Once continuous improvements’ process breaks then asset reliability starts to suffer.

Following are the main elements that need to be resolved by the ED, if XLean is to meet the reduced cycle times and achieve higher plant availability:

- Reactive maintenance to be reduced from the current level of 30% to less than 10%;
- Improve the way planning and scheduling activities are undertaken;
- Align the manufacturing plan to the maintenance plan;
- Carry out asset criticality as well as PM task criticality;
- Complete a high level Reliability Centered Maintenance (RCM) activity on all assets that have a PM schedule; and
- Undertake a Preventive Maintenance Optimisation (PMO) exercise on the current PM’s to ensure only value adding activities are conducted.

The consequence of not achieving the five day production cycle will result in not meeting the contractual obligations between XLean and its key customers. In order to meet the five day batch cycle XLeans’ maintenance strategy needs to be reviewed and reactive maintenance work needs to be brought down to 10% from the current level of 30%. A maintenance resource structure needs to

be developed to meet the reduced cycle time. Ability to plan and schedule the work in advance will help achieve the targets as well as improve wrench time.

The ‘maintenance hero’ mentality is alive at XLean but there is a lack of strategy to combat the current issues. XLean maintenance is good at getting the horse back into the barn after it has escaped. One of the main challenges XLean faces is how to change the mindset that keeping the horse in the barn is what maintenance is about. XLean is no different to most companies who think that maintenance is a necessary evil. The purpose of maintenance at XLean is seen as repairing failed assets, thus adding little value to the organisation. It is only recently that XLean has started to believe that maintenance is about delivering value to the business and improving plant reliability. It is about making the paradigm shift that maintenance is a reliability function and not a repair function.

XLean has come to the conclusion that it cannot be a world leader in the production of pharmaceutical products if it does not have a reliable and robust maintenance process working together with manufacturing. It has been recognised within the organisation that equipment reliability is essential, if progressing down the path of excellence. Senior management is of the strong belief that the organisation cannot continue to develop and seek new opportunities if the existing foundation (plant reliability) is not stable.

#### **4 DISCUSSION AND FINDINGS**

The philosophy of XLean’s maintenance strategy is to be proactive and not reactive. XLean plans to achieve this by striving for maintenance excellence. One of the key strategies that will be used to achieve maintenance excellence in XLean will be the SIRFrt method in exploring and resolving its maintenance problems.

A self-assessment audit was undertaken on each of the seven elements of the SIRFrt AMEA audit to determine XLean’s maintenance excellence journey. Each of the seven elements is applied to the Intent, Approach, Deployment, Results, and Improve (IADRI) five-point inquiry model, which forms the basis for self-assessment and scoring (SIRFrt, 2010). The IADRI model sets the context for a challenging critical review of the completeness and effectiveness (NSW Trade & Investment, 2012) of the current maintenance processes at XLean.

The advantage of scoring using the IADRI model is that points are allocated based on many facets and not on the individuals’ perception. The categories under the IADRI model are:

**Intent:** highlights the purpose and expected outcomes aimed by the organisation.

**Approach:** aims at identifying the planning carried out.

**Deployment:** aims at outlining how and where the activities/processes were carried out.

**Result:** aims at identifying whether the anticipated outcomes have been achieved.

**Improvement:** targets at identifying the way past improvements were carried out and assessing their effectiveness.

The IADRI model sets the context for a complete self-audit on all the 7 elements of the SIRFrt method as listed below along with the maximum achievable score.

1. Leadership (140 points)
2. People (180)
3. Planning and scheduling (110)
4. Maintenance process and practices (160)
5. Reliability improvement (180)
6. Resource management (110)
7. Business performance (120)

The above scores were taken from the SIRFrt maintenance excellence awards criteria and these evaluation categories total up to 1000 points. The audit was conducted by the local branch of the SIRFrt and included XLean staff from Manufacturing, Engineering and the Quality Assurance departments.

It was considered to be beyond the scope of this paper to list all the individual assessment sub-elements under each main element. Hence the average scores that were the outcome of the audit across each of the 7 elements are presented in Figure 1.

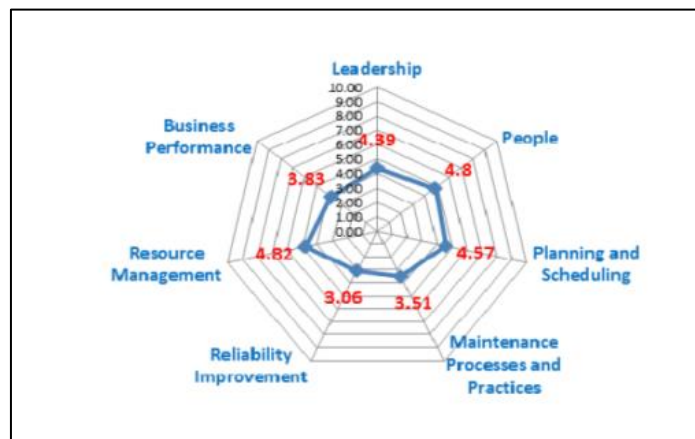


Figure1: Audit summary - Average Scores

When this self-assessment was conducted at XLean, the reliability improvement element scored the lowest and hence required further analysis.

Reliability improvements in the audit were assessed against the following five sub-elements. Figure 2 shows the scores for the five sub-elements for reliability improvement.

1. Reliability improvement identification (processes used to determine when reliability improvement is required) - Currently there is no documented procedure when or how to capture certain repeated failures and pass this information on to the reliability group.



2. Reliability improvement process (processes used to deliver reliability improvements) - The audit identified that there was not a process in place to work on reliability issues. There were various RCA methodologies being used on site.
3. Achieved reliability improvement (Improvements to asset performances that have been achieved as a result of improved reliability) - There were no measures in place to see if the reliability program was having an impact in improving the uptime. There was no system in place to capture all the reliability improvements that were carried out over the past year. The current KPIs need revisiting.
4. Data for overall improvement (Data being collected and its usage to improve the overall performance of the business) - The maintenance management system did not have a category for reliability improvement. It was difficult to differentiate between reliability work and other PM work. The information gathered was not being used for new plant design or for improving the current maintenance strategy. Past trends and data were not being used for failure analysis.
5. Learnings from reliability improvements being used for new projects (Maintenance learning incorporated into the design and purchase of new equipment) - It was found that there was insufficient communication and procedural exchange between Maintenance and the Projects department. This resulted in the experience of the maintenance engineers not being captured in new projects. It was found in the audit that this resulted in the same deficiencies being reintroduced in new installations. The audit also found that the project engineers were not aware of the requirements of the maintenance department when it came to handing over projects. This included minimum training, spares and no PM's in place for the new equipment.

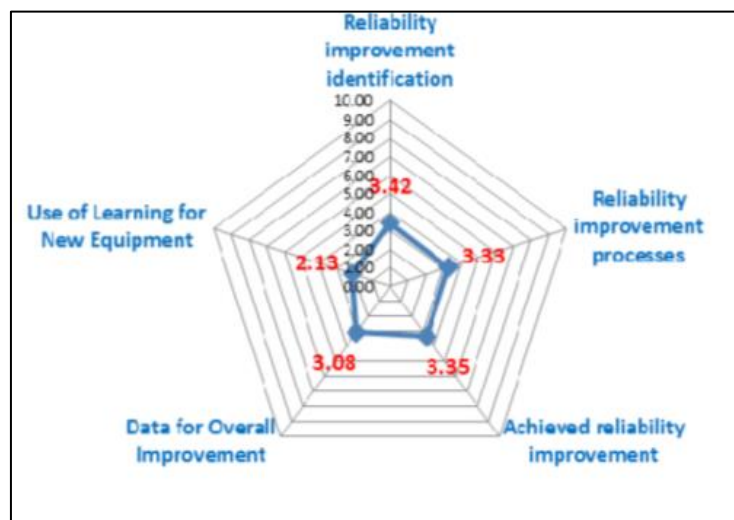


Figure 2: Reliability Improvement

To counteract these problems, findings from the maintenance self-assessment audit revealed that focus groups should be set up to deal with the following high priority issues which would free up

time and resources for the organisation to concentrate on all the elements required to achieve maintenance excellence.

1. Time wasted due to production personnel not giving enough information on the work order.
2. No proper system to ensure that specialised tools are returned to the store after use.
3. Better planning and scheduling.
4. Spares parts removed from the store need to be accounted for.
5. Need to have a reliability culture and not a breakdown culture.
6. Work closely with production to maximise plant availability.
7. Set up a Reliability group with a clear mandate.
8. Leadership and team building.

It is expected that the findings will help in improving plant reliability at XLean. Improvements made should be validated by conducting a repeat audit once the improvements have been implemented. It is important that a culture of proactive rather than reactive maintenance is developed to support the operations of the organisation and reduce cycle times and the culture is in sync with its philosophy. An overall maintenance strategy that is designed to ensure reliability and minimisation of resource consumption should be looked into by XLean and finally it should be ensured that the continuous improvement cycle of Plan-Do-Check-Act should be carried out uninterrupted.

## 5 CONCLUSION

The aim of this paper was to assess ways to improve plant availability of an organisation by reducing reactive maintenance from its current level of 30%. It is understood that the reduction in cycle times will allow more batches to be produced thereby reducing the shortage of life saving products produced at this plant. However reduced cycle time also reduces the opportunity to carry out critical maintenance activities. This increases reactive maintenance due to breakdowns which consequently impacts the cycle time.

SIRFRt method was found suitable to review XLean's journey towards maintenance excellence. As evident from the SIRFRt audit, reliability improvement was an area that needs attention. It is vital to optimise the current maintenance practices under the current regime of reduced production cycle and high reactive maintenance. It is highly recommended that organisations facing similar challenges assess their maintenance strategies and conduct regular audits to improve their maintenance systems.

Although this paper only reviewed reliability elements, it is important to have a more holistic view of maintenance rather than just investigating one element. It is recommended that the other elements be addressed as part of future studies. Generalisability of the findings is not advised due to the nature of case study methodology.



This research can be further extended to the remaining six elements identified to achieve maintenance excellence. An important part of maintenance is managing people and hence leadership needs to be considered as one of the key areas of interest for cultural change. Benchmarking against similar companies could be beneficial in improving maintenance management.

XLean along with many other pharmaceutical companies has realised the importance of maintenance, which in turn has increased its awareness of the maintenance processes. The audit indicated that it is difficult to achieve maintenance excellence by improving all seven elements simultaneously. It has therefore identified that roll out of the reliability program in the first phase of implementation of the maintenance excellence plan is needed.

It is vital that maintenance patterns at XLean changes from being reactive to proactive where senior management need to play an important role in ushering this change and foster a culture that drives right staff attitudes and adequate resource allocation.

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