WRFM Process Improvement

Master of Engineering Management Project Report

Ama Wickramanayake
**DOCUMENT CONTROL**

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Comments</th>
<th>Persons in Possession</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 January 2014</td>
<td>1.0</td>
<td>First Draft</td>
<td>Ama Wickramanayake, Andrew Inwood</td>
</tr>
<tr>
<td>31 January 2014</td>
<td>2.0</td>
<td>Implementation Plan and Appendices Updated</td>
<td>Ama Wickramanayake, Andrew Inwood</td>
</tr>
<tr>
<td>06 February 2014</td>
<td>3.0</td>
<td>Changes Following Sponsor Feedback</td>
<td>Ama Wickramanayake, Andrew Inwood</td>
</tr>
<tr>
<td>13 February 2014</td>
<td>4.0</td>
<td>Changes Following Supervisor Feedback</td>
<td>Ama Wickramanayake, Andrew Inwood,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Assoc. Prof. Piet Beukman</td>
</tr>
</tbody>
</table>

**DISCLAIMER**

This Report has been submitted to the University of Canterbury for the partial fulfilment of the Master of Engineering Management degree requirements. The Report has been made available to Shell Todd Oil Services Limited on the condition that neither the author nor the University will have any legal responsibility for the statements or recommendations made therein. Should Shell Todd Oil Services rely on the contents of the Report, or to implement any its recommendations it must do so solely in reliance on its own judgement.
ABSTRACT

The intent of this Project was to identify areas of improvement in Shell Todd Oil Services (STOS) Well, Reservoir and Facility Management (WRFM) practices, in order to meet full compliance with Shell global WRFM Standards by their next annual review in Q4 2014. A gap analysis was carried out to identify where improvement efforts must be focused and measures to support optimisation, streamlining and alignment of processes have been recommended.

The Shell Blade 27 – Well, Reservoir and Facility Management Guideline was used to obtain insight and understanding of the WRFM process and requirements. The STOS WRM Management Manual, WRFM Plans and Health-check outputs were used as supplementary documentation for the gap analysis. The Shell WRFM minimum requirements were used as the established benchmark against which STOS practices were measured using the asset assessment tool. Interviews were carried out to further highlight complexities and constraints at STOS to meet Shell criteria.

The findings in this report provide evidence of issues that should be addressed for the continuous improvement of WRFM at STOS. These have been provided for the consideration of Shell Todd Oil Services Limited WRFM Steering Committee Chair.
ACKNOWLEDGEMENTS

My heartfelt gratitude goes to my friends and family for their unconditional support throughout this challenging year.

To the Class of 2013, for welcoming this Aucklander aboard and being great friends and classmates. My Christchurch/MEM experiences wouldn’t be the same without you!

To Professor Piet Beukman and Beverley Hall for their never-ending support, guidance and words of wisdom throughout the year; you always had our best interests at heart, and for that I am grateful.

And last but not least to all my colleagues at STOS for taking a chance on this stranger to the oil and gas industry and for being more than willing to help whenever I asked, both in and out of work. My special thanks go to Andrew Inwood for giving me this opportunity, mentoring me and challenging me throughout this project. I have gained much valuable insight that I will take with me. My special thanks also go to Graeme Caskey for his constant support and guidance throughout my time at STOS. It has been my pleasure working with you all.
EXECUTIVE SUMMARY

This report provides recommendations for the prospect of optimising the Well, Reservoir and Facility Management (WRFM) processes within Shell Todd Oil Services Limited (STOS).

The areas of focus analysed include:

- The scope of the project;
- Analysis of the current WRFM Practice at STOS;
- Industry and literature review for benchmarking;
- Proposed solutions;
- Recommendations for continuous improvement.

PROJECT SCOPE

The scope of the project involved understanding the working business environment to determine the gaps in meeting Shell requirements, assessment of the value of each activity or process and justifying the need for gap closure. The following tools and analysis techniques were used to formulate appropriate recommendations for improvement:

- Shell Blade Review
- Observation
- Interviews
- Root-Cause Analysis

BENCHMARKING

Royal Dutch Shell provides the Operational Excellence in Production Framework for Shell Operational Units to use as a guide to best practice. These operational excellence guidelines were reviewed to obtain an understanding of best practice criteria and the minimum benchmark requirements for WRFM.

Due to WRFM processes being considered confidential Shell Intellectual Property, other oil and gas organisations were not approached.

ANALYSIS OF WRFM AT STOS

The WRFM Process at STOS was analysed through participant and non-participant observation and investigations to obtain an understanding of WRFM within the organisation.

WRFM underpins STOS goal of maximising value to field owners, and is key to managing long-term asset performance and showing the responsible stewardship of hydrocarbon resources. Integrated efforts from Petroleum Engineering, Production Operations, Field Engineering and Completions and Well Interventions are provided to manage WRFM within STOS.

The WRFM process within STOS were analysed with the aid of:

- The WRFM Assessment Tool;
- Interviews; and
- Root-Cause Analysis;

The WRFM Assessment Tool, which is a Shell Global spreadsheet based tool that assesses asset performance against a set of predetermined criteria, gave STOS a compliance score of 38%. Shell minimum standards require a score of 60%. In most cases STOS had alternative processes that met the intent of Shell requirements but required support to become more robust. The main areas of improvement identified were:

- Ownership of WRFM critical data and processes
- Staffing requirements – competency management, training, succession planning
- Better definition of team roles and responsibilities
• Definition and monitoring of KPIs
• Management of opportunities and threats – opportunity maturation process, non WRFM activities categorised as WRFM

The interviews also highlighted the following issues in WRFM within STOS:

• Limited understanding of WRFM and STOS goals and objectives
• Poorly defined roles and responsibilities – responsibilities defined at a discipline level, however individuals are unsure of expected contributions
• Vague strategy – approach to achieving full compliance is not clear and is inadequately communicated
• Poor planning – allocation of time, deadlines.
• Limited visibility of upcoming WRFM activities, targets and progress

The current WRFM strategy is also in need of review. Insufficient communication of the strategy has prevented full utilisation of information and quality reporting. It is recommended that a strategy for WRFM be formulated with the use of strategic planning tools including:

• SWOT analysis
• Critical success factor determination
• PESTLE and Porter’s five forces analysis;
• Stakeholder analysis;

As part of this it is also beneficial to clearly define WRFM practitioner responsibilities, which will enable them to gain a better understanding of their role within WRFM. A clear timeline will also improve the quality of deliverables, which is critical for the continuous improvement of WRFM. It is essential to employ appropriate communication methods when formulating and implementing new strategies to ensure full team engagement.

Detailed recommendations to address all identified gaps have been discussed below.

**BUSINESS IMPACT**

Following gap identification the gaps were categorised into the following areas:

- People
- Processes
- Data / Documentation
- Equipment
- Management
- Metrics

A business case to justify tangible and intangible benefits of gap closure was carried out and presented to the sponsor. Recommendations on how STOS might approach addressing these gaps can be found below.

**CONCLUSIONS AND RECOMMENDATIONS**

An overview of the conclusions and recommendations from the analysis has been prioritised below.

<table>
<thead>
<tr>
<th>Conclusions</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| 1 The vague and poorly communicated strategy has resulted in limited understanding of WRFM amongst practitioners. This affects practitioner understanding of WRFM scope in pursuing business excellence. | As a team, redefine strategy through:  
- Analysis of WRFM practice at STOS  
- Identifying and evaluating the best strategic option  
- Executing strategy  
- Use of KPIs to monitor and evaluate progress  
- Communicate the steering committees long term vision to the practitioners  
- Carry out WRFM training and refresher sessions to ensure clear understanding of process objectives |
<table>
<thead>
<tr>
<th>Conclusions</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| 2 | Poorly defined roles and responsibilities and lack of a proper on-boarding / induction process have led to practitioner ambiguity of expected input/deliverables. This has resulted in rushed and ad-hoc reporting where quality is compromised as a result.  
- Catalogue roles required for successful WRFM practice along with responsibilities, competencies and expected deliverables  
- Ensure these get included in practitioner IDPs and GPAs  
- Provide regular WRFM training and refresher courses. |
| 3 | All practitioners do not engage in WRFM as a full time role. This along with poor planning (e.g.: deadlines and practitioner time allocation) has resulted in a perceived lack of time. As a result practitioner time is not utilised in the most efficient and effective manner.  
- Address issues as small projects  
- Automate systems and process where possible.  
- Increase visibility of upcoming targets/deliverables by having a clear timeline which is to be monitored  
  - Via CWE meetings  
  - By line managers  
- Demonstrate / share / communicate benefits to gain practitioner endorsement |
| 4 | External review of Operational Excellence Blade 27 is due in Q4 2014 will formally identify gaps and suggest an improvement plan.  
- Hold an internal review and identify gaps in preparation for external audit *(done in January 2014)*  
- Devise an improvement plan based on findings  
- Carry out improvements as small projects to close as many gaps as practicable |
| 5 | Progress against some KPIs (e.g.: WRFM data quality, opportunity and threat register) is not monitored due to lack of understanding poor visibility of KPIs and deliverables. As a result potential value is not gained.  
- Approach Global Production Excellence WRFM Team for Clarification  
- Automate systems and process where possible.  
- Increase visibility of upcoming targets/deliverables by  
  - Monitoring KPIs via CWE meetings  
  - Linking to outlook calendars if possible or place a process to send reminder emails |
| 6 | WRFM is practiced as best endeavours as opposed to a requirement, due to lack of enforcement (e.g.: perception that non-compliance is acceptable) This has hindered STOS ability reap full benefits of the process.  
- Give WRFM a better structure and communicate requirements more firmly  
- Include WRFM responsibilities in IDPs and GPAs |
| 7 | Processes such as manual data management (e.g.: down-hole pressure and temperature logging, production testing, annulus pressure monitoring in some cases) consume practitioner time, which could be utilised for value-added work.  
- Automate processes where possible.  
  - Research:  
    - Existing software capability  
    - Shell software that addresses problem  
    - Software is used in industry |
| 8 | WRFM practice is hampered due to underutilisation of Shell global resources (e.g.: Shell software support network, expertise of Global WRFM team).  
- Use shell online forums and tools for guidance  
- Utilise expat staff connections for problem resolution |
| 9 | There are many discrepancies in WRFM practice across assets due to different work styles (e.g.: quality and content reported in WRFM plans). This defeats the overarching WRFM goal of achieving consistency across assets.  
- Use of Shell standard templates where possible  
- Create STOS standard templates where global templates are not available  
- Increase visibility of available templates  
- Restrict ability to alter templates to avoid practical drift. |
<table>
<thead>
<tr>
<th>Conclusions</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>10  There will be competency gaps in the future due to staff turnover and</td>
<td>• Identify WRFM critical roles and put a succession plan and mentoring scheme in</td>
</tr>
<tr>
<td>lack of a succession-planning scheme for WRFM.</td>
<td>place to ensure knowledge transfer</td>
</tr>
<tr>
<td>• Include training required in IDPs and GPAs</td>
<td></td>
</tr>
<tr>
<td>11  Inadequate integration of models (e.g.: IPSM) constrains understanding</td>
<td>• Ensure the model development team consists of members across disciplines</td>
</tr>
<tr>
<td>of the overall system and emergent properties.</td>
<td>• Provide additional support and training to increase competency in modelling</td>
</tr>
<tr>
<td>software across disciplines</td>
<td></td>
</tr>
<tr>
<td>12  Functional silos have impeded achieving full WRFM potential. This leads</td>
<td>• Facilitate more cross discipline interaction through shared responsibility of</td>
</tr>
<tr>
<td>to working on assumptions, which affect understanding of the overall system.</td>
<td>tasks</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>II</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>III</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>IV</td>
</tr>
<tr>
<td>Abbreviations</td>
<td>X</td>
</tr>
<tr>
<td>1.0 Introduction</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Background</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Project Overview</td>
<td>1</td>
</tr>
<tr>
<td>1.3 Scope of Works</td>
<td>2</td>
</tr>
<tr>
<td>1.3.1 Phase One – Planning</td>
<td>2</td>
</tr>
<tr>
<td>1.3.2 Phase Two – Data Acquisition</td>
<td>2</td>
</tr>
<tr>
<td>1.3.3 Phase Three – Review</td>
<td>3</td>
</tr>
<tr>
<td>1.3.4 Phase Four – Gap Analysis</td>
<td>3</td>
</tr>
<tr>
<td>1.3.5 Phase Five - Recommendation</td>
<td>3</td>
</tr>
<tr>
<td>2.0 Observations</td>
<td>5</td>
</tr>
<tr>
<td>2.1 Organisation Structure</td>
<td>5</td>
</tr>
<tr>
<td>2.1.1 Policies and Protocol</td>
<td>5</td>
</tr>
<tr>
<td>2.2 WRFM Structure</td>
<td>6</td>
</tr>
<tr>
<td>2.2.1 Stakeholders</td>
<td>7</td>
</tr>
<tr>
<td>2.2.2 Strategy</td>
<td>8</td>
</tr>
<tr>
<td>2.2.3 Key Success Factors</td>
<td>8</td>
</tr>
<tr>
<td>2.3 Observation Summary</td>
<td>8</td>
</tr>
<tr>
<td>3.0 Literature Review</td>
<td>10</td>
</tr>
<tr>
<td>3.1 Shell Practice</td>
<td>10</td>
</tr>
<tr>
<td>3.2 STOS Practice</td>
<td>10</td>
</tr>
<tr>
<td>3.3 Lean and TQM</td>
<td>10</td>
</tr>
<tr>
<td>4.0 WRFM Analysis</td>
<td>12</td>
</tr>
<tr>
<td>4.1 WRFM Asset Assessment Tool</td>
<td>12</td>
</tr>
<tr>
<td>4.2 Interviews</td>
<td>12</td>
</tr>
<tr>
<td>4.3 Root-Cause Analysis</td>
<td>13</td>
</tr>
<tr>
<td>4.4 Analysis Summary</td>
<td>13</td>
</tr>
<tr>
<td>5.0 Business Impact</td>
<td>14</td>
</tr>
<tr>
<td>6.0 Summary of Findings</td>
<td>14</td>
</tr>
<tr>
<td>7.0 Implementation Plan</td>
<td>19</td>
</tr>
<tr>
<td>7.1 Scope</td>
<td>21</td>
</tr>
<tr>
<td>7.2 Outcomes</td>
<td>21</td>
</tr>
<tr>
<td>7.3 Anticipated Challenges</td>
<td>21</td>
</tr>
<tr>
<td>7.4 Approach</td>
<td>22</td>
</tr>
<tr>
<td>7.5 Recommendations</td>
<td>23</td>
</tr>
<tr>
<td>8.0 After Action Review</td>
<td>24</td>
</tr>
<tr>
<td>9.0 References</td>
<td>27</td>
</tr>
</tbody>
</table>
APPENDIX A: FURTHER READING ............................................................................................... 31
APPENDIX B: ROOT CAUSE ANALYSIS .................................................................................. 32
APPENDIX C: BUSINESS IMPACT OF GAP CLOSURE .............................................................. 33
   PEOPLE ................................................................................................................................. 33
   PROCESSES .......................................................................................................................... 34
   DATA / DOCUMENTATION ................................................................................................. 35
   EQUIPMENT ........................................................................................................................... 35
   MANAGEMENT ....................................................................................................................... 36
   METRICS ............................................................................................................................... 36
APPENDIX D: ACTION TIMELINE .............................................................................................. 37
APPENDIX E: SWOT ANALYSIS ................................................................................................ 38
APPENDIX F: WRFM STRATEGY OVERVIEW ......................................................................... 39
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>CWE</td>
<td>Collaborative Work Environment</td>
</tr>
<tr>
<td>DCAF</td>
<td>Discipline Control and Assurance Framework</td>
</tr>
<tr>
<td>GPA</td>
<td>Goals and Performance Agreement</td>
</tr>
<tr>
<td>IDP</td>
<td>Individual Development Plan</td>
</tr>
<tr>
<td>IPSM</td>
<td>Integrated Production Systems Model</td>
</tr>
<tr>
<td>JV</td>
<td>Joint Venture</td>
</tr>
<tr>
<td>MEM</td>
<td>Master of Engineering Management</td>
</tr>
<tr>
<td>OU</td>
<td>Operational Unit</td>
</tr>
<tr>
<td>PSO</td>
<td>Production Systems Optimisation</td>
</tr>
<tr>
<td>QA/QC</td>
<td>Quality Assurance/Quality Control</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
</tr>
<tr>
<td>STOS</td>
<td>Shell Todd Oil Services</td>
</tr>
<tr>
<td>TA</td>
<td>Technical Authority</td>
</tr>
<tr>
<td>TQM</td>
<td>Total Quality Management</td>
</tr>
<tr>
<td>WBS</td>
<td>Work Breakdown Structure</td>
</tr>
<tr>
<td>WRFM</td>
<td>Well, Reservoir and Facility Management</td>
</tr>
</tbody>
</table>
INTRODUCTION

The Well, Reservoir and Facilities Management (WRFM) project at Shell Todd Oil Service (STOS) was carried out over the period of October 2013 – February 2014, based in the STOS New Plymouth Office, New Zealand.

This report covers the development of a plan of action, data collection, benchmark and analysis and recommendations going forward for WRFM at STOS.

1.1 BACKGROUND

WRFM is an operational excellence process carried out within the Shell Group. Excellence in the WRFM context is the art of extracting maximum value from oil and gas assets by creating a systemic understanding of reservoirs, wells and facilities and optimising their performance (1).

The primary goal of the WRFM process is to create a detailed, systemic understanding of the reservoirs, wells and facilities and how they interact together, and use that understanding to maximise the value of the asset. Developing that understanding requires a structured and integrated cross-functional approach to data gathering, analysis and modelling, review and decision-making. It involves formulating a surveillance plan that encompasses reservoirs, wells and facilities, developing and updating fit-for-purpose models, identifying and ranking new opportunities, and producing reliable and consistent production and reserves forecasts.

Although effective WRFM is fundamentally about understanding the reservoir and its interaction with the wells and facilities, most of the reservoir understanding is necessarily derived from well performance. An understanding of wells has a pivotal role because it also enables optimisation of facilities.

Through proper WRFM, the risks and uncertainties inherent in the Field Development Plan and Asset Reference Plan are progressively reduced, opportunities for optimisation are elucidated, and the impact of less favourable reservoir response is mitigated. Ultimately, this translates into increased production, reserves gains and reductions in unit cost, all with improved asset integrity and safety.

Currently Shell Todd Oil Services Ltd (STOS) uses Shell Global guidelines for the management of WRFM processes in their assets, and are required to fully comply with these standards by the end of 2014. Shell Global has incredibly broad guidelines on how wells, reservoirs and facilities should be managed and aims to ensure that data collection, analysis, decisions making, implementation and gap closure are done in a standard way with a certain level of accuracy across all of their facilities. STOS has implemented many of these processes at their Taranaki facilities but have had various levels of success. Much of the information is available, however, a business process is needed to collectively assemble the information, process and make it available to users in a consistent and structured manner. This provided the baseline for investigating the effectiveness of the existing WRFM processes (2).

1.2 PROJECT OVERVIEW

The objective of the project was to identify areas of improvement through review, value analysis and justification of existing and required STOS WRFM processes. The currently practiced processes were analysed and benchmarked against Shell global standards to identify gaps, followed by business case to justify the need for gap closure. The review of the WRFM processes addressed the need to:

- Rationalise and/or streamline elements of the STOS WRFM system;
- Align Intra-STOS with Intra-Shell WRFM standards.
To achieve:

- A consistent approach to managing WRFM and reporting WRFM Information;
- Full compliance with Shell Global standards;
- Improved productivity and resource expenditure through reducing time and resource consumption through:
  - Discrepancy resolution;
  - Improved data accessibility and availability.
  - Identifying sources of incorrect or corrupted data;
  - Minimizing/eliminating non-value-adding activities;

1.3 SCOPE OF WORKS

The project was split into the phases outlined below.

| Planning 1.0 | Data Acquisition 2.0 | Review 3.0 | Gap Analysis 4.0 | Recommendation 5.0 |

Figure 1: Project Overview

1.3.1 PHASE ONE – PLANNING

A project proposal, charter and plan were developed detailing the scope, approach and structure of the project. These documents were approved by the MEM Course Director and the WRFM Steering Committee Chair and served as the foundation documents for the investigation. These documents outlined in and out of scope tasks, objectives, deliverables and milestones. A comprehensive schedule was also formulated to monitor project progress and to ensure deadlines were met. The allowance for restrictions to human resources over the year-end commitments and seasonal holidays was underestimated which posed a challenge in the following phases.

1.3.2 PHASE TWO – DATA ACQUISITION

Organisation Familiarisation

Familiarisation of organisation culture and STOS practices was required to obtain a full understanding of the current situation at STOS for analysis and recommendation purposes. Information was gathered by way of observation through induction and stakeholder engagement to determine:

- WRFM intent and strategy
- Expectations, requirements and standards
- Documentation
- Key staff
- Business relationships
- Data management
- Policies and protocols

Observations made during these engagements are detailed in Section 2.0.
**STAFF FEEDBACK**

15 formal interviews with key contributors to WRFM were also arranged to capture staff perspective of STOS WRFM practices. This provided valuable insight, which may have been otherwise overlooked. Some information was also gathered in an informal setting over the course of the project. Staff feedback was given due consideration and has been encapsulated in the recommendations.

**1.3.3 PHASE THREE – REVIEW**

**LITERATURE REVIEW**

Parallel to Phase Two, this phase was also carried out to understand the context and business impact of WRFM in the oil and gas industry. The aim of this phase was to identify best practice and standards in industry.

Due to the confidential nature of WRFM initiatives not much information was publicly available. However, Shell has an Operational Excellence Framework dedicated to WRFM detailing compliance requirements for the restricted used of their Operational Units (OU). STOS has full access to this documentation due to their agreement to follow Shell practice under the JV agreement.

The Shell Operational Excellence Framework – Blade 27 was used as the benchmark for the work that followed. STOS WRFM practices were to be critically evaluated against Blade 27 requirements to identify where STOS optimisation efforts need to be focused on.

In addition to these Lean and Total Quality Management (TQM) guidelines and methodologies were also analysed to provide a framework for continuous improvement of WRFM.

**1.3.4 PHASE FOUR – GAP ANALYSIS**

The gaps identified in the benchmarking process were analysed in detail during this phase. Root-cause analysis was utilised to identify complexities and constraints that hinders STOS ability to comply with Shell Blade 27 requirements.

Investigations were also carried out to identify what WRFM optimisation measures have already been initiated. Analysis was carried out to highlight the existing level of efficiency and effectiveness of these initiatives and also to provide an insight of what measures can be taken to increase efficiency of processes or remove blockers. Findings from this analysis were prioritised by cost, value and ease of implementation for recommendations and implementation proposal.

**1.3.5 PHASE FIVE - RECOMMENDATION**

Recommendations for improvement initiatives were based of priority and practicality of implementation. The current working environment was given much consideration to ensure the proposed timeline is suitable and within STOS capability. Recommendations were directed towards TQM and Lean thinking for continuous improvement and shift in culture.

The recommendations and proposed timeline is targeted for the steering committee and addresses issues at a high level. It is highly recommended that a comprehensive implementation plan be developed with contributions from the practitioners.

There was a general consensus that a culture shift is needed in order to sustainably embed WRFM within the organisation. However reluctance to implement change (such as adoption of new systems and processes)
remains a challenge. Therefore it is highly recommended that long-term strategy and expected benefits are made clear and visible to practitioners to gain their endorsement. Lean and TQM practices would be highly beneficial to individual practitioners as well as WRFM as a whole in allowing value-added work to become the focus of WRFM activities. Many resources to support this are available within the Shell group itself and it is recommended that these resources are fully utilised to allow practitioners to obtain a better understanding and also to be able to see real life working examples of successful Lean and TQM initiatives in practice.
2.0 OBSERVATIONS

Initially being unfamiliar with the oil and gas industry and WRFM practices, the work breakdown structure prepared in the planning phase was used to systematically approach predetermined areas of assumed relevance to the project.

To avoid selective data collection both participant and non-participant observation techniques were employed in opened and closed settings where appropriate. Though this balanced observations methods a comprehensive understanding of the WRFM process was accomplished and clear gaps were identified.

2.1 ORGANISATION STRUCTURE

The systems and processes within STOS are strongly influenced by Royal Dutch Shell according to the Joint Venture Operating Agreements (JVOA). However, as a Joint Venture (JV) STOS has the authority to make separate operational decisions in the best interest of its stakeholders where appropriate. STOS Information Technology (IT) framework is linked to the global Shell network. Software tools and applications used are predominantly Shell standard applications, however locally developed solutions are also utilised in some occasions.

WRFM underpins STOS aims of maximising value to the field owners and is key to managing long-term asset performance and showing the responsible stewardship of hydrocarbon resources. Integrated efforts from Petroleum Engineering, Production, Field Engineering and Completions and Well Interventions are provided to manage WRFM within STOS. The WRFM Structure is discussed in detail in Section 2.2.

2.1.1 POLICIES AND PROTOCOL

Under the Crown Minerals (Petroleum) Regulations 2007 STOS is legally required to report certain WRFM activities to relevant authorities. This information must be provided in good faith, according to the best information at hand and in a timely manner (3) (4).

The Joint Venture Operating Agreements (JVOA) places particular information sharing and communication obligations on STOS. Appropriate levels of communication are in place to mitigate any ineffective provision of information and/or breach of contract.

The requirements under the Shell WRFM operational excellence framework – Blade 27 is intended to be followed where practicable. Where there is a valid reason and business case for deviating from these requirements a standard waiver process is in place. This process requires approval and signoff from the asset development manager, operations manager, general manager and the regional WRFM lead prior implementation.

Each year a WRFM Plan for the following year is compiled outlining all WRFM activities, estimated start and end dates, budget and impact on production. This is the key WRFM deliverable for each asset and there is a clearly defined, rigorous review and validation process. This provides an opportunity for data discrepancies to be resolved before critical financial reports and implementation plans are issued.

In carrying out day-to-day tasks there is also a quality assurance process for WRFM critical data. The teams are grouped by function and local expertise is relied upon where practicable. Where local expertise is unavailable STOS has the opportunity to tap into expertise within the Shell global network.
2.2 WRFM STRUCTURE

The WRFM team consists of a five tier hierarchical structure as indicated in Figure 2. Hierarchy and authority are relative within STOS and higher tier positions generally have a working knowledge of the roles they manage within WRFM. In some cases this is not true and this can be attributed to role transitions that involve shifting disciplines.

WRFM at STOS is led by the WRFM Steering Committee who is responsible for providing resources for operation and removing blockers. The WRFM Steering Committee includes the:

- Head of Production Services (Chair)
- WRFM Focal Point
- General Manager
- Operations Manager
- Exploration and Development Manager
- Well Delivery Lead
- Maintenance Engineering and Project Delivery Manager

The WRFM teams consist of the following disciplines:

- Process Engineering
- Reservoir Engineering
- Well Engineering
- Materials and Corrosion Engineering
- Production Technology
- Petrophysics
- Operations

Each delegate is responsible for producing and ensuring their contribution is quality assured relative to their role within the team. Function-based grouping and shared responsibilities has allowed consistency and thorough knowledge in individual disciplines. However this has resulted in silos and there is limited cross function knowledge transfer.

WRFM relies on vital cross discipline and intra-Asset communication. Therefore asset-based teams would be more beneficial for the purpose of WRFM. However, practitioner responsibilities are not limited to WRFM within STOS and therefore purely asset-based teams would have negative impacts on other areas of within the
organisation. Function-based teams also allow cross asset knowledge transfer, which has benefits in developing discipline specialists and is also beneficial in terms of succession planning. Therefore for an OU the size of STOS a hybrid solution is most appropriate.

STOS has several modes of internal and external communication and a central database where information is made available. However the external channels are underutilised (e.g.: software support from Shell Network). The teams’ main interaction is a weekly Collaborative Work Environment (CWE), which takes place in the form of a meeting for reporting and discussion of WRFM activities.

The main WRFM deliverable for the year is the WRFM Plan. The team is responsible for compiling plans for the Maui, Kapuni and Pohokura assets. The documents undergo a rigorous quality assurance process through respective discipline channels. All technical data undergo a quality assurance process through a Technical Authority (TA) structure.

Reporting and review intervals are dictated by the WRFM Practice Table. The review cycles can be daily, weekly, monthly, quarterly, annually or biennially depending on the output and its impact. At STOS the practice table is not followed rigorously and some reviews have never been done (e.g.: PSO Review, Quarterly Well Review). This may have critical impact on business decisions and is an issue that needs to be addressed.

2.2.1 STAKEHOLDERS

WRFM is an internal operational excellence framework. Therefore, its key stakeholders are internal departments, STOS management and the Shell group. External stakeholders such as JV parties and government also have an interest in output from WRFM due to investment and statutory obligations respectively. The stakeholder relationships are supported by contractual agreements.

The major stakeholders and their involvement in WRFM are described in Table 1 below.

Table 1: WRFM Stakeholders and Involvement

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Deliverable</th>
<th>Input and Impact on WRFM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shell Group</td>
<td>Reporting of WRFM Performance</td>
<td>Provide resources, tools and training to improve performance</td>
</tr>
<tr>
<td>Government</td>
<td>Activity Reports</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reserve Changes</td>
<td>-</td>
</tr>
<tr>
<td>JV Partners</td>
<td>WRFM Plan and Budget</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Reserve Changes</td>
<td>-</td>
</tr>
<tr>
<td>General Public</td>
<td>Waste, Emissions and Environmental Impact</td>
<td></td>
</tr>
<tr>
<td><strong>Internal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steering Committee</td>
<td>WRFM Plan</td>
<td>Decision-making. Provide access to required resources. Remove blockers. Impacts ability to continue operations</td>
</tr>
<tr>
<td></td>
<td>WRFM Critical Information</td>
<td></td>
</tr>
<tr>
<td>Asset Development</td>
<td>WRFM Plan</td>
<td>Responsible for compiling WRFM Plan and having data QA/QCed. Modelling reservoir behaviour, this will impact all key decisions.</td>
</tr>
<tr>
<td>Well Completions and Interventions</td>
<td>WRFM Plan</td>
<td>Carrying out well intervention activities to stimulate production.</td>
</tr>
<tr>
<td>Operations</td>
<td>Operational Data</td>
<td>Operate equipment, test wells and report accurate raw data</td>
</tr>
</tbody>
</table>
2.2.2 STRATEGY

The annual plan, the main WRFM deliverable for the year, outlines all activities for the upcoming year. This is compiled and made available to all stakeholders at the end of each year.

The long term WRFM strategy however is not well documented and is inadequately communicated. This needs review and increased awareness across relevant stakeholders.

2.2.3 KEY SUCCESS FACTORS

In pursuing full compliance with Blade 27 requirements, the following factors are deemed critical for successfully embedding WRFM within STOS:

- Well defined roles and responsibilities
- Simple and robust data management processes
- Adequate training and succession plan
- Strong leadership / steer

2.3 OBSERVATION SUMMARY

Throughout the course of the project various stakeholder engagements were initiated. A number of gaps and discrepancies were made evident during this process. These include:

- Lack of awareness and understanding of WRFM within the team and the greater organisation
- Poorly defined roles and responsibilities
- Insufficient planning
- Gaps in data flow process
- Inadequate subsurface models
- Insufficient integration across disciplines
- Insufficient direction/steer

The following pockets of excellence were also observed:

- Strong technical knowledge in respective disciplines
- Some processes (e.g.: Weekly CWE meetings) were well organised and practitioners saw great value in them.
- Staff interest / commitment to uplift WRFM quality within STOS.
Recommendation emphasis is placed on ill-defined roles, insufficient integration and planning.

More frequent WRFM training is recommended to increase practitioner understanding of WRFM. It is also recommended that roles and responsibilities be captured in Individual Development Plans (IDP), and Goals and Performance Agreements (GPA) to drive the WRFM process.

Further consultation is advised to aid integration across disciplines. Automating and increasing visibility of upcoming WRFM activities and deliverables is also suggested to improve the quality of outputs.

It is also advised that STOS WRFM strategy is redefined better capturing STOS current situation and key success factors are translated into corresponding Key Performance Indicators (KPI), tactics and measures. This will facilitate the alignment of WRFM strategic objectives with action, and provide quantifiable metrics.

The Shell Global WRFM training course is expected to cost approximately $5,000 per participant (all costs inclusive). All other recommendations can be managed inhouse and therefore costs involved are associated with staff time.

An approximate budget of $150,000 is required to implement these recommendations.
3.0 LITERATURE REVIEW

Industry practice was reviewed to identify benchmark requirements. Literature was consulted to provide insight on methodologies and frameworks that can be utilised to support gap closure.

3.1 SHELL PRACTICE

As mentioned earlier in this report, STOS has access to Shell operational excellence documentation. There is a set of operational excellence standards and guidelines dedicated to WRFM known as Blade 27. Outlined in this framework are all the suggested standards to be pursued by Shell OUs. While it is not mandatory to achieve best in class standard for each criterion, the Blade document outlines a set of minimum requirements that are obligatory to all assets.

Under this framework WRFM encompasses the following processes:

![WRFM Cycle](image)

3.2 STOS PRACTICE

STOS has operationalised the Shell WRFM requirements and created the STOS WRFM Management Manual. This document is intended to highlight the WRFM requirements and how it particularly relates to STOS assets and activities.

However the STOS Manual is not widely circulated and there is limited knowledge of its existence. It is also out of date and contains obsolete information.

3.3 LEAN AND TQM

Lean and Total Quality Management (TQM) frameworks were also investigated into to gain a better understanding of Operational Excellence frameworks and applicability to WRFM within STOS. An index of relevant sources for further reading can be found in Appendix A.
The TQM implementation model for achieving organisational excellence below is highly applicable to STOS.

![TQM Implementation Model](image)

This model provides a clear path that STOS might pursue following self-assessment. It also provides an opportunity to look back and identify any key processes that may have been overlooked in pursuing excellence. As mentioned earlier there is a general lack of awareness and understanding of WRFM within the team and the greater organisation and therefore it is recommended that STOS efforts are focussed on setting and communicating WRFM vision, goals and strategies. Further detail on gaps, business impact and recommendations for gap closure are provided in the sections below.
4.0 **WRFM ANALYSIS**

Three main tools were used to analyse the WRFM process. These included:

- WRFM Asset Assessment Tool;
- Interviews; and
- Root-Cause Analysis.

4.1 **WRFM ASSET ASSESSMENT TOOL**

The WRFM Asset Assessment Tool, which is a Shell Global spreadsheet based tool that assesses asset performance against a set of predetermined criteria, was used for gap analysis. Staff feedback, observation and analysis of existing STOS documentation was utilised to provide input. A wide range of documents and persons were consulted in order to accurately capture the current situation at STOS and to avoid skewed results.

The WRFM Assessment Tool gave STOS a compliance score of 38%. Shell minimum standards require a score of 60%. Having said that, it is worth noting that STOS has many procedures in place that meet the intent of Shell requirements and efforts need to be focussed on how these are documented and presented. The main areas of improvement identified in the assessment were:

- Ownership of WRFM critical data and processes
- Staffing requirements
- Team roles and responsibilities
- Definition and monitoring of KPIs
- Management of opportunities and threats

These areas were further investigated into and details can be found in *Section 6.0*.

4.2 **INTERVIEWS**

A Total of 15 interviews were conducted across the WRFM practitioners throughout December 2013 in order to gain an understanding of complexities and constraints within STOS and practitioner thoughts and views on how WRFM is applied at STOS.

The selected interviewees ranged from:

- Recently employed to long term STOS employees; and
- Employees with WRFM experience from previous employment in other Shell OUs.

The high level of diversity within the interview group provided valuable insight and clear themes emerged during the course of the interviews. The key findings and recommendations are detailed in *Section 6.0*.

In January STOS was fortunate to have the WRFM Global Theme Lead for Process Engineering visit for a week. During this time discussion enabled to gain invaluable insight and understanding of the global processes and available resources to support WRFM improvement at STOS. Some of these findings and recommendations are also detailed in *Section 6.0*. 
4.3 ROOT-CAUSE ANALYSIS

Root-Cause Analysis (combined with 5 whys technique (7)) followed gap analysis to identify predecessors to inadequate WRFM practice. Inadequate WRFM practice can be defined as failure to meet Shell minimum requirements.

Stakeholder feedback and naturalistic observation was utilised to complete this analysis. The findings have been illustrated by using an Ishikawa (cause-and-effect) diagram found in Appendix B.

The key causes for inadequate WRFM practice were found to be:

- Limited understanding
- Poorly defined roles and responsibilities
- Vague strategy
- Limited visibility
- Elements of STOS culture

The impact of each cause highly varies depending on the task and also across disciplines.

4.4 ANALYSIS SUMMARY

There are a number of recurring issues that cause discrepancies and hinder STOS ability to comply with global standards. The sources of these issues have been identified during the investigation, which formed a basis for improvement recommendations in Section 6.0.
5.0 BUSINESS IMPACT

Following gap identification the business impact of gap closure was investigated. The areas of improvement were categorised as follows:

- People
- Processes
- Data / Documentation
- Equipment
- Management
- Metrics

The tangible and intangible benefits versus cost and required effort were investigated. The gaps were then ranked against Importance, cost and ease of implementation and it was identified that the items below should be given priority in implementation.

- WRFM Activities in IDPs and GPAs
- Live WRFM Plan
- KPIs - Visibility and Measure
- Up-to-date Documentation
- Standard Templates

It was concluded that these activities need to be looked into in further detail with input from practitioners. Detailed business case results can be found in Appendix C. These results have been used to provide recommendations outlined in Section 6.0.

6.0 SUMMARY OF FINDINGS

Based on an established understanding of WRFM and STOS practices the following conclusions were formulated in Table 2 below.

Appropriate and achievable recommendations are offered and prioritised to address the issues and gaps identified within WRFM at STOS. Recommendations have been prioritised from one - eleven with rank one being highest and eleven being lowest. An action timeline (found in Appendix D) complementing these recommendations have been developed taking into consideration the availability of resources and capability.

Development of a clear strategy has the highest rank for action, as this will improve practitioner understanding and guide future actions to sustainably embed WRFM at STOS.
<table>
<thead>
<tr>
<th>Priority</th>
<th>Findings</th>
<th>Conclusions</th>
<th>Recommendations</th>
<th>Action Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>- Vague Strategy</td>
<td>- Limited understanding of WRFM across practitioners</td>
<td>Redefine Strategy</td>
<td>Immediate Action</td>
</tr>
<tr>
<td></td>
<td>- WRFM Strategy not well communicated (e.g.: practitioners not aware of long term goals)</td>
<td>- Affects practitioner understanding of WRFM scope in pursuing business excellence</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Priority</td>
<td>Findings</td>
<td>Conclusions</td>
<td>Recommendations</td>
<td>Action Timeline</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td>-------------</td>
<td>-----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>2</td>
<td>• Poorly defined roles and responsibilities <em>(e.g.: responsibilities defined at a discipline level, individual responsibilities are not defined)</em>&lt;br&gt;• No proper on-boarding / induction process</td>
<td>• Practitioners are not clear on input/deliverables expected from them&lt;br&gt;• Leads to rushed and ad-hoc reporting&lt;br&gt;• Quality is compromised due to time pressure</td>
<td>• Catalogue roles required for successful WRFM practice along with responsibilities, competencies and expected deliverables&lt;br&gt;• Ensure the items above get included in practitioner IDPs and GPAs&lt;br&gt;• Ensure accountabilities align with DCAF&lt;br&gt;• Provide regular WRFM training and refresher courses. Some of the Shell training tools can be accessed online and is available at no cost.</td>
<td>Immediate Action</td>
</tr>
<tr>
<td>3</td>
<td>• All practitioners do not engage in WRFM as a full time role&lt;br&gt;• This along with poor planning <em>(e.g.: deadlines and practitioner time allocation)</em> has resulted in a perceived lack of time</td>
<td>• Practitioner time is not utilised in the most efficient and effective manner.</td>
<td>• Address issues as small projects&lt;br&gt;• Automate systems and process where possible.&lt;br&gt;• Increase visibility of upcoming targets/deliverables by having a clear timeline which is to be monitored&lt;br&gt;• Via CWE meetings&lt;br&gt;• By line managers&lt;br&gt;• Demonstrate / share / communicate benefits to gain practitioner endorsement</td>
<td>Immediate Action</td>
</tr>
<tr>
<td>4</td>
<td>• External review of Operational Excellence Blade 27 is due in Q4 2014</td>
<td>• The audit will formally identify gaps and suggest an improvement plan&lt;br&gt;• Provide a rank on the global league table</td>
<td>• Hold an internal review and identify gaps in preparation for external audit&lt;br&gt;• Devise an improvement plan based on findings&lt;br&gt;• Carry out improvements as small projects to close as many gaps as practicable</td>
<td>Immediate Action</td>
</tr>
<tr>
<td>5</td>
<td>• Poor visibility of KPIs and deliverables.&lt;br&gt;• Poor understanding of Global KPIs and their value.&lt;br&gt;• STOS KPIs are better understood.</td>
<td>• Progress against some KPIs is not monitored <em>(e.g.: WRFM data quality)</em>. As a result potential value is not gained.&lt;br&gt;• Deliverables are not completed / rushed. Quality is compromised</td>
<td>• Automate systems and process where possible. This will free up employee time to do more value-added work&lt;br&gt;• Increase visibility of upcoming targets/deliverables by linking to outlook calendars if possible or place a process to send reminder emails</td>
<td>Immediate Action</td>
</tr>
<tr>
<td>Priority</td>
<td>Findings</td>
<td>Conclusions</td>
<td>Recommendations</td>
<td>Action Timeline</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td>-------------</td>
<td>-----------------</td>
<td>----------------</td>
</tr>
</tbody>
</table>
| 6        | • Inadequate enforcement of WRFM within STOS  
          • Non-compliance/ ad-hoc approach is acceptable culture | • WRFM is practiced as best endeavours as opposed to a requirement  
          • WRFM practice is hampered | • Give WRFM a better structure and communicate requirements more firmly  
          • Include WRFM responsibilities in IDPs and GPAs | Immediate Action |
| 7        | • Manual data management is prevalent in many cases (e.g.: down-hole pressure and temperature logging, Production testing, annulus pressure monitoring in some cases)  
          • It is possible to automate a number of these processes | • Increases workload on practitioners  
          • Time is not efficiently utilised to do value-added work | • Automate processes where possible  
          - Look into existing software capability  
          - Look into Shell software that addresses problem  
          - Look into what software is used in industry | 0 - 6 months |
| 8        | • Global resources are underutilised (e.g.: Shell Global software support network) | • WRFM practice is hampered  
          • Constrained by issues to which solutions exists | • Use Shell online forums and tools for guidance  
          • Utilise expat staff connections for problem resolution | 0 - 3 months |
| 9        | • There are many discrepancies in WRFM practice across assets (e.g.: content reported and quality of reporting in WRFM plans) | • WRFM practice at STOS is hugely dependent on the person carrying out the respective tasks  
          • Defeats the overarching WRFM goal of achieving consistently across assets | • Use of Shell standard templates where possible  
          • Create STOS standard templates where global templates are not available  
          • Increase visibility of available templates  
          - Instruct existing employees where to find these documentation  
          - Instruct new employees where to find these documentation as part of on-boarding  
          • Restrict ability to alter templates to avoid practical drift. If more efficient ways are identified a standard review process should be implemented across all assets. | 0 - 8 months (in time for external audit) |
| 10       | • There is no succession planning scheme for WRFM | • There will be competency gaps in the future due to staff turnover | • Identify WRFM critical roles and put a succession plan and mentoring scheme in place to ensure knowledge transfer  
          • Include training required in IDPs and GPAs | 0 - 9 months (in time for 2015 IDPs and GPAs) |
<table>
<thead>
<tr>
<th>Priority</th>
<th>Findings</th>
<th>Conclusions</th>
<th>Recommendations</th>
<th>Action Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>- Inadequate integration of models (e.g.: lack of an adequate IPSM model)</td>
<td>- Constrains understanding of the overall system and emergent properties</td>
<td>- Ensure the model development team consists of members across disciplines</td>
<td>0 - 18 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Provide additional support and training to increase competency in modelling</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>software across disciplines</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Strategic review of IPSM</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>- Inadequate integration across WRFM disciplines (e.g.: subsurface disciplines are not aware of status of surface models)</td>
<td>- The full potential of WRFM not achieved due to silos</td>
<td>- Facilitate more cross discipline interaction through shared responsibility of tasks</td>
<td>0 - 24 months</td>
</tr>
<tr>
<td></td>
<td>- Disciplines function on assumptions made on each other</td>
<td>- Run into non-existent constraints due to assumptions (e.g.: assumed constraint in pressure requirements for surface facilities)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Literature and consultation with relevant staff members have identified how STOS might approach implementing some of the abovementioned recommendations. A Gantt chart outlining the approximate timeline has been illustrated in Appendix D. A SWOT Analysis and Strategy overview has also been compiled and can be found in Appendix E and F respectively. It is highly recommended that issues be addressed according to order of priority.

Further investigation and involvement of both practitioners and the steering committee is essential in implementing the above recommendations.
7.0 IMPLEMENTATION PLAN

A proposal for implementation of WRFM Improvement practices have been compiled and is intended to act as the key document for further development in meeting WRFM global process requirements and achieving best in class standards in the future. The implementation plan covers a proposal for the consideration of the WRFM steering committee and an overview is illustrated in Error! Reference source not found. below.

An event to create an in-depth plan shall be organised by practitioners with the assistance of the business improvement team to ensure Lean and TQM practices are incorporated from the early stages of development. It is strongly recommended that all practitioners are involved and provide input to this process if the recommendations are accepted. This will be beneficial in setting common goals and vision for achieving operational excellence and to maximise the value and understanding of the process.

Examples of how LEAN / TQM would be implemented / adopted, and some specific elements that should be utilised have been detailed below.

APPLICATION OF LEAN

Lean philosophies in particular can be applied to the WRFM planning process. The gaps in this process were detailed in Section 6.0 above. A number of Lean tools (8) and principles can be applied to streamline this process. These include:

- Andon / Visual Factory – visual representation of WRFM plan, can help bring attention to present and upcoming activity. This can be made visible in the CWE room and should be included as part of the monthly agenda.
- Value Stream Mapping - Show the current and future state of WRFM processes. Exposes waste in the current processes and highlights opportunities for improvement.
- Bottleneck Analysis - Identify which parts of the planning process limit the overall throughput and improve the performance of that part of the process.
- Continuous Flow – can be utilised in the planning process to ensure activities are carried out with minimum disruption and waiting time (e.g.: compiling and quality assuring processes for annual WRFM plans).
- Use of KPIs to monitor progress of work against WRFM plan (there are some KPIs for this already in place but process needs to be reinforced)
- SMART Goals – ensure WRFM goals are: Specific, Measurable, Attainable, Relevant, and Time-Specific. This will help ensure that goals are effective.

APPLICATION OF TQM

A number of TQM principles, tools and techniques are able to add value to WRFM within STOS. These include:

- DMAIC (Define, Measure, Analyse, Improve, Control) – at STOS the WRFM processes are poorly defined and monitored. This framework can be of great use in guiding how STOS might approach redefining their WRFM strategy.
- Continuous training – people development is a strong focus of TQM and is a gap within WRFM that needs addressing. Further reading material on this is topic recommended in Appendix A.
- Long-term emphasis on measurable processes – performance measurement is in the core of TQM culture. At STOS WRFM KPIs are not well understood and not rigorously monitored. Further reading material on understanding performance measurement and setting useful KPIs is recommended in Appendix A.
**LONG TERM OUTCOME**
Best-In-Class WRFM standard achieved with combined Lean and TQM mentality to carry out only value-adding activities in maximising overall asset performance and value.

**MEDIUM TERM (3-5 YEAR) OUTCOME**
- Full compliance with Shell WRFM standards
- Practitioner focus on continuous improvement through Lean and TQM thinking
- Efficient and effective across discipline functionality
- Elimination/reduction of recurring problems
- Maximised utilisation of available resources

**SHORT TERM (1 YEAR) OUTCOME**
Fully compliant with Shell Global WRFM minimum requirements

**IMPACT**
- Increased understanding of WRFM
- Robust processes
- Increased production
- Reduced risk through intervention/maintenance
- Fully integrated models

- Increased understanding of industry standards
- Lean and TQM culture embedded in day-to-day activity
- Each practitioner is a Lean champion

- Increased inter-discipline awareness and understanding
- Improved business relationships
- Increased competence
- Continuous problem solving

- Live and visible WRFM plan
- Key issues resolved
- Standard templates and procedures

- Streamlined processes
- Automated data management
- More value-added work
- Opportunity and threat management

**IMPLEMENTATION**

- Year 3+
  - Annually review and communicate strategy, plans and projects
  - Lean and TQM concepts at the core of all WRFM activities
  - Build on WRFM standards to achieve Best-in-Class ranking
  - Multiple Lean champions allocated across disciplines

- Year 1-3
  - Model integration
  - Build on WRFM minimum requirements
  - Monitor progress against plans
  - Review, design and purpose improvement plans for cross-discipline integration

- Year 1
  - Lean and TQM training
  - Process automation
  - Standard templates and procedures
  - Sustain planning

- Immediate
  - Redefine and communicate WRFM Strategy
  - Link strategy to EPI’s and OPAs
  - WRFM training
  - Small projects for guidance
  - Improve visibility and understanding of EPI’s and deliverables

**ACTION TIMELINE**
7.1 SCOPE

The Implementation Plan outlines an approximate timeline to address the gaps identified over the course of the investigation. Closure of each gap will be initiated as sub-projects. The scope of the implementation plan shall include, but not be limited to the following objectives:

Table 3: Action Timeline and Objectives

<table>
<thead>
<tr>
<th>Action Timeline</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate Action</td>
<td>Plan</td>
</tr>
<tr>
<td></td>
<td>Raise awareness</td>
</tr>
<tr>
<td></td>
<td>Define roles and responsibilities</td>
</tr>
<tr>
<td></td>
<td>Train staff</td>
</tr>
<tr>
<td>Year 1</td>
<td>Implement and reinforce core processes and deliverables</td>
</tr>
<tr>
<td></td>
<td>Reinforce accountabilities and staff requirements.</td>
</tr>
<tr>
<td></td>
<td>Complete gap closure for minimum standards / achieve &amp; demonstrate compliance with minimum standards</td>
</tr>
<tr>
<td>Year 3</td>
<td>Every individual a champion</td>
</tr>
<tr>
<td></td>
<td>Cross discipline integration benefiting WRFM practice</td>
</tr>
<tr>
<td></td>
<td>Learning from implementation successes</td>
</tr>
<tr>
<td>Year 5</td>
<td>Lean and TQM embedded in STOS WRFM culture</td>
</tr>
</tbody>
</table>

7.2 OUTCOMES

The key medium term outcomes to be pursued include:

- Full compliance with Shell WRFM standards
- Practitioner focus on continuous improvement through Lean and TQM thinking
- Efficient and effective cross discipline functionality
- Elimination / reduction of recurring problems
- Maximised utilisation of available resources

7.3 ANTICIPATED CHALLENGES

The following issues have been recognised as the key challenges to be addressed in implementing improvement initiatives.

RELUCTANCE TO CHANGE

WRFM Improvement, Lean and TQM initiatives must be communicated with care to avoid misinterpretation and resistance from practitioners. If forced practitioners may feel threatened, this will have negative impacts on the effectiveness of the process. Proper training must be provided to improve understanding of the overarching principles and the benefits to both the individual and the organisation.

It is also suggested that a few inefficient processes are identified (e.g.: implementing/ tracking progress of activities WRFM plan) and improved through Lean and TQM approaches such as resolving waiting time and minimising variability. The outcome is to be used to demonstrate, share and communicate benefits to practitioners and gain their endorsement, which would ease implementing change.
**PERSISTENCE**

Changing practitioner mentality to incorporate Lean and TQM concepts in day-to-day business activity is expected to be a major challenge. This may take a number of years to sustainably embed within the organisation and will require a great level of persistence. Increased visibility of Lean and TQM practices and routine training workshops and allocation of Lean and TQM accountabilities in GPAs at a suitable level will aid achieving culture shift. Utilising small projects demonstrate, share and communicate benefits to practitioners would also assist gaining their endorsement, which would ease implementing change.

**PRACTICAL DRIFT**

One of the WRFM goals is to achieve consistency across all of Shell OUs. However this is very hard to achieve as it is in human nature to drift to fit own work styles. It is imperative that there are systems and processes in place to minimise the level practical drift and to formally capture and communicate where possible improvements are identified. Increasing visibility and access to standard templates and operating procedures and regular training will aid minimising practical drift.

**PERCEIVED AVAILABILITY OF TIME**

Ad-hoc and inadequate planning processes and has resulted in inefficient utilisation of practitioner time as discussed in Section 6.0. Practitioners are focused on overcoming day-today challenges and spend a significant portion of their time engaging in non-value-adding activities. Therefore practitioners may feel that they have insufficient time to commit to any more responsibility. This will be difficult to refute until there is an understanding of Lean and TQM and benefits can be established. Automation where possible will enable and aid process streamlining and free practitioner time for value-added work.

### 7.4 APPROACH

All practitioners and steering committee must agree on the approach to implementation in order to maximise buy-in and ensure long-term success.

To ensure improvement initiatives are received positively, it is strongly recommended that the WRFM strategy is revised / redefined, with performance factors then incorporated into IDPs and GPAs. With WRFM targets affecting the individuals overall performance they are likely to strive to implement and support improvement initiatives.

A generic approach to implementation is suggested below.

1. Lean, TQM and WRFM training workshops conducted to
   - Raise awareness
   - Improve understanding
   - Allow questions and clarification in a constructive environment
   - Provoking interest in important concepts
2. Incorporate WRFM, Lean and TQM responsibilities in GPAs
3. Practitioners to approach gap closure in the form of small and achievable projects
4. Where possible arrange for practitioners to visit other OUs to see / gain experience in successful WRFM practice.
7.5 RECOMMENDATIONS

Improvement initiatives play a key role in the sustainability of WRFM and it is critical that these initiatives are followed through. Inclusion of WRFM responsibilities and accountabilities in GPAs will provide the drive required to successfully carry out gap closure projects. It is recommended that:

- Management embrace and support all improvement initiatives
- Practitioners continually monitor progress of projects and optimise where possible
- Assess and seek to understand the reasons behind both successfully completed and failed projects.
- Document and share learning to promote organisation wide development.
8.0 AFTER ACTION REVIEW

This section documents learning over the project duration and serves to support improved performance in future projects.

PLANNED VS. ACTUAL

By October 2013, I had developed my project plan, which was to act as the key reference document for the project scope, milestones and deliverables during the course of the project. In reality a number of deviations from the original plan was encountered which in some instances affected outputs and project deadlines. Overall the actual course of action provided me with a better understanding of the project and challenged my ability handle unexpected obstacles which positively impacted my personal growth.

The key deviations are outlined in the table below.

Table 4: Planned vs. Actual Occurrence of Events

<table>
<thead>
<tr>
<th>What was Planned</th>
<th>What Actually Occurred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systematically follow Work Breakdown Structure (WBS)</td>
<td>There was a delay due to IT issues, which required me to fill my time with alternative work during the first week. In reality there was no formal induction to WRFM and I had to learn on the job. The WRFM process was much more complex and broader than I had anticipated in the initial planning stage which required me to spend more time familiarising than anticipated. The interview process dragged out longer than anticipated due to staff availability issues. The other members on the interview panel had other commitments, which led to postponing interviews by a month. The review process was also extended due to seasonal holidays.</td>
</tr>
<tr>
<td>Formal reports outlining findings</td>
<td>Due to workload and delays it was more practical to organise a weekly meeting with the sponsor to report progress and gain direction. Ad-hoc meetings were also arranged where necessary. Formal monthly reports were provided to the supervisor to monitor progress.</td>
</tr>
<tr>
<td>Remain within project scope</td>
<td>In reality the scope was proven much broader than initially planned. This required much background work and out of scope activities to gain a better understanding of the process. Initially due to lack of understanding of the process much time was spent doing other tasks within the department.</td>
</tr>
</tbody>
</table>

Lessons Learned

- Allow more time for project familiarisation
- Make greater allowance for human resource availability
- Include allowance for I.T. related issues in contingency planning
- Physically visit organisation/department prior to development of plan to gain an indication of complexity and breadth of subject and potential project risks.

WHAT WENT WELL AND WHY?

Key successes during the project and reasons for success are outlined in the table below.

Table 5: Project Successes and Underlying Reasons

<table>
<thead>
<tr>
<th>What went Well</th>
<th>Why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRFM interviews</td>
<td>Due to the delay in the process I had more time to think about the expected outcomes of the interview and draft appropriate questions with guidance and support from my sponsor. Through this I was able</td>
</tr>
</tbody>
</table>
collect valuable insight into the process and was able to identify key themes. This was of great use in providing recommendations. I also chased up the other interviewers in many occasions to ensure the process was conducted in a timely manner. This sped up the initial contact and review process in particular.

<table>
<thead>
<tr>
<th>Steer from sponsor</th>
<th>The sponsor provided clear instructions of task goals and his expectations. He also guided me towards relevant WRFM practitioners within STOS where relevant, which greatly impacted my understanding of WRFM.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to information and resources</td>
<td>When tasks were given I spent some time planning the task and was able to give sufficient notice of required resources and access where possible. This led to smooth completion of tasks in most instances.</td>
</tr>
<tr>
<td>Staff engagement</td>
<td>Where possible I strived to give as much notice as possible in setting meeting times which enabled keeping the project on track. The staff members were friendly and happy to help which made this process easy.</td>
</tr>
<tr>
<td>WRFM gap analysis tool</td>
<td>The Shell tool used for gap analysis has very clear statements on requirements, which enabled providing a clear picture of STOS current situation. This heavily impacted my understanding and recommendations.</td>
</tr>
</tbody>
</table>

**Lessons Learned**

- Providing sufficient notice is always best practice and also allows tasks to be carried out smoothly
- Planning adds much value to investigations
- Initiative/Follow up is critical to ensure tasks get carried out as planned in a busy working environment

**WHAT CAN BE IMPROVED AND HOW?**

The areas of improvement identified throughout the project are listed below.

**Table 6: Areas of Improvement**

<table>
<thead>
<tr>
<th>What can be Improved</th>
<th>How?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular status reporting</td>
<td>If weekly meeting are cancelled / postponed send an email outlining current status. If urgent issues exist approach next best person or arrange an ad-hoc meeting.</td>
</tr>
<tr>
<td>Contingency planning</td>
<td>Allow a greater buffer for IT related issues and project familiarisation</td>
</tr>
<tr>
<td>Acronyms and jargon</td>
<td>Acronyms and jargon are heavily used within STOS and Shell, and is often assumed to be understood by new employees. If unsure don’t hesitate to ask. It is also a good idea to note these down for future reference.</td>
</tr>
<tr>
<td>Allowance for human resource availability</td>
<td>This was underestimated initially. End of year is a busy time for the organisation so it is wise to make arrangements early and provide sufficient notice. If the person required is unavailable find out who the next best person to approach is.</td>
</tr>
<tr>
<td>Ability to challenge</td>
<td>Challenge all assumptions and opinions and dig deeper to gain a better understanding of the situation. Where controversial statements are made, look for evidence.</td>
</tr>
</tbody>
</table>

**Lessons Learned**

- Do not hesitate to approach staff. While it can be quite daunting, staff members are usually willing to help
- If unsure, ALWAYS ask and ask until you understand. There are no silly questions
REFLECTION ON PERSONAL GROWTH

I was fortunate to have been given the opportunity to be independent and manage the project as I saw fit. I was thrown in the deep end from day one, which greatly impacted my ability to overcome challenges. My sponsor also pushed me to initiate engagements across the organisation, which was daunting at first but greatly built my confidence and enabled me to tap into a professional network.

The project itself was challenging and taught me how to maintain a work-life balance.

Having to work with a diverse group of people has taught me to appreciate different styles of work and to maintain a professional stance in challenging and frustrating situations. I have also gained a greater appreciation of business relationships, strategic management and the ability to comprehend the wider business context.
9.0 REFERENCES


APPENDIX A: FURTHER READING

A list of useful literature has been outlined in Table 7 below.

<table>
<thead>
<tr>
<th>Literature</th>
<th>Description</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well and Reservoir Management - Management System (STOS, 2011)</td>
<td>Application of WRFM at STOS. Description of tools and techniques used to achieve operational excellence requirements</td>
<td>Understanding STOS WRFM practice and structure.</td>
</tr>
<tr>
<td>WRFM Interviews – Key Findings (Beaumont M., Hale M., Wickramanayake A., 2014)</td>
<td>Key issues hindering WRFM at STOS and recommendations for improvement</td>
<td>Understanding key complexities and constraints affecting WRFM at STOS</td>
</tr>
<tr>
<td>WRFM Asset Assessment (Wickramanayake A., 2013)</td>
<td>Self Assessment</td>
<td>Understanding current situation of WRFM</td>
</tr>
<tr>
<td>Lean in WRFM (Shell Exploration and Production, 2008)</td>
<td>Application of lean philosophies in WRFM</td>
<td>Streamlining WRFM and minimising waste</td>
</tr>
<tr>
<td>Total Quality Management (TQM) (Dept. of Trade and Industry – UK)</td>
<td>An Over view of quality and TQM principles</td>
<td>Understanding quality and issues addressed through the TQM framework.</td>
</tr>
<tr>
<td>Implement - from Quality to Organisational Excellence (Dept. of Trade and Industry – UK)</td>
<td>An implementation model for achieving organisational excellence</td>
<td>Defining strategy and translation into core process to ensure sustainability</td>
</tr>
<tr>
<td>Quality Management Systems (QMS) (Dept. of Trade and Industry – UK)</td>
<td>A systems approach for achieving continuous improvement</td>
<td>A systems approach for achieving continuous improvement</td>
</tr>
<tr>
<td>Process Understanding and Improvement (Dept. of Trade and Industry – UK)</td>
<td>An approach to understanding business processes and guidance for improvement</td>
<td>Gaining a better understanding of STOS processes and pinch points</td>
</tr>
<tr>
<td>TQM Process Improvement Tools (Dept. of Trade and Industry – UK)</td>
<td>Tools and techniques for systematic process improvement</td>
<td>Tools and techniques for systematic process improvement</td>
</tr>
<tr>
<td>People Development and Teamwork (Dept. of Trade and Industry – UK)</td>
<td>Guideline to understanding people and team building approaches</td>
<td>Cross discipline integration, training and succession planning</td>
</tr>
<tr>
<td>Performance Measurement (Dept. of Trade and Industry – UK)</td>
<td>Understanding cost of quality, establishing metrics and understanding performance.</td>
<td>Understanding KPIs and Business impact</td>
</tr>
<tr>
<td>Self-Assessment and Awards (Dept. of Trade and Industry – UK)</td>
<td>Evaluation against excellence models, approaches to self assessment and business excellence awards</td>
<td>Approaches to self assessment for annual reviews</td>
</tr>
<tr>
<td>The 14 Principles of the Toyota Way (University of Michigan, 2003)</td>
<td>The 14 Principles of the Toyota Way</td>
<td>Building quality into WRFM. Solving root causes to drive organisational learning and continuous improvement</td>
</tr>
</tbody>
</table>
APPENDIX B: ROOT CAUSE ANALYSIS

Figure 6: Root-Cause Analysis for WRFM at STOS
**APPENDIX C: BUSINESS IMPACT OF GAP CLOSURE**

The tangible and intangible benefits from gap closure, cost and effort required are detailed in the sections below.

**PEOPLE**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WRFM Activities in IDPs and GPAs</strong></td>
<td>• Defined process owners</td>
<td>• Clarity of role/responsibilities and</td>
<td>Low cost, low effort required to enforce formal capture of roles and responsibilities. Further investigation into specifics is required.</td>
</tr>
<tr>
<td><em>Not rigorously implemented at present.</em></td>
<td>• Ability to monitor progress</td>
<td>expectations</td>
<td><em>(can be easily implemented)</em></td>
</tr>
<tr>
<td></td>
<td>• Succession planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Ability to identify individual strengths/weaknesses and provide support</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Ability to identify vacancies</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>WRFM Training</strong></td>
<td>• Minimises time/effort spent on non WRFM activities that are thought of as WRFM <em>(e.g.: drilling activities in WRFM plan)</em></td>
<td>• Greater understanding of WRFM</td>
<td>Online course free till April 2014. A few hours of practitioner time required</td>
</tr>
<tr>
<td><em>Training has not been carried out since 2012.</em></td>
<td>• Builds competency</td>
<td></td>
<td><em>(can be easily implemented)</em></td>
</tr>
<tr>
<td></td>
<td>• In tune with latest tools and techniques</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Improves quality of deliverables</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Integration across Disciplines</strong></td>
<td>• Eliminates assumptions</td>
<td>• Greater understanding of WRFM</td>
<td>Difficult to implement as employees do not have full time WRFM roles at STOS</td>
</tr>
<tr>
<td><em>Current layout is by function, which has led to silos.</em></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## PROCESSES

<table>
<thead>
<tr>
<th>Gap</th>
<th>Tangible Benefit</th>
<th>Intangible Benefit</th>
<th>Cost/Effort required for Gap Closure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Live WRFM Plan</strong>&lt;br&gt;<em>Current documentation procedure lacks visibility and progress is not monitored.</em></td>
<td>• Ability to visualise upcoming tasks thereby improving planning&lt;br&gt;• Acts as a reminder&lt;br&gt;• Ability to identify pinch points</td>
<td></td>
<td>Low cost, can use existing software. Effort required to collate and feed activities into software. Further investigation into specifics is required.</td>
</tr>
<tr>
<td><strong>Automation / Minimising Manual Data Management</strong>&lt;br&gt;<em>Substantial amount of manual data management prevalent at present.</em></td>
<td>• Practitioners able to utilise the time for value-added tasks&lt;br&gt;• Minimises human error&lt;br&gt;• Improves data accessibility</td>
<td>• Boosts morale</td>
<td>A substantial amount of effort and time will be required to build a robust system. Some cost may also be incurred for new software if existing software is inadequate. Further investigation into specifics is required.</td>
</tr>
<tr>
<td><strong>IPSM / Model Integration</strong>&lt;br&gt;<em>Use of separate surface and subsurface models at present. However efforts have been focused on integration.</em></td>
<td>• Ability to visualise/identify emergent properties&lt;br&gt;• Minimises having to work on assumptions&lt;br&gt;• System optimisation made easier</td>
<td>• Better understanding of overall system behaviour</td>
<td>A substantial amount of effort and time will be required to build a robust system. Substantial costs in providing training. However business impact is not limited to WRFM alone. Further investigation into specifics is required.</td>
</tr>
<tr>
<td><strong>Use of Shell Global Tools</strong>&lt;br&gt;<em>Lack of communication with global community has caused constrains in using full potential of available tools.</em></td>
<td>• Support from global community&lt;br&gt;• No training required to bring on-boarding Shell expat staff up to speed.</td>
<td></td>
<td>Capital investment and initial efforts to train staff is relatively high. However over the long term it will be a robust and sustainable process. Further investigation into specifics is required.</td>
</tr>
<tr>
<td><strong>Opportunities and Threats Register</strong>&lt;br&gt;<em>Not utilised consistently and is not monitored as required.</em></td>
<td>• Visibility of identified opportunities and threats&lt;br&gt;• Acts as a reminder</td>
<td>• Streamlines strategy</td>
<td>Low cost, medium effort to monitor tasks. Further investigation required to see if better tools are available</td>
</tr>
</tbody>
</table>
### DATA / DOCUMENTATION

<table>
<thead>
<tr>
<th>Gap</th>
<th>Tangible Benefit</th>
<th>Intangible Benefit</th>
<th>Cost/Effort required for Gap Closure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Templates</td>
<td>• Consistency</td>
<td>• Ability to directly compare asset performance</td>
<td>Low cost, substantial effort. Further investigation into specifics is required.</td>
</tr>
<tr>
<td></td>
<td>• Ability to directly compare asset performance</td>
<td>• Minimises duplication</td>
<td>Some templates can be obtained through Shell. Where no standard templates are available STOS will need to create their own.</td>
</tr>
<tr>
<td></td>
<td>• Reduces workload</td>
<td></td>
<td>(can be easily implemented)</td>
</tr>
<tr>
<td>Up-to-date Documentation</td>
<td>• Accurate information</td>
<td>• Reliability</td>
<td>Low cost, medium effort. Further investigation into specifics is required.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(can be easily implemented)</td>
</tr>
</tbody>
</table>

A number of WRFM documentation is out of date at present.

### EQUIPMENT

<table>
<thead>
<tr>
<th>Gap</th>
<th>Tangible Benefit</th>
<th>Intangible Benefit</th>
<th>Cost/Effort required for Gap Closure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent Down Hole Pressure Gauges (PDHPG)</td>
<td>• No static BHP measurement required</td>
<td>• More accurate models</td>
<td>Cost of PDHPG = $365K</td>
</tr>
<tr>
<td></td>
<td>• Saves time and money required to mobilise units</td>
<td>• Indications of scaling, skin factor and apparently changes in permeability</td>
<td>Total operation cost for SBHP (off shore) = $35K/well</td>
</tr>
<tr>
<td></td>
<td>• Minimises no. of well interventions required: saves money and staff utilise time for other tasks</td>
<td></td>
<td>Total operation cost for SBHP (off shore) = $27K/well</td>
</tr>
<tr>
<td></td>
<td>• Gives an indication of well performance</td>
<td></td>
<td>• For Pohokura – unmanned; No PDPHG = no data, so it is necessary to have these in place.</td>
</tr>
<tr>
<td></td>
<td>• More accurate models</td>
<td></td>
<td>• For Maui – at present with declining pressure wanting to do SBHP measurements on 9 wells at least twice a year at $35K/well Therefore payback period for</td>
</tr>
<tr>
<td></td>
<td>• Indications of scaling, skin factor and apparently changes in permeability</td>
<td></td>
<td>(can be easily implemented)</td>
</tr>
</tbody>
</table>
each PDHPG = 5.2 yrs.
On a cost basis without taking into considerations any of the added benefits

- For Kapuni – SBHP measurements done once a year on 9 wells at $27K/well
  Therefore payback period for each PDHPG = 13.5 yrs.
  On a cost basis without taking into considerations any of the added benefits

MANAGEMENT

<table>
<thead>
<tr>
<th>Gap</th>
<th>Tangible Benefit</th>
<th>Intangible Benefit</th>
<th>Cost/Effort required for Gap Closure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Active Engagement with Practitioners</strong></td>
<td>• Eliminates assumptions</td>
<td>• Insight on ongoing issues and successes</td>
<td>Low cost, some effort required. Further investigation into specifics is required.</td>
</tr>
<tr>
<td>Inadequate interaction and communication has caused variance in perception of WRFM performance.</td>
<td>• Eliminates misrepresentation</td>
<td></td>
<td>(can be easily implemented)</td>
</tr>
<tr>
<td></td>
<td>• Ability to identify where blockers exist / provide steer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

METRICS

<table>
<thead>
<tr>
<th>Gap</th>
<th>Tangible Benefit</th>
<th>Intangible Benefit</th>
<th>Cost/Effort required for Gap Closure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KPIs - Visibility and Measure</strong></td>
<td>• Clear indication of performance</td>
<td>• Better understanding of current situation</td>
<td>Low cost, substantial effort to put relevant processes in place. Further investigation into specifics is required.</td>
</tr>
<tr>
<td></td>
<td>• Visibility of goals</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Practitioners will try to achieve goals if they know it exists and are reminded of them</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Steering committee indicated as to where intervention is required</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Visibility and understanding of KPIs are poor at present. A number of KPIs do not get measured / performance is not known by practitioners.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX D: ACTION TIMELINE

Figure 7: WRFM Improvement Action Timeline
APPENDIX E: SWOT ANALYSIS

The SWOT analysis was conducted to identify the internal factors that affect WRFM practice at STOS. The WRFM practitioners were interviewed to obtain their thoughts and views of the process. A set of actions for the future has also been suggested as part of this analysis.

Figure 8: SWOT Analysis of STOS Current Situation, and GIDA Analysis for Future Actions
APPENDIX F: WRFM STRATEGY OVERVIEW

The STOS WRFM strategy has been broken down to the four areas below. These highlight the overarching principles of WRFM to clarify users of benefits and uses desired through implementing projects. The aim is to achieve better results through adequate consideration of the overall system.

Figure 9: strategy outline for moving forward

Note that the above strategy has been tested and validated at other Shell assets showing that the benefits outlined can be attained through implementation of WRFM.