Developing a Reference-Model for Benchmarking: Performance Improvement in Operation and Maintenance

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Statoil has a major responsibility of “driving simplification and improvement initiatives” by relying on tools such as benchmarking. The aim is to drive business performance based on best practice rather than on compliance. To date, the full potential of benchmarking has not been realized since the concept is not easy to define, let alone follow-up. A great deal of knowledge and practice remains hidden in the Statoil system that can be effectively used to drive performance based on effective Benchmarking. However, no major initiative to date had the objective of uncovering this information. The presence of many benchmarking opinions and methodologies has cluttered the process and made it difficult to compare and rank facilities or projects using a systematic benchmarking methodology.

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Executive Summary

Statoil has a major responsibility of “driving simplification and improvement initiatives” by relying on tools such as benchmarking. The aim is to drive business performance based on best practice rather than compliance. To date, the full potential of benchmarking has not been realized since the concept is not easy to define, let alone follow-up. A great deal of knowledge and practice remains hidden in the Statoil system that can be effectively used to drive performance based on effective Benchmarking, however no major initiative to date has aimed to uncover this information.

As part of the requirements for MSc. in Offshore Technology, Industrial Asset Management, this initiative has been taken on. The challenge is to uncover and analyse Statoil’s benchmarking practices, integrate into them benchmarking best practice and derive a resulting reference-model that will enable *Operation and Maintenance* within the company to manager performance towards world-class.

Interestingly, very different performance management strategies and objectives have been identified within the company varying from one department to another. More alignment and common practices are recommended as well as improved communication and better understanding of benchmarking principles by staff within all levels of the organization.

The concept of “*Integrated Benchmarking*” has been introduced as a solution to some of the areas of improvement identified within benchmarking practice, which is considered to be a fairly new and underdeveloped hypothesis only documented in few previous publications, none of which empirical in nature. Therefore, this effort is thought to be a genuinely original contribution to the field of benchmarking within performance management.

It is recommended that this effort is further developed in the form of the two proposed projects identified in the Areas of further work chapter to assess the practicality of using the model on projects and assets, as well as actually applying the model practically on projects and for assets to enhance technical performance on specific indicators.

Acknowledgements

"People come into your life for a reason, a season or a lifetime" - UNKNOWN

The words of the title to this popular poem have never made an alike impression in the author's mind, as they have throughout the MSc. in Offshore Technology journey over the past two years; and especially so, during the past months while working on this thesis. While some people have been influential from the start, setting high targets and always expecting more, others have provided great support and backing and a few have kept the fire burning through intermittent words of encouragement and recognition. Friendships have been struck that will last for years to come and contacts have been made where business interests will certainly come to fruition but most importantly, my efforts and commitment have made those proud that have been my support team from the start.

Special thanks to my professor, academic supervisor and mentor Jayantha Prasanna Liyanage, who has taught me what it is to be a perfectionist and helped me bring structure and direction to my work. He has been an integral part of my masters both in terms of course work and this thesis. Although we have had our disagreements and discussions, his effort is much appreciated and his attention to detail and level of quality is to be admired.

Per Arild Bjørnland, one of the "gurus" of maintenance management and my industry task owner and mentor, has played an equally important role in the development of this thesis in the form of technical discussions and helping me think outside the box. Having a mentor and supervisor that has been around in Statoil for some years and in addition is much respected, helped me break the ice in many of the discussions and workshops carried out to gain the required knowledge. To a veteran that still defines cutting-edge within operation and maintenance management, he was central to developing the master thesis topic. Thank you for your time and patience, I know I ask too many questions.

Another person who has been vital in the delivery of this scope is Hildrun Friederike Sommer, my "resource owner" and I can declare, she did not boss me around too much ☺ Hildrun helped me gain access to the information I needed and with her strong personal networks managed to put me in touch with the right people to get the required data.

Others that have been key to gaining a thorough understanding of benchmarking and shared with me some of their vast experience are Helge Riber, Frithjoff Tønnessen, Ellinor Hoemsnes, Einar Møvik and Kevin Tuan Nguyen; while others have demonstrated the values of Statoil and provided me with an insight into how their departments carry out benchmarking including Terje Palmesen (HSE), Eva Elisabeth Lund (HSE), Gard Pedersen (HSE), Alena Korbovà Pedersen (SCM), Sander Vankan (PRO), Eldfrid Irene Hognestad (PRO), Ben Hern (D&W), Øystein Hult (D&W) and Knut Vidar Larssen (IP).

Finally, I would like to thank my family who have been a great support for me, encouraging me along the way and believing in me as well as friends who have supported me and put up with my busy schedule.

A special thanks to Silje Paraply who has played a very important role in keeping me sane and healthy, I hope I can return the favour during your master thesis.

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List of Abbreviations

A2A	Ambition to Action
AHP	Analytical Hierarchy Process
APQC	American Productivity and Quality Centre
BPI	Business Process Improvement
BSC	Balanced Scorecard
CMMS	Computer-aided Maintenance Management System
D&W	Drilling and Well
DG	Decision Gate
E&P	Exploration and Production
EFQM	European Foundation for Quality Management
EQA	European Quality Award
FFA	Force Field Analysis
FMECA	Failure Mode, Effects and Criticality Analysis
FR	Functional Requirements
HRO	High Reliability Organization
HSE	Health, Safety and Environment
HWE	Health and Working Environment
IEC	International Electrotechnical Commission
IP	Improvement Projects
ISO	International Standardization Organization
JO	Joint Operations
KPI	Key Performance Indicator
L&L	Lunch and Learn
MC	Management Committee
MIS	Management Information System
MPR	Marketing, Processing and Renewables
NCS	Norwegian Continental Shelf
O&M	Operation and Maintenance
OPD	Operational Performance Dashboard
PE	Production Efficiency
PMD	Process Management and Development
POOM	Process Owner Operation and Maintenance
POSC	Process Owner Supply Chain Management
PPIP	Project Performance Improvement Project
PRO	Project Development
SAP	Systems, Applications and Products in Data Processing
SCM	Supply Chain Management
SERVQUAL	Service Quality Framework
SMART	Strategic Measurement, Analysis and Reporting Technique
SSC	Subsurface Support Centre
STB	The Statoil Book
TEX	Technology Excellence
TPD	Technology Projects and Drilling

Introduction

The idea behind this scope of work has been developed in collaboration between the University of Stavanger and Statoil ASA in January of 2012. After discussing two focus areas the company was looking to improve, this project was chosen and the project proposal that was signed at kick off is attached in Appendix D. It can be seen from reviewing the project proposal versus the scope covered by this report, that although not all tasks have been conducted, all aims and objectives have been reached and the associated deliverables have been satisfied in due time.

Companies are continuously striving to gain an edge on their competitors to increase market share and ultimately profits. More efficient processes and effective procedures, new and improved products and streamlined operations and maintenance, are some of the areas gaining much attention. These areas are proving to significantly impact the bottom line, whether in terms of production volumes or profits.

Many methods have been adopted and developed to boost performance. Some are widely accepted and used, whilst others are less popular. One of the most popular techniques is *benchmarking*, so much so that it features as a common job-description competency for production managers in Japan. Having spawned and improved over the past two centuries, it is now one of the most effective tools for continuous performance improvement and innovation. Even though it is believed to have been in practice since the 1700's, when shoemakers used it for relative pricing, it was not recognized as a methodical performance management tool until the 1970's. Xerox was the first to document and implement the practice systematically and successfully while competing with its Japanese counterparts. Robert Camp, considered as the forefather of benchmarking, was part of Xerox's widely acknowledged benchmarking campaign in the late 70's. It is evident from the literature, that most modern benchmarking models are based on Camp's documented method. In some cases, it was considered the key factor in transforming fading businesses into global conglomerates; taking over majority market-share, as was the case for Xerox in the late 1970's. Nevertheless, literature about the technique is mainly geared towards case studies and practices. The gap in literature is highlighted and contributed to, in an effort to complete the theoretical depiction of benchmarking.

The working definition of benchmarking throughout this report is based on Camp's (1989) concept, stating that *"benchmarking is the continuous process of measuring a firm's own performance against industry best practice, leading to superior performance through structured changes to operations"*.

How does the process work? To truly capitalize on the gains attainable by benchmarking, a thorough understanding of one's existing business practices, processes and performance is crucial; as well as a clear understanding and continued focus on the objectives of benchmarking. Along with a strong and concrete implementation plan, this will give organizations a solid chance in achieving world-class performance.

So, how to ensure the best outcomes of the process? After Xerox, many organizations and industries adopted benchmarking as a performance management tool, stretching its boundaries in every sense. Its success stories, challenges and critiques are well documented, yet there seems to be a lack of coherence on how to effectively conduct benchmarking or implement improvements. Anand and Kodali (2008) conducted a comprehensive review of the available models on benchmarking, where they compared the

different models, highlighting differences and similarities and their respective relevant application areas. The scope of this report focuses on taking this type of analysis a level further. By combining the academic review and analysis with an empirical study related to existing benchmarking practices within Norway's largest oil and gas company, a coalesced benchmarking reference-model is developed and applied to several *Operation and Maintenance* indicators to demonstrate its effectiveness.

Throughout this report, unless specifically stated, "the company" or "the organization" refers to Statoil, examining its methodologies, principles and practices.

Problem Description

Statoil has a major responsibility of "driving simplification and improvement initiatives" by relying on tools such as benchmarking. To date, the full potential of benchmarking has not been realized since the concept is not easy to define, let alone implement and follow-up. A great deal of knowledge and practice remains hidden in the Statoil system that can be effectively used to drive performance based on effective benchmarking. However no major initiative to date aimed at revealing this information. The aim is to uncover some of this knowledge and understand why and how Statoil benchmark, so that recommendations can be made resulting in improved benchmarking practices, demonstrating how such a large multi-national and expert organization can attain world-class performance through benchmarking.

Scope and Objectives

Therefore, by reviewing a wide range of performance management and benchmarking best practices, the report covers a comprehensive literature review of over 120 publications. The scope includes identification of literature gaps in the subject of benchmarking and contributes where possible, before delving into an empirical study. Initially the empirical study examines performance management philosophy at a high-level with regards to the objectives of benchmarking in one of the world's largest oil and gas exploration and production companies. Then, in more detail, different benchmarking models within the company are analysed and compared, before developing the "*Integrated Benchmarking*" reference-model for driving performance improvement within *Operation and Maintenance*.

Finally, the integrated benchmarking model is applied to several specific indicators utilized by the *Operation and Maintenance* department, in an effort to demonstrate how continuous improvement towards world-class levels can be realized. The boundaries of this part of the detailed analysis are limited to *Operation and Maintenance*, its key performance indicators, benchmarking process, improvement identification process, implementation process and feedback loop as well as process evaluation.

The objective is to combine Statoil's expertise, knowledge and experience with benchmarking best practice to develop a reference-model enabling the *Operation and* Maintenance department to reach their goal of becoming world-class.

Limitations

This report is specifically targeted towards the improvement and development of the *Operation and Maintenance* department's benchmarking activities. It only reviews the benchmarking models of other departments within the organization at a high level for comparison purposes without extensively going through every step of the process.

Methodology

This project is industry-based and while working with Statoil, it attempts to address a company need, as well as enhance theoretical and academic learning.

To fulfil the scope and objectives of this project, an in-depth analysis of the subject area was conducted. This commenced with a detailed academic literature review through the *University of Stavanger* library services, online journals and papers. Very few of the publications reviewed provided a comprehensive view of benchmarking practice, each was centralized around a specific outcome the author wanted to achieve. Additionally, many of the publications refer to the same base literature, which shows a consistency of the science over the years in spite of having witnessed continued development and a lack of consensus in some aspects. Furthermore, interviews and workshops with industry experts, colleagues and contacts enriched the study providing a valuable hands-on perspective.

In terms of the empirical study, it was imperative to review company requirements in contrast to the empirical evidence of those actually involved in performance management in the company. To get this breadth in opinions and variety of context, the first step was to research governing documents, functional requirements and work processes related to performance measurement and management. This was followed by interviews, workshops with 2-3 people, e-mail correspondence and phone calls. The latter turned out to be an especially valuable source for understanding the practical application of strategies and documented practices.

Company Background

Statoil was the first Norwegian nationally-owned oil company when it was founded in 1972 to secure Norway's participation in the oil industry on the Norwegian Continental Shelf and to build up Norwegian competency within the petroleum industry. In 2007 the company merged with NorskHydro's oil and gas division to become one of the world's largest offshore oil and gas companies. Statoil ASA, as it is known post-merger, is an international energy company with operations in 36 countries. This year the company fulfils 40 years of oil and gas production expertise on the Norwegian continental shelf. Statoil is a world leader in the development of oil and gas technology. In the 80's it was a pioneer investor in subsea technology leading to Norway's significant advancement in the field. Through the application of cutting-edge technologies and by introducing innovative business solutions, Statoil confirms its commitment to accommodating the world's energy needs. Statoil's headquarters are in Stavanger, Norway, with approx. 21,000 employees worldwide. It is listed on the New York and Oslo Stock Exchanges (Statoil.com).

Statoil's philosophy is that competitive returns for shareholders are best achieved through a value-based corporate culture, adherence to ethical principles and integrity, and a code of conduct promoting teamwork, transparency, accountability and innovation.

Structure of the Report

In terms of the report structure, due to the extent of the scope and its diversity between an academic and an empirical study, three main sections have been developed. The first section makes up the academic, or literature review, portion of the report while the two others are included as parts of the Empirical Study. Finally all findings and recommendations are compiled in the Discussion chapter before presenting projects proposals for two further master theses in Areas of further work. Challenges and Limitations are highlighted thereafter and the main findings are summarized in the Conclusion.

The first section titled "Section 1: State of the Art" documents the findings of the in-depth analysis of benchmarking, describing its evolution from its technical inception in the late 1970's until the present. Later, typologies of benchmarking are assessed, as well as the ethics and challenges associated with the practice. Current Models for performance management are presented and included in the same chapter is a reflection their contribution to the concept of *Integrated Benchmarking*, discussed later. At the conclusion of the first section, a brief investigation into the perception of Benchmarking in the Standards is conducted, demonstrating that the practice is used for continuous improvement and development towards world-class rather than compliance.

Once the perception of benchmarking is established, the second section commences the Empirical Study. Starting off with a presentation of the company's strategic objectives concerning benchmarking, followed by a more in-depth analysis of benchmarking practice within several of Statoil's value chain processes, comparisons are made and summarized in an inter-departmental learning effort. Using this knowledge and adapting benchmarking best practice to the company's operating model and culture, the reference model is presented in Section 3: From Good to World-Class, which marks the start of section three.

In section three, after the literature review and after understanding the practical implementation of benchmarking within the organization, the reference model is introduced for the *Operation and Maintenance* department including a proposed road-map of how it could be introduced into the organization. Finally, to test the soundness and practicality of the model, specific *Operation and Maintenance* benchmarking indicators are selected to demonstrate how the model would be implemented for specific cases. Recommendations are made with respect to the indicators from best practice literature followed by a theoretical application of the process using the reference model.

As mentioned before, the Discussion sums up and pulls the findings of the work together and the Areas of further work chapter, which represents one of the most important chapter for the author to ensure continuity of this effort, captures the essence of two further master thesis proposals that would be carried out next year to build up on the efforts of this project.

Section 1: State of the Art

Evolution of Benchmarking

Benchmarking is not just a new name for networking or comparative data analysis, as highlighted by Morton Inger (1993), it is a sophisticated tool, a multi-faceted procedure, usually conducted by teams, for identifying and adapting best-in-class practices. In the author's view, it is as much a sophisticated science as it is fine art. Since its inception around the 18th century, many different views and models described it. It was finally acknowledged as a tool for performance measurement and management in the 1970's when Xerox used it expressly for the purpose of catching up to and surpassing its Japanese competitors. In the 1980's, relevant literature surged and continues to develop to date, following the trend outlined by Maire et al. in 2005 (Figure 1). This correlates closely to Ahmed and Rafiq's (1998) definition of several different generations of benchmarking, ranging from reverse engineering of products at the outset and moving towards strategic and global benchmarking with time. Widespread application in all industries followed and bears witness to the value of the technique. Firstly, it is useful to look at the diversity in the definitions of benchmarking along with the literature responsible for such variety before delving into the suggested models and different types of benchmarking.

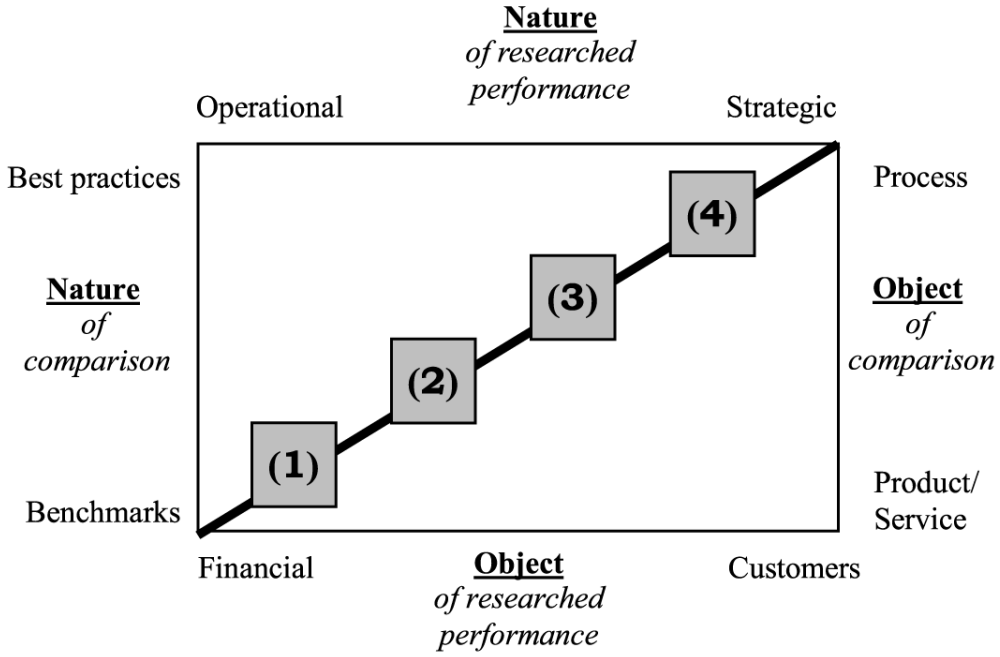


Figure 1. Evolution of Benchmarking (Maire et al., 2005)

As early as 1992, Spendolini published "*The Benchmarking Book*", where he already by that time uncovers 49 different definitions for the term "benchmarking". Within 10 years of his findings, Dattakumar and Jagadeesh (2003) found that a large increase in publications required them to conduct further reviews of literature about the technique. In 2003, after five years of collecting and studying various literature in the subject area, they published their paper titled "A review of literature on benchmarking", where they evaluate over 350 publications within the theme up to June 2002 (Dattakumar and Jagadeesh, 2003).

Dattakumar and Jagadeesh (2003) found that these publications could be grouped in four main categories shown in Figure 2 below.

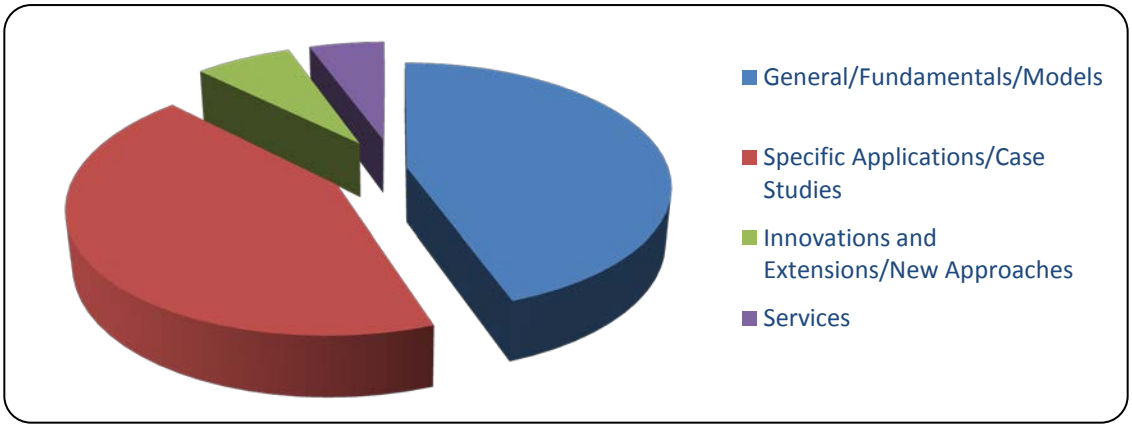


Figure 2. Pie-chart of publications according to benchmarking categories (Dattakumar and Jagadeesh, 2003)

The first category, "general/fundamentals/models", is geared towards first-time readers and covers a lot of the fundamental concepts associated with the technique. As the name of the second category suggests "specific applications/case studies" covers applications and success stories through the use of benchmarking. This category is very useful for lessons learned and improvement of the benchmarking technique, as also recognized by Dattakumar and Jagadeesh. As the technique became widely used and understood, novelties began emerging; this literature was captured in the third category "innovations and extensions/new approaches". Finally, the fourth category was reserved for literature applicable for academicians. Since both authors are affiliated to educational institutes, they felt that this category would be of interest and benefit. For a listing of all publications (382), the reader is referred to Dattakumar and Jagadeesh's (2003) publication, Table IV on page 186. Furthermore, Anand and Kodali (2008) have made an interesting observation that due to the strong focus on application of the practice, the majority of literature is so inclined. Out of 406 papers published by *Benchmarking: An International Journal*, only 4% were of conceptual nature, with the large majority focusing on empirical studies.

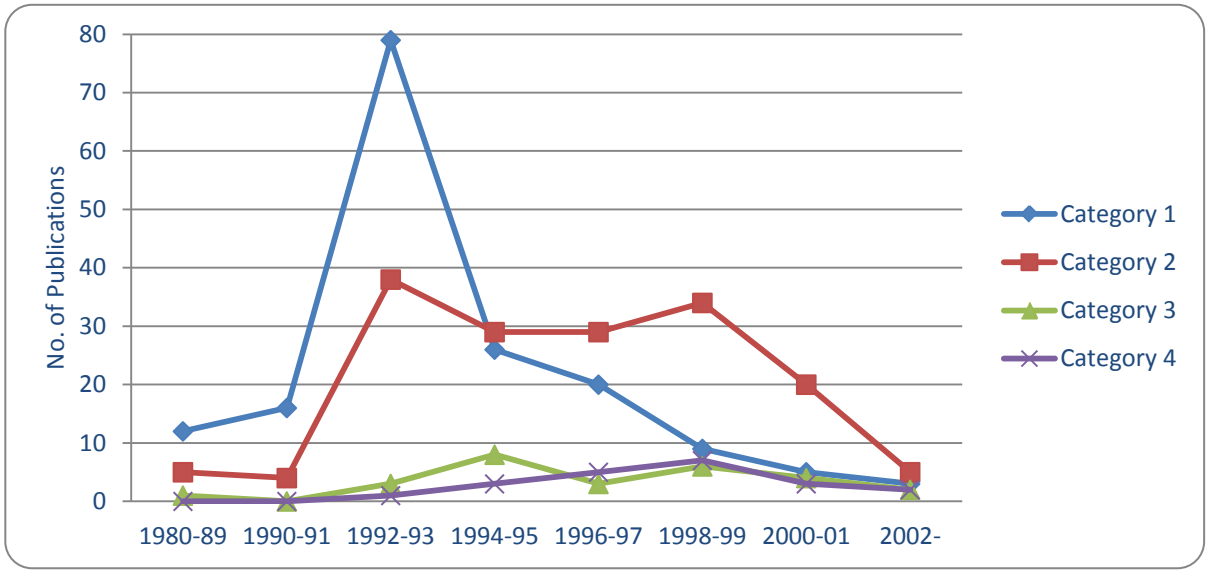


Figure 3. Summary of No. of publications per period (reproduced) (Dattakumar and Jagadeesh, 2003)

In addition to the four categories mentioned above, Dattakumar and Jagadeesh (2003) have further coded the literature according to the period during which it was published, which helps demonstrate the trend in literature and the science as a whole. A summary is shown in Figure 3 above. Furthermore, as the practice developed throughout the years, so have the definitions of the term "benchmarking".

Some of the more notable definitions that show the trend in evolution of the technique are mentioned below. It is evident from literature that as benchmarking became more widely used, it also became more sophisticated, this is also clear in the development of models discussed later in the report.

Camp (1989): *The search for industry best practices, which lead to superior performance.*

Spendolini (1992): *A continuous systematic process for evaluating the products, services and work of organizations that are recognized as representing best practices for the purpose of organizational improvement*

Garvin (1993): *A disciplined process that begins with a thorough search to identify best-practice-organizations, continues with the careful study of one's own practices and performance, progresses through systematic site visits and interviews, and concludes with an analysis of results, development of recommendations and implementation*

Allan (1997): [Benchmarking is] *the process of identifying and learning from best practices anywhere in the world*.

Fernandez, McCarthy and Rakotobe-Joel (2001): *Benchmarking is a management technique that seeks to achieve business improvement by helping organizations and individuals learn and develop*.

Kumar et al. (2006): *It is the process of identifying, understanding and adapting outstanding practices from organizations anywhere in the world to help an organization improve its performance. It is an activity that looks outward to find best practice and high performance and then measures actual business operations against those goals.*

Anand and Kodali (2008): *Benchmarking can be described as a continuous analysis of strategies, functions, processes, products, services, performances, etc. compared within or between best-in-class organizations by obtaining information through appropriate data collection method, with the intention of assessing an organization's current standards and thereby carry out self-improvement by implementing changes to scale or exceed those standards.*

Moriarty and Smallman (2009): *Benchmarking is an exemplar driven teleological process operating within an organization with the objective of intentionally changing an existing state of affairs into a superior state of affairs*.

Although most definitions seem to be fairly similar and often overlap, it is important to note the minor differences between them. These minor differences give an insight into the motivation and advancement of the technique as well as the depth of understanding of the author or firm. Taking the first expressly documented definition by Robert Camp (1989), the forefather of benchmarking who spearheaded Xerox's revolutionary benchmarking campaign carried out in the late 70's, it is evident that even at such an early stage it was granted, that benchmarking was not merely a reproduction exercise but one that aimed at achieving superior performance.

Later, with a dedicated focus of simplifying and clarifying the benchmarking process, Spendolini (1992) explicitly states that to reap the benefit of benchmarking it must be a continuous and systematic process focusing on products, services or the core business of the company. He also vaguely touches on the point that benchmarking is ultimately geared towards achieving organizational improvement. With today's understanding it can be interpreted to mean that not all best practices need to be incorporated, only those that combined with the company's objectives and strategies introduce improvements. He does however drop the notion that effective benchmarking should ultimately result in superior performance to existing best practices.

Garvin (1993) seems to outline a simple process of benchmarking; stopping short at mentioning what the ultimate goal or aim of the process is and concludes with recommendations. The author also seems to have started the process by identifying "best-practice-organizations" without first identifying areas needing improvement. It is important to first identify and understand the "practice" one wishes to improve upon, since best-in-class companies for a specific practice might in fact not be competitors but instead firms operating in a completely different line of business. Camp successfully grasped this concept and used companies such as L.L. Bean when studying mail order operations and logistics, even though their line of business is apparel and outdoor equipment, not copiers. In his 1993 publication he mentions "In the early days, we spent 80% of our benchmarking time looking at competition. Today, we spend 80% of that time outside our industry". Benchmarking should include a variety of organizations, large and small from different industries and with different areas of excellence. This is the only way to attain optimum benefit. No company is too small to justify benchmarking.

As the market developed, "best-in-practice" organizations became geographically spread across the globe and with the help of fast developing communication and IT tools, globalization was at the doorstep. Allan (1997) was one of the first to explicitly allude to that by stating that such learning can be achieved from "anywhere in the world". Allan does however leave out any specific indication of the ultimate goal or means of benchmarking. Fernandez, McCarthy and Rakotobe-Joel (2001) highlight another important aspect, namely that benchmarking is not carried out solely by large corporations but can just as well be used by individuals and small firms.

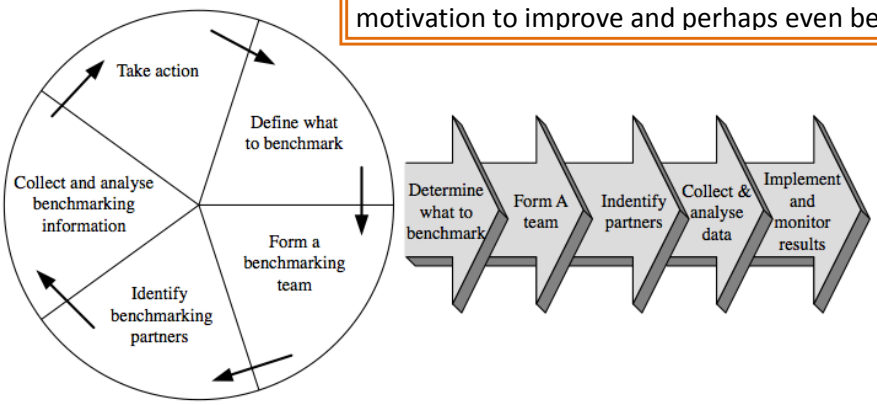
The definition provided by Kumar et al. (2006) seems to be more in line with the modern benchmarking technique and shows maturity of the technique by that time. However, it seems to firstly refer to external benchmarking only and secondly to suggest measuring actual performance against those "goals", which would be defined by the benchmarked organization's achieved performance levels. Benchmarking can be carried out in many different ways. External benchmarking seems to be the most popular technique, yet internal benchmarking is sometimes just as effective and can result in even better

results. This is discussed further in the report and demonstrated through some practical examples and case studies. In addition, the aim of benchmarking is not only to measure and compare but it is to get a deeper understanding of the processes leading to best practice and incorporating them into the company's internal culture to achieve best-in-class results.

Anand and Kodali's (2008) more recent version, although lengthy, accurately represents the aims and technique of benchmarking. Nonetheless, they limit the benchmarking cluster to best-in-class organizations. By stating that benchmarking is carried out "within or between" best-in-class companies they touch on a very interesting concept. Ideally, companies would only compare and share data with best-in-class to ensure maximum benefit. This is not practical though, since benchmarking clusters often comprise organizations ranging from best-in-class to those barely achieving the industry average levels. It is a theoretical concept that a company would be best-in-class in all areas of its business; consequently organizations within the cluster may be poor performers in some practices, which is not accounted for in Anand and Kodali's (2008) definition.

In 2009 Moriarty and Smallman made a valuable contribution to the science of benchmarking by identifying a gap in knowledge. They focused their research on the "area of primal definitions that attempt to describe benchmarking in absolute words". Their thorough examination took on five different perspectives in an attempt to find a provisional definition of benchmarking: historical context, modern use of the term, organizational perspective, key features and what it is not. Their work was based on published literature with a critical view of many publications. It is the author's view that Moriarty and Smallman (2009) have conducted a very thorough research, capturing different angles of benchmarking and attempting to develop an all-encompassing definition of benchmarking. Yet they have apparently overcomplicated the matter and in trying to find a broad definition lost the detail and specific focus of benchmarking. This leads to amorphous thinking and ambiguity. Benchmarking is a subjective practice and although the general concept is agreed upon, the methods and aims can be completely different. Furthermore, benchmarking cannot be regarded as a teleological process since there is no fixed end point or final result, the target is continuously moving. There are two figures cited in Moriarty and Smallman's publication, which in a way, seem to contradict one another when it comes to this point (Figure 4). The first shows a continuous, looping process while the other outlines a linear sequential process

Reflections: Benchmarking is a continuous process, with a clear end goal in mind but no end date; rather, a continuous drive and motivation to improve and perhaps even become best-in-class.



PDCA 'continuous circle' framework: Adapted from camp (1989), Spendolini (1992)

PDCA 'stepwise' framework: Adapted from Drew (1997)

Figure 4. Benchmarking process models based on TQM model

Reflections: The author does not wish to attempt to create yet another definition of the word "benchmarking", rather to define some core elements that are important in understanding the art of benchmarking. Moving away from the empirical theories developed for benchmarking and into a more academic or theoretical one, the core elements would be:

- ⇒ Initially define the company's strategic direction, objective and focus
- ⇒ Gain a thorough understanding of one's own processes and practices, strengths as well as weaknesses and define areas for improvement
- ⇒ Use scaling factors, commonly called "complexity factors", to compare one's own performance internally and / or with other companies identified to be "best-in-class" in that specific practice[1]
- ⇒ Learn about the underlying processes and practices leading to best-in-class performance
- ⇒ Adapt[2] such processes and practices to one's own operating culture, strategy and goals to achieve superior performance, i.e. attempt to be best-in-class
- ⇒ Continuously evaluate and repeat the process to maintain world class performance

Notice that it is crucial to first get a clear understanding of what the company strategy and objectives are. Otherwise it will be unclear what the focus should be when prioritizing areas of improvements and hard to maintain the benchmarking team's focus and commitment. "Performance" can be defined in terms of different variables: outcome indicators, process indicators – commonly called lead and lag indicators are all valid forms of capturing performance levels. Nevertheless, the most important is that once comparison is made to best-in-class, the underlying processes setting the best apart are identified in order to be incorporated into one's own company environment. Helgason (1997) summarized the basic objective of benchmarking elegantly by posing the simple questions: "Is a 70% satisfaction of customers, good or bad performance? Is the measured cost per student in a primary school, high or low?" Benchmarking is an important tool for comparing and evaluating performance objectively. It is also a continuous process. As George Fisher once said "when you aim for perfection, you discover it is a moving target" and this was reiterated by Kozak (2004) while discussing the perishability of benchmarking by correctly stating that "what is a standard of excellence today may be the expected performance of tomorrow". Continuous benchmarking helps maintain focus on this ever-moving target.

Types of Benchmarking

As the art of benchmarking developed over the years and different industries and companies adopted it, several different types of benchmarking practices surfaced. They will be discussed in this section while attempting to break them down into simpler categories.

First of all, it is worth noting that there is no consensus on a scheme for classifying benchmarking practices. Fong et al. have documented this in 1998 and so have Anand and Kodali in 2008. Lack of agreement is still evident in today's literature and practice. In 1998, Fong et al. tabulated the different types of benchmarking in an attempt to finally create some sort of a standard classification system. This has not succeeded and although some authors accept this classification scheme and its associated definitions, others continue to develop their own.

At the highest-level, there are some categories that seem to be commonly agreed upon. They include outlook of the benchmarking process: whether an organization is looking within itself or externally; geographic boundary: will it be limited to a certain operating region or conducted globally; focus area of the process: what is to be compared? Work processes, business functions, outcome indicators representing cost, time and quality or strategic aims and directions? And finally intention: whether the outcome of the benchmarking study is to compete with benchmarking partners (e.g. Xerox's benchmarking study with its Japanese competitors who were selling copiers for less than it was costing Xerox to manufacture them) or is it to encourage learning and mutual benefit. The breakdown is presented graphically in Figure 5. It can be thought of as a process flow chart where decisions need to be made downstream of the four classifications.

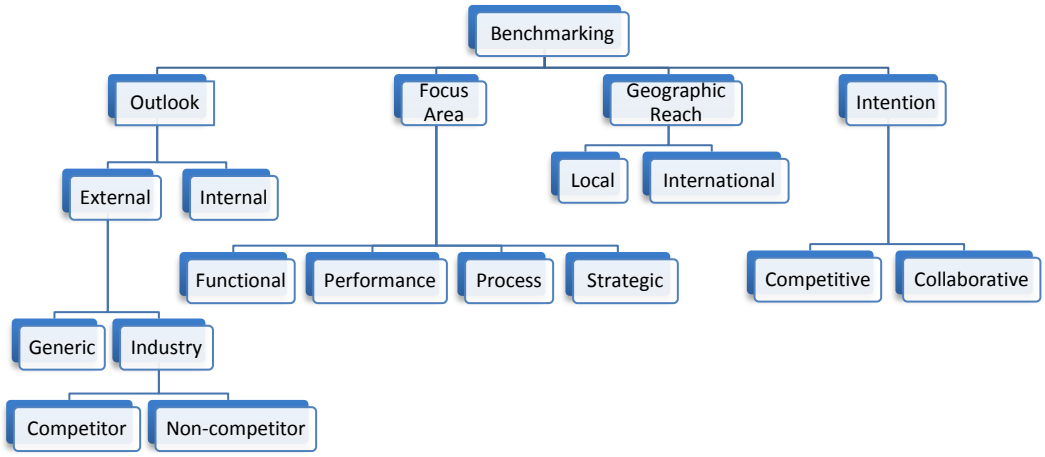


Figure 5. Graphical Representation of different types of benchmarking

Example: when a company has understood its processes, evaluated its performance and wishes to conduct a benchmarking study to compare results, it starts by choosing the outlook. If some of the internal projects or plants are already excelling at that specific practice and define world-class, then internal benchmarking is the most effective method of sharing that excellence. If the best assets within the company cannot be compared to best-in-class, then external benchmarking will be more beneficial. For specific processes or tasks, the focus area would be "*Process*", and depending on whether this is a common practice amongst all projects / facilities internationally or exclusive to a certain region, the geographical reach can be determined. Whether an external or internal outlook is taken, the intention

can be either competitive or collaborative. Competitive intention is mostly reserved for external benchmarking studies even though it can be used for internal studies. If the study is internal, competition between projects / facilities or branches would be of a friendly nature where a certain reward or bonus is on the line, after which the learning is shared if the organization as a whole is to benefit.

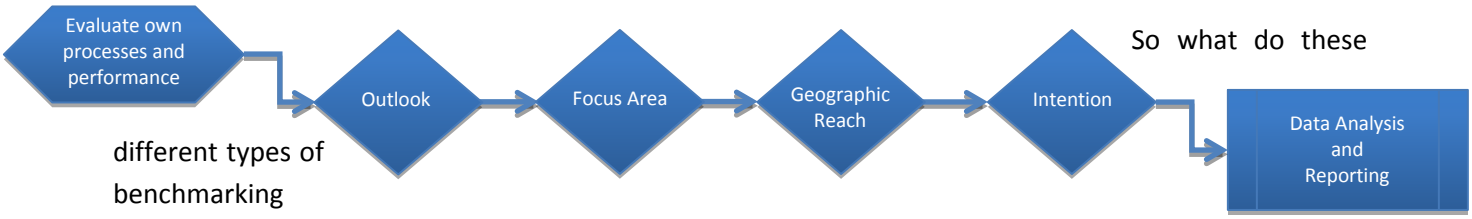


Figure 6. Decision flow diagram for choosing "type of benchmarking" study

actually entail? Table I below, published by Fong et al. (1998), summarizes the meaning of each of the different types of benchmarking. Note that in the graphical representation above, "Competitor", "Industry" and "Generic" have been grouped into "External", for similarity and simplification.

Table I. Classification of benchmarking (Fong el al., 1998)

Classification	Type	Meaning
Nature of reference other	Internal	Comparing within one organization about the performance of similar business units or processes
	Competitor	Comparing with direct competitors, catch up or even surpass their overall performance
	Industry	Comparing with company in the same industry, including non-competitors
	Generic	Comparing with an organization which extends beyond industry boundaries
	Global	Comparing with an organization where its geographical location extends beyond country boundaries
Content of benchmarking	Process	Pertaining to discrete work processes and operating systems
	Functional	Application of the process benchmarking that compares particular business functions at two or more organizations
	Performance	Concerning outcome characteristics, quantifiable in terms of price, speed, reliability, etc.
	Strategic	Involving assessment of strategic rather than operational matters
Purpose of the relationship	Competitive	Comparison for gaining superiority over others
	Collaborative	Comparison for developing a learning atmosphere and sharing of knowledge

It is useful to highlight a noteworthy link at this point. Many of the types of benchmarking above are closely related. For example, when attempting to identify enabling processes and practices that affect overall performance and the level of the benchmarked organization is not quite known, it is useful to first start off by identifying the areas in which the benchmarked organization actually excels – which would require *"Performance"* benchmarking. Once this is done, then "*Process*" benchmarking can be carried out to identify the enabling processes and practices responsible for the good results. Relationships such as these exist all through the typology presented above; and once a good

understanding of the different types is gained, they can be combined effectively to achieve even better results.

Taking a closer look at some of the benchmarking types and their applications, it is worth noting a few success stories associated with some of them. "*Generic*" benchmarking, for example, proved to be one of the hardest benchmarking practices to plan and carry out since it is difficult to identify benchmarking partners let alone try to relate equivalent practices. Several success stories emerged from this type of benchmarking such as the one between Xerox and L.L. Bean; or the example of the consortium of Swedish hospitals who were benchmarking their in-patient admittance process against hotels, airlines and car rental agencies. At the end of the benchmarking campaign, the consortium managed to cut down the processing time to 11 hours per patient as best-in-class. When they conducted "*Generic*" benchmarking and compared their results, they were able to improve this figure and bring it down to 2 hours per patient; a significant improvement. If the consortium had not kept an open mind and looked beyond their core industry, it would have never had the opportunity to reach such substantial improvements.

Although the above breakdown of Figure 5 does not represent all classifications or types of benchmarking introduced by literature, it still captures the essence of what is being communicated. For instance, Kozak (2004) uses the term "relationship benchmarking" to indicate what is herein referred to as "collaborative benchmarking". However, Kozak only mentions relationship benchmarking in the context of benchmarking with organizations with which a relationship already exists and trust is established. No mention of mutual benefit or learning environment is made, which is a clear technical differentiation between the two definitions.

Shetty (1993) defines three types of benchmarking in total. The first is strategic, which is the same as mentioned above. The second is "operational benchmarking", and the third type is "management benchmarking". Shetty focuses on cost or ways of increasing product differentiation in the former; and analysis of support functions in the latter. In essence this is a combination of process, functional and performance benchmarking as described above. The only difference is in the definition of Fong et al. (1998), where there is no limitation of what the outcome of the study is, which helps the benchmarking team focus on one aspect at a time. It is difficult to combine analysis of process indicators and outcome indicators since they are very closely linked but are widely different. It is therefore recommended to use the classification by Fong et al. in order to be able to differentiate clearly between process benchmarking, performance benchmarking and functional benchmarking. Indeed, during the implementation of improvement initiatives phase, these must be assessed in correlation to one another.

Patterson (1995) addressed another interesting type of benchmarking: "shadow benchmarking". This type of benchmarking can be easily mistaken for an unethical benchmarking practice against the "unwritten rules" of benchmarking. However in its purest form, it is not. "Shadow benchmarking" means conducting comparisons with a competitor organization without the competitor's awareness of the process. As long as data is gathered from publicly available sources and published data, there is no risk of crossing the red line into unethical benchmarking. But, if the benchmarking team is able to gain access to data that is not publicly available, or material the competitor organization has not released as public, it would be a breach of ethical boundaries and may in some cases be considered illegal. Patterson states

that this is an expensive and time consuming exercise, taking between six and twelve months to complete. The costly part of conducting such a study lies in securing experienced and professional team members to ensure that data is gathered correctly and meticulously, analysed, and transferred to learning, without jeopardizing the company's ethical or legal position.

> *Reflections*: Little benefit will come out of "*Shadow Benchmarking*" in terms of process improvement. Since most companies try to keep the key to their superiority confidential or patented, only dated initiatives or general strategic direction can be gained. In some cases, information made publicly available could actually be misleading, throwing the benchmarking organization completely off track.

Patterson (1995) also classifies "generic" benchmarking slightly differently. "World-class benchmarking" as he calls it, is only conducted amongst "world-class organizations". The author agrees with Patterson that "generic" benchmarking should be carried out with world-class organizations, at least when addressing a single area or process of their business. Since world-class organizations are sometimes found across borders, further challenges are faced and as identified by Helgason (1997) "there is considerably less experience in benchmarking organizations across countries than within countries". This is not always feasible or practical due to political reasons lack of international collaborative agreements.

Ethics of Benchmarking

As can be seen from the above classification of benchmarking practices, there are some fine lines differentiating benchmarking from re-engineering for example, or copycatting. The distinction between ethical and unethical benchmarking can be difficult to establish. Different points of view and agendas complicate the matter even further while some activities could border on the illegal. While there is an abundance of literature about benchmarking code of conduct from third party benchmarking facilitating organizations, there seems to be a lack of mention about ethics in case study / specific application related literature. Evidently, the most popular "Code of Conduct" publication quoted is that produced by *American Productivity and Quality Centre* (APQC) upon which the *International Benchmarking Clearinghouse* and *European Benchmarking* codes of conduct are based.

Numerous authors have pointed to this topic, but none have discussed it in much depth. Some of the most notable ethical constraints are discussed herein to give the reader a feel for what considerations need to be taken into account to ensure ethical benchmarking.

The APQC Code of Conduct consists of eight principles; each has its own sub-bullets that describe the heading and what it entails. The structure is presented in Appendix C as obtained from APQC's publication titled "Benchmarking Code of Conduct" (2010).

Taking a closer look at some of the principles and underlying defining statements, it is obvious that benchmarking should not be used solely as a tool for gaining unfair advantage. Simply gathering data from other organizations and comparing to one's own performance will not yield any favourable results unless it is coupled with a specific action plan that implements improvement initiatives. Benchmarking

will not offer any secret or magic solutions to operational challenges. It will, however, offer an insight into what other organizations excel at and how to implement similar regimes. Trying to bypass the formal communication channels and agreed, standard procedures to obtain more information is not permitted, and even if such information is obtained, it cannot be used in order to warant ethical integrity and honest transactions.

It is important to point out that while an organization obtains information on how it could possibly improve some of its processes, it must be willing to provide information to its benchmarking partners on how they could mutually benefit from the exercise. Sharing benchmarking reports is the most common way of doing this to ensure all partners have the same data and information. Information sharing must be reciprocal, of equal quality and level, complete and timely to ensure a positive benchmarking relationship. Attempting to shortcut benchmarking partners by providing them with less information than agreed, while getting all the information required, is unethical and will affect future benchmarking relationships.

Subsequently, it is important to agree on the benchmarking terms prior to commencing any benchmarking tasks or sharing of information to ensure that all parties are clear on what the objectives, goals and procedures are. Communication needs to be transparent from the start including expected data and information to be received. Hidden agendas are not welcomed in this process.

Besides the eight principles and their underlying defining statements, APQC have developed protocols, the *Do's* of benchmarking. Their purpose is to guide the benchmarking organization with regards to what to look out for and how to prepare for a benchmarking exercise. A rough protocol was also developed for face-to-face site visits, which can be very helpful, particularly for organizations that are benchmarking for the first time. With practice, many of these behaviours will seem logical and natural, however especially on the first benchmarking initiative, it is recommended to follow the protocols carefully. Finally, specific competitor benchmarking guidelines have been established by APQC since this is one of the most sensitive and tempting types of benchmarking where the ethical boundaries could be easily breached. The main concept in competitive benchmarking is that if you're unsure or uncomfortable, do not proceed. Non-disclosure or confidentiality agreements may be a solution to this issue; nonetheless mutual agreement must be gained as to what data will be gathered and how it will be used. The detailed protocols and guidelines are listed in Appendix C along with the eight principles.

Several other bodies have adopted the Code of Conduct developed by APQC, such as the European Benchmarking Code of Conduct, which considers it in light of European Competition Law, Article 85 of the Treaty of Rome. One of the notable differences between the two codes is the way in which the European Benchmarking Code of Conduct is setup. Although most of the information it contains is very similar, and in some cases identical, to that encapsulated in APQC's code, they have broken it down into a logical sequence starting with the planning phase, moving into making contact with benchmarking partners, gathering and exchanging data all the way through to completing the process. This, in a way, makes it easier for benchmarkers to follow the process and maintain an ethical focus. The guidelines are also very similar with some minor differences accounting for the specific nature of European context.

Reticence to Benchmarking

The value of benchmarking should be clear by this stage:

1. It helps achieve world-class performance by setting realistic, achievable goals that others have in fact achieved;
2. It enables a company's resources to maintain focus and alignment with corporate strategy and vision.

The technique, as popular as it seems to be, still faces some criticism. Detractors argue that benchmarking is merely a way of copying what others are excelling at and exposes a company's weaknesses and shortcomings by "hanging out their laundry". Andy Opsahl's (2006) publication titled: "Does this benchmarking make me look inefficient?" discusses how the public sector in the U.S.A., seems to want to avoid external benchmarking in an effort to conceal inferior performance. This notion is evident even amongst the most professional and prestigious private firms. Williams, Brown and Springer (2012) have comprehensively documented different reasons why employees and companies are reluctant to benchmark. They found that these reluctances fit roughly into four categories, as follows:

- Relating to the soundness of benchmarking (i.e. comparing "apples to oranges")
- Concern about lack of resources (financial, time, expertise, data, etc.)
- Inertia: resistance to change (comfort, fear of the unknown, regulations, etc.)
- Concern regarding impact of implementing new practices (loss of influence, job changes, etc.)

Some of the specific concerns drawn from Table II of Williams, Brown and Springer's (2012) publication, have had direct impact on the author and are discussed in some detail.

"Lack of common definitions of data elements": the problem of comparing "apples to oranges", as it is commonly referred to, seems to exist in almost all benchmarking projects. At this stage, prior to conducting any benchmarking activities, the challenge takes on a slightly different form compared to when it occurs during the benchmarking campaign. The challenges and barriers faced during benchmarking campaigns are discussed in the next section. Although, theoretically, the challenge is easily resolved, the practical implication of defining a common set of indicators for all parties to report on is much more cumbersome. Therefore it needs to be thought of and planned for prior to commencing benchmarking efforts. Complexity factors are commonly used in an attempt to better align "apples" and "oranges". In other words, consider an example where two offshore installations are compared. One is a brand new subsea-to-shore installation using the latest sensors, condition monitoring and automated intervention technology, while the other is a platform installed in the mid 1970's, complete with full processing capabilities including separators, compressors, scrubbers, pumps and more. The platform designed and installed in the 70's is far more complex and uses more "mechanical" equipment that is more difficult to diagnose and maintain compared to the electronics-studded subsea installation which has been designed and programed to resolve many of its own anomalies. Consequently, when it comes to comparing, for example, maintenance costs or outstanding maintenance man-hours, it is not possible to compare the two on par. A well-developed set of complexity factors must be used to be able to compare them as "apples to apples". Furthermore, these complexity factors cannot be generic or simply applied to any comparisons. They must be carefully selected, and altered according to necessity, to

reflect each specific case. McKinsey benchmarking, accepted globally as one of the most reliable oil and gas benchmarking practices, uses a combination of complexity factors that take into account variables such as complexity, size, number of components and other constraints. Even then, disagreements are common when it comes to rankings.

In certain cases, there seems to be disagreement regarding the results or ranking of benchmarking studies, which forms a two-fold problem. Firstly, the main focus should not be to rank or give merit; the focus should be on continuous improvement and learning outcomes. Secondly, it demonstrates the lack of transparency in how standards of merit are determined (Williams, Brown and Springer, 2012). It is the author's experience that projects or facilities contend their attained ranking, believing that they have been assessed unfairly. They feel that reputation is at stake, bonuses at risk, and possibly their jobs too. Through thorough planning and effective communication with management, necessary top-level support can be achieved driving the entire organization towards embracing benchmarking and understanding its improvement and development potential rather than focusing on the numbers. Learning what the practice is and understanding its benefits will eliminate the fear of blame and ensure that employees gain the most benefit from it. Greg Hackett, Managing Director of one of the leading benchmarking firms, claims that the value of benchmarking derives from understanding the process that produces the given data and in formulating ways to incorporate these practices into the organization (Elmuti and Kathawali, 1997).

If it later appears that the same apprehensive attitude still exists, then management is responsible for reassuring employees and refocusing attention on improvement and learning. Publishing clear standards of merit and explaining the areas and basis of comparison to provide contentment and avoid demoralization. The flip side of this not being managed properly, is false reporting of data to give an impression of better performance than actually achieved and a reduced learning potential.

"Errors in data" becomes the resulting detractor, which many use as a reason for not benchmarking. "*The data reported does not represent actual performance levels anyway*"; "*People just report the good results to secure their bonuses*". "Lack of common data collection procedures" along with "lack of funding for benchmarking analysis or implementing new practices" are the two most common reasons recorded for reluctance to conducting benchmarking (Williams, Brown and Springer, 2012). Therefore, developing a common data collection procedure, especially when it comes to conducting internal benchmarking, is absolutely crucial and must be reviewed during the initial planning stage of the benchmarking study. Ensuring a robust and comprehensive data collection model will simplify the process and circumvent confusion with regards to what data should be gathered and how this should be done. Most importantly, it will significantly enhance efficiency and therefore reduce resource requirements. Expenses related to travel, indirect costs associated with employee time devoted to team meetings and travel (Feltus, 1997) can be reduced by tackling benchmarking one step at a time. Working efficiently as well as communicating effectively are both key to minimizing costs and conducting thorough planning. In general, the average cost of one benchmark study has dropped from $50,000 in 1992 to only $5,000 by 1996 (Elmuti and Kathawali, 1997). So evidently, thorough planning and communication are key to efficient benchmarking and making the most of resources available.

Another important concern addressed by thorough planning is “implementation of unrealistic standards of merits” coupled with “preference [by management] not to know the truth”. These were documented by Williams, Brown and Springer (2012) and are quite closely related. Companies trying to produce better numbers quickly can cause employee burnout, errors and the need for rework (Elmuti and Kathawali, 1997). Line organizations that continuously miss their targets become demoralized, job satisfaction drops and productivity is affected. Focusing on achieving benchmarking targets could actually be leading the organization away from the original goal and off the strategic path with regards to a balanced performance outlook.

Therefore, the goals, outcomes, methods, resources and expectation during the planning phase must be clearly outlined and documented. Current performance must be reviewed and enclosed, if available, to justify the need for benchmarking and the set targets. Management buy-in is then gained through exposing them to these figures early on, and agreeing on the outcomes prior to commencing the benchmarking exercise. This averts corporate divisions setting unrealistic goals which add unnecessary pressure on project teams and forces them to either succumb to the fact that such goals are not achievable (demoralizing) or report “fudged” figures.

As an example, consider production efficiency (PE) as an indicator. Since this is a figure that directly impacts the bottom line of an oil and gas operator company (profits), there is much focus on this single number. What is behind the number is in fact a simple mathematical ratio comparing actual production volumes to potential or possible production volumes (Figure 7). Potential production volumes are set based on a model of several variables including reservoir estimates, reservoir draining strategy, geological data, well characteristics and platform production capacity, amongst others. It should be evident that this exercise is highly complex and inconstant due to the number of parameters involved and ever changing well behaviour. Consultations and interviews indicate that production volumes should rather be used for benchmarking whilst sensitive PE ratios and similar “outcome indicators” remain confidential. This will motivate the crew, prompting them to deliver better than their historical records and simultaneously enable management to keep an eye on problem areas for improvements.

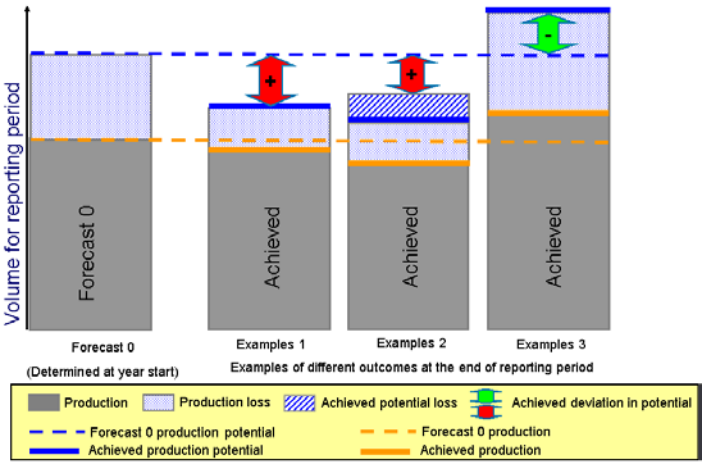


Figure 7. Visual Representation of Production Efficiency (MIS Statoil - “APOS”)

The second deterrent mentioned above, namely “preference [by management] not to know the truth”, also carries a second dimension. As discussed in several literatures (Driscoll, 1999; Bert, 2009; and Achtemier and Simpson, 2005) it appears that within some larger organizations there seems to be an informal three-tier structure. The highest structure represents the financial, resource management and strategic management of an organization. The middle tier is more involved with management of operations, definition of procedures and processes and maintaining company culture. The third tier represents the “units that fill the remaining space” which is basically everyone involved in the

implementation of projects and tasks. The middle tier reportedly seems to operate as a type of “screen” between the implementation teams and the organization’s top management. Acting as an unofficial filter of “bad news”, only “just as expected” news is reported while bad news is pushed back for operating teams to resolve. While top-level management are often unaware of this, or choose to ignore it, it can lead to challenges getting further complicated than they originally were, potentially distorting the channels of responsibility and accountability. Hence, it is important to create a corporate culture that encourages employees to be courageous, open and willing to speak out. Encouraging employees at all levels to report on their findings, no matter how bad the results are, will guarantee that issues are resolved before they snowball and get out of hand. This will only happen when top level management are aware of what is going on within their business areas, maintaining clear official communication channels that protect the individual’s identity and focus on resolution and improvement rather than blame.

Another important point, which seems to surface in every discussion, is that the benchmarking rankings as well as recommendations resulting from benchmarking campaigns that are meant to help seal the gap, are often given too much weight. It must be understood that benchmarking delves beyond the numbers and into the enabling processes. Unfortunately, too often benchmarking focuses on data as opposed to the processes used to result in that data (Muschter, 1997). Operations, projects and the company as a whole should review the numbers, assess them in terms of in-depth analysis of enabling processes and practices, capture best practice and adapt suitable measures that will result in the most effective gains and align well with company and team cultures. To be able to do this, there must be a clear separation between rewards and benchmarking results. Again, this reverts back to management expectations and positive leadership, where instead of focusing on the end results, management places more value on learning and development. Achieving this will allow the organizations’ line teams to focus more on the improvement suggestions instead of spending time and energy justifying or contesting their results.

Although all tabulated concerns in Williams, Brown and Springer’s (2012) publication are valid and form valid reason for evident reluctance, leadership seems to be the common theme across the board. It is imperative to establish committed leadership that believe in and support the benchmarking process. They must support their organizations in learning about benchmarking and its intent, while establishing and maintaining clear and open communication channels. Employees’ attitudes towards benchmarking often reflect their managers’ level of commitment and enthusiasm (Williams, Brown and Springer, 2012).

Based on Williams, Brown and Springer’s (2012) study, best practices to overcome benchmarking reluctance converge into four sequentially related categories listed below and presented in Figure 8.

1. Front-end planning and analysis
2. Gain initial management buy-in and commitment
3. Establish formal methodology and plans
4. Support continuity of benchmarking process

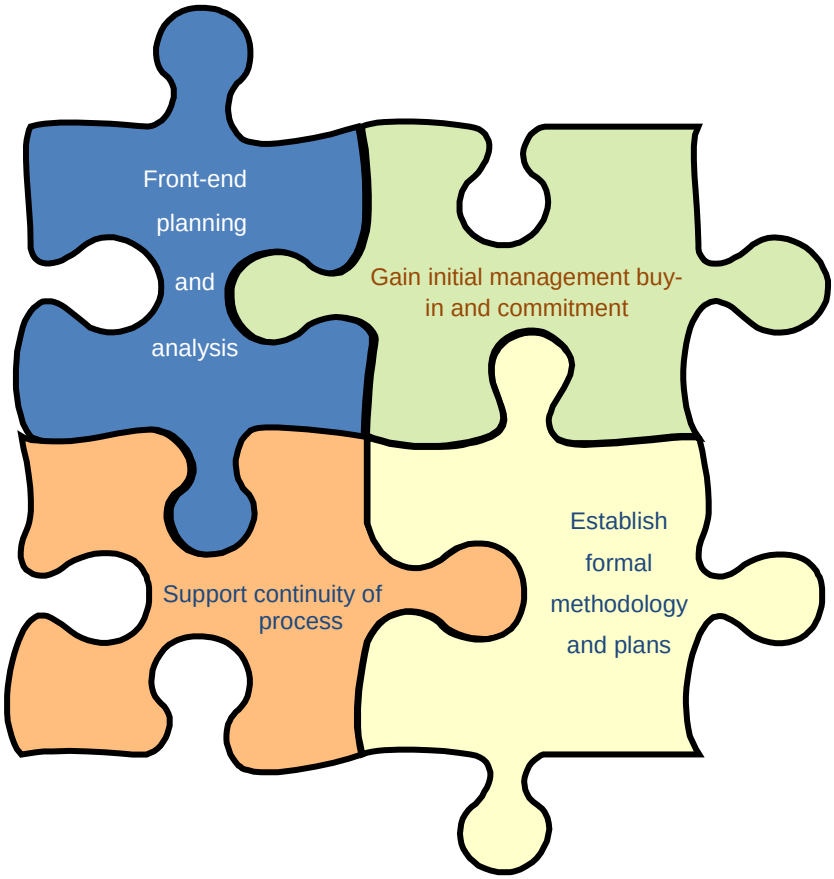


Figure 8. Best practice to overcome benchmarking reluctance

Challenges / Barriers of Benchmarking

In this context, challenges and barriers of benchmarking are quite different to the critiques of benchmarking discussed above. Once benchmarking is accepted and a decision has been made to use it as a performance driving tool, the challenges and barriers are these issues faced over the course of the process. Some of the most commonly noted challenges and barriers are discussed below; some apply to Statoil while others are covered for illustrative purposes. For a more comprehensive listing of benchmarking barriers and challenges covered by the literature, refer to Williams, Brown and Springer (2012).

In no particular order, the first challenge relates to overcoming resistance by employees and / or management to benchmarking. Once the practice is adopted and a company commits to using benchmarking as a tool to drive performance, there are always some sceptics who show resistance. Some of the reasons why employees are sceptical relate to company culture and employee attitude. For those believing that benchmarking is “spying” on the competitors, it must be understood that by benchmarking, management cannot lower their guard in terms of creativity and innovation (Boxwell, 1994). According to Walleck (1991): "*The purpose of benchmarking is to expose managers to new ways of doing things in order to spark creativity, not to create efficient copy cats!*" (Walleck, 1991, p. 4). Benchmarking provides a means to identify the gap between one’s own performance and that of other companies and in some instances learn and adapt some of the best practices they use. It is still essential to be creative both when adopting practices and when improving on practices to gain superiority.

Other employees are reluctant to get involved and simply refuse to comply with new policies, whether it is due to stress factors, related to working outside of their comfort zones, or learning new skills (Amaral and Sousa, 2009 and Elmuti and Kathawala, 1997). Others, who are more innovative and competitive, seem to lose interest and get discouraged especially if they see that the aim of benchmarking is mainly targeted towards matching competitor's performance and simply adopting common competitor practice (Shetty, 1993). In contrast, while some would rather adopt competitor practices, others are reluctant to accept such additions to their organization. The "not invented here" syndrome described by Amaral and Sousa (2009) displays a special kind of reluctance where employees are not willing to incorporate any products or practices developed elsewhere. This is also not encouraged since in some instances it is wise to accept practices from other organizations while improving and developing them further. Arun Maua, Vice-President at Arthur D. Little states that "you can't just impose a best practice. It has to be adapted to your own company's style".

In some cases it is the organizational culture that induces this inherent resistance. Organizations considered to be "not a learning organization" seem to possess a culture where knowledge transfer, learning from past experience, problem solving and experimentation are not common. This reflects upon the employees, who are not used to seek or share knowledge (Amaral and Sousa, 2009).

One of the most challenging phases of benchmarking is the implementation phase, which logically poses some of the most delicate challenges to deal with. In some instances lack of proper implementation is a result of inadequate or insufficient employee skills when it comes to benchmarking implementation. A lack of understanding of the organization's products and services leads to frustration and stagnation in the process, which could be due to inadequate training or poor leadership (Amaral and Sousa, 2009). Poor planning during the initial phase and failing to clearly identify the goals of the process, tasks, resources and deadlines appear later down the track and adversely affect implementation. Another common challenge presented by Elmuti and Kathawala (1997) as one of the most common implementation challenges, is lack of involvement from employees within the line organizations during the benchmarking process. Commonly, the benchmarking process is carried out by a corporate performance management team or a dedicated group that does not include those, who are actually responsible for delivering the results. During implementation, challenges arise due to the disconnect between organizational levels, leading to poor implementation and frustration that affect not only the conducted benchmarking effort but any future benchmarking campaigns due to its bad reputation. Linked to this issue, is the inadequate definition of the benchmarking scope. Since, in some instances, the line organization employees are not sufficiently engaged in the process, the topic becomes too broad or poorly articulated using management jargon that is too abstract to measure or implement in practice (Amaral and Sousa, 2009). So, it is important to actively engage the employees during the process, since they will be the ones actually using the information and improving the process (Omachonu and Ross, 1994).

Regrettably, benchmarking is commonly carried out as a once-off exercise. This is in fact a poorer solution than not carrying out benchmarking at all. The concept of "ignorance is a bliss" may work well as long as the company is profitable. In cases where benchmarking is used as a last resort when companies are failing, it is then too late to benchmark. Conducting benchmarking as a one-time project results in a very limited comparison scope, poses the risk of misinterpreting or misusing the information and does

not allow the organization sufficient time to get acquainted with best practices in order to adopt and adapt them. Carrying out benchmarking as an on-going process allows the company to develop its knowledge and expand its scope of companies studied: looking at competitors, non-competitors within the same industry, and other companies in different industries (Elmuti and Kathawali, 1997). This is the exposure a company needs to advance to the top by applying benchmarking effectively.

Another challenge that benchmarking organizations are repeatedly hurdled with is the lack of clarity on where the data originated. This is an issue encountered in both stages, reluctance to benchmarking prior to conducting it and a source of confusion during benchmarking campaigns, which is why it is highlighted again. During the process, it mainly relates to how well staff involved with benchmarking, are aware of the objectives, process and data flow. If those gathering and compiling the data have a clear understanding of the process, and incentives are not tied back to reported performance rankings and in addition analysis is carried out in an open manner, communicating what the merits of evaluation are and how complexity factors are used, this challenge does not cause any concerns. Elmuti and Kathawala (1997) have come across and documented incidents where errors were made in the comparison of data because either the data was gathered based on different understandings or because the evaluation methods were not transparent and well aligned. They noted the example of Intel Corporation, where benchmarking efforts did not succeed due to them needing to spend an extensive amount of resources on reconciliation of data, so that they could compare apples-to-apples. This rework yielded the study "incredibly unproductive" and therefore did not provide them with the gains they were expecting.

Current Models

As the literature in the subject matter has been predominantly based on the application / case study theme, it is understandable that there have been many different models suggested over the years. A few of these models that gained wide acceptance and were the basis for further development are discussed in this research.

It is only fitting to begin by analysing one of the first documented and widely accepted models, which was used by Xerox during their benchmarking campaign in the late 70's and early 80's. This model has been the basis for many later developed models and seems to form the ground level of benchmarking practice.

In 1989, Robert Camp wrote about the "10-step process" Xerox adapted, sharing the success story, process, challenges and essence of benchmarking with the world. Listed below are the five sequential phases suggested as part of Camp's (1989) model, the full 10-step process is graphically presented in Appendix A:

1. Planning
2. Analysis
3. Integration
4. Action
5. Maturity

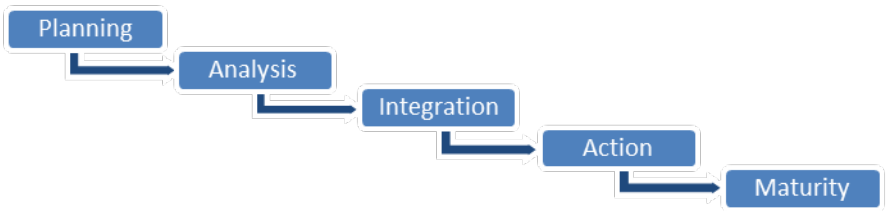


Figure 9. Xerox's benchmarking model. (Camp, 1989)

Xerox began the process in the late 70's primarily because their Japanese competitors were selling copiers at prices lower than the manufacturing cost Xerox was able to achieve, and were still making a healthy profit. They started the journey at Fuji Xerox, their Japanese affiliate, and branched out from there.

The first phase was planning. It included processes such as identifying what to benchmark. Unit-manufacturing costs were examined by comparing product quality and selected product features. Initially, managers were focusing on comparative costs; though after gaining some experience in benchmarking, they focussed on processes, practices, methods and factors that could be adapted to achieve the benchmarked costs (Shetty, 1993). It was crucial to the success of the project to identify the activities that represented a significant part or a growing proportion of the costs, "priority candidates" as Camp labelled them. Shetty (1993) highlights Porter's value chain as a useful tool to help identify such activities.

Another important contribution Xerox made early on in the benchmarking game was to recognise the potential value in benchmarking organizations outside of their immediate competitor or even industry portfolio. For instance comparing notes with L.L. Bean, the catalogue sales company with a strong track record in warehousing and distribution, they were able to gain valuable insight supporting their logistics and distribution functions. Through this comprehensive study, they demonstrated that benchmarking partners should be selected based on their merit in the specific function in question, regardless of their line of business or scope. This was part of Camp's second step in the first phase: whom to benchmark.

The third step involving data collection and analysis could be one of the most formidable tasks especially when benchmarking with competitors or an organization with which there was no prior association. Several sources of information are available such as business libraries, newspapers, journals, corporate and company publications as well as presentations at public meetings and conferences, yet the most effective source of information is the customers, as several studies demonstrate. Customer surveys provide information about competitor's products, services and pricing. In industries where information is slightly harder to obtain from customers, such as the maintenance industry, company employees are an excellent source of intelligence through both their professional and personal networks as well as previous experience. Suppliers and distributors could also be used as long as ethical boundaries are maintained and communication is regulated. Of course, direct contact and collaboration is the most obvious and direct route, if the possibility exists.

During the third step of the process, where data collection method is selected and data collected, it is critical to clearly understand internal processes both of one's own company and that of the benchmarked organization, rather than simply focusing on the end results. As mentioned above, this requires some experience in benchmarking in order to be able to look beyond the outcomes and identify the underlying practices. Once the data is collected, analysed and the performance level of the organization as well as its competitors clearly defined, it is necessary to set the target future performance levels. As highlighted previously, this must be done in collaboration with the "third tier" of the organization to ensure realistic goals are set and ownership is established.

Once the gap is identified and projected, whether positive, negative or parity, practical action plans must be developed. Action plans will depend on the outcome of the gap analysis. If the gap is positive then a

strategy for maintaining superiority is required. If the analysis indicates negative results, then an action plan enabling the organization to improve performance and gain superiority should be developed instead. Finally, specific actions, periodic measurements and assessment of achievement should be carried out to ensure stated goals are actually being achieved. It is imperative, as discussed earlier, that the people actually performing the work tasks, “tier three”, are involved in defining these specific actions and implementing the benchmarking findings. Another critical factor is maintaining an effective feedback loop to be able to identify any improvements or recalibration actions needed to sustain superiority and alignment with customer expectations.

According to Camp (1989), once all these steps are properly executed and best practices are incorporated in all business processes, then maturity and sustainable superiority can be achieved. Shetty (1993) discusses basically the same process breaking it down into a five step process instead of ten, by combining some of the steps. However, this is not an exhaustive overview of existing processes or models. Although they might represent the basis for many others, there are some that are distinctly or distinctly different.

One of those peculiarly different models is that developed by Watson in 1993 (Watson, 1993 b). Watson simplified the process down to four high level but logical questions. Some view Watson’s model as too general and high level, while others have accepted it such as Boeing, Digital Equipment, Motorola and later Xerox (Ahmed and Rafiq, 1998). In the author’s view, the questions that make up the framework are very high level and could be easily misinterpreted or misused. Organizations planning on adopting Watson’s model must have a good understanding of and experience with benchmarking before attempting to address these questions. This will avert addressing only surface issues without actually making valid detailed conclusions or improvements. Listed below are the four questions along with the graphical presentation (Figure 10) of the template developed by the companies mentioned above (Ahmed and Rafiq, 1998).

(1) What should we benchmark?
(2) Whom should we benchmark?
(3) How do we perform the process?
(4) How do they perform the process?

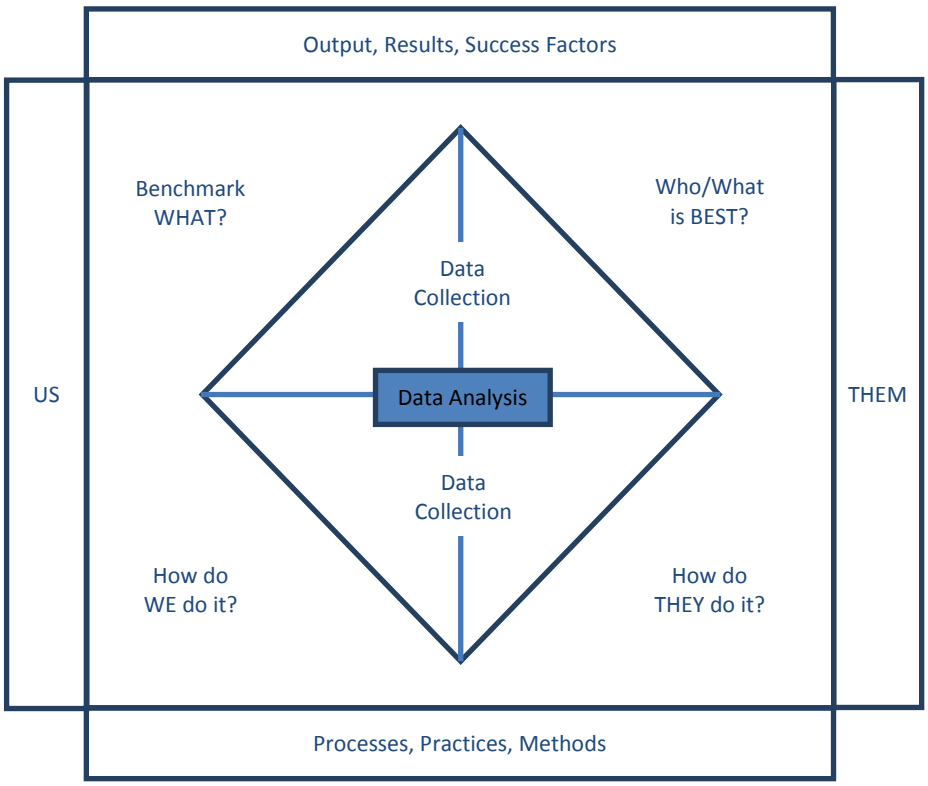


Figure 10. The benchmarking template developed by Boeing, Digital Equipment Company, Motorola and Xerox. (Watson, 1993 b)

Due to the fact that these four questions are set at a very high level, they establish the framework for a process and a more detailed breakdown is required to complete the model. Xerox is usually the recommended model to be followed, even in this case, to get a more detailed description of actions required.

Another similar benchmarking model to Watson's is presented in the first figure of Appendix B for completeness purposes. It shows that the process can be customized to fit a specific industry or application. Avon Products' benchmarking model developed by McNair and Liebfried (1992) identifies customer needs and then focuses on internal and external key staff to gather relevant information before identifying gaps and implementing improvements.

A common theme within the models above is that they all focus on understanding internal performance, comparing it with best practice to identify the gap and then implementing some sort of improvement campaigns. As effective as this has reportedly been, benchmarking alone is not a complete tool for continuous performance improvement aiming at world class. Such a tool must be integrated into a wholesome approach to truly be able to achieve world-class performance.

Only few authors have described examples of such integrated approaches such as Ahmed and Rafiq (1998), Bhutta and Huq (1999) and Ross and Droge (2001). The concept is to couple benchmarking models, such as the ones described above, with other types of performance measurement and management tools such as Balanced Scorecards, Analytical Hierarchy Process (AHP) technique, spider diagrams and other gap analysis tools, service quality framework (SERVQUAL), strategic measurement analysis and reporting technique (SMART) system and the viable systems model, among others.

The reason multiple performance measurement tools and techniques are used is to help address shortfalls of some techniques and cover different areas for improvement. Even if two or more techniques address the same area, results can be used to verify the assessment or provide a different perspective. Different results do not necessarily mean that one method is superior to another. It just indicates that different perspectives have been identified; and the differences should be celebrated. For instance, the EQA model presented in Figure 11 provides a comprehensive overview of the dimensions to be examined to produce organizational excellence. Whilst the model encourages best practice, it does not define what best practice actually is or what the metrics are to achieve improvements. As an end result, EQA can provide a useful one-dimensional gap analysis; however, trade-offs need to be considered to truly achieve the best results. In this case tools such as balanced scorecard or spider web diagrams can be integrated for improved results.

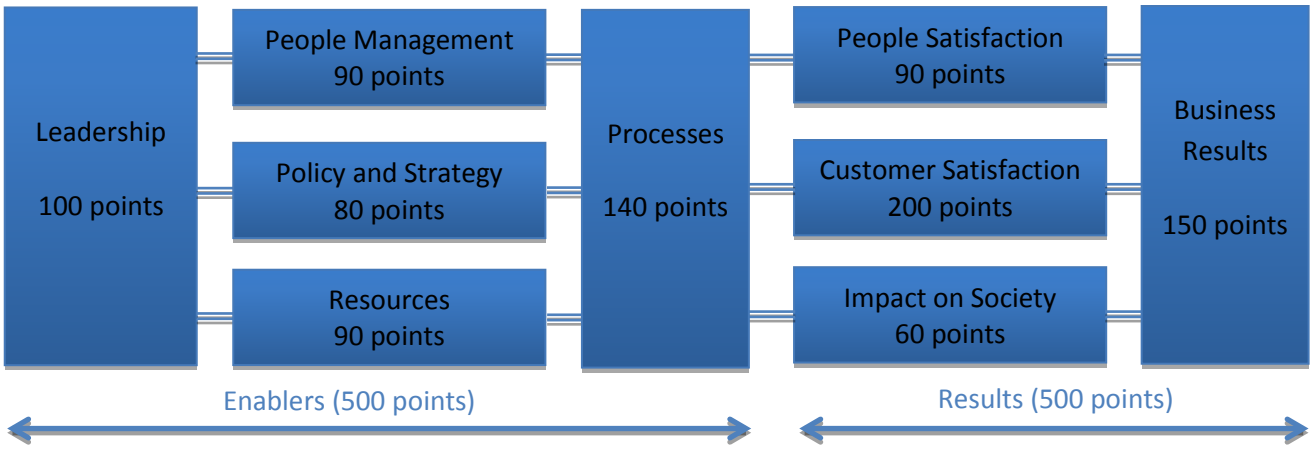


Figure 11. European Quality Model or European Quality Award (EQA) (EFQM, 1996)

Later in the report, "Section 3: From Good to World-Class" discusses in more detail the concept of "*Integrated Benchmarking"* and suggests how Statoil can make the most of its highly developed Balanced Scorecard and other practices in combination with benchmarking.

Reflections: The performance-management models presented in this section provide the basis for the *Integrated Benchmarking* reference-model where a more comprehensive awareness of balanced perspectives, along with specific measures, is suggested.

Benchmarking in the Standards

When reviewing "the standard" in benchmarking, it is interesting to analyse the different views and opinions of several stakeholders. There is no such thing as "the standard" when it comes to benchmarking. Different people at different levels of the organization and on different sides of the benchmarking table have a diversity of opinions, which may be contradictory in some cases. While the regulating authorities seem to have a fairly loose and undefined perspective on benchmarking, merely stating that companies should always strive to achieve better results, other organizations such as McKinsey or APQC view it as minimalist effort to be competitive in the industry. In this section, different perspectives of benchmarking standard and expectations are reviewed and discussed.

The views of the regulating authorities are taken with respect to a specific topic: Operation and Maintenance. This is considered one of the most critical areas for ensuring good performance within the oil and gas industry, both in terms of impacting the bottom line and production, and for its adverse potential in creating hazardous situations.

Within this framework and taking a closer look specifically at the Health, Safety and Environment (HSE) aspects of benchmarking within Operation and Maintenance. It is relevant to review what PTIL, Petroleumstilsynet or Petroleum Safety Authority, has to contribute. In interviews with resources within PTIL, the general advice to companies is to carry out benchmarking by comparing data by means of self-run initiatives and making use of the data and reports available from PTIL as a tool for continuous improvement. There is no concrete, documented guideline or standard that states that benchmarking is required or must be carried out to a certain acceptable level. Nevertheless, in section 47 of Chapter IX in the "*Regulations relating to conducting Petroleum Activities*", there is a clear mention of incorporating performance-monitoring activities into the maintenance program for activities with an associated HSE risk in case of a fault. The regulations go on to state in section 49 of the same chapter: "maintenance effectiveness shall be systematically evaluated based on registered performance and technical condition data" and concludes by stating: "evaluation shall be used for continuous improvement". So although not explicitly stated, there seems to be a suggestion that benchmarking, or the effort of continuously measuring, assessing and improving performance, is required for all activities that could have an adverse effect on HSE.

The IEC (International Electrotechnical Commission), now in a collaborative effort with ISO (International Organization for Standardization), makes several statements well-aligned with benchmarking and continuous improvement in their *Application Guide – Maintenance and Maintenance Support* publication. In chapter 8 of the guide, IEC states: "improvements need to be made during the operation and maintenance phase as experience is gained, situations change, equipment ages and new techniques become available". To do this, it is necessary to be aware of initiatives run by other organizations within and outside one's own industry, which in turn is benchmarking as long as the motive is to reach better and possible best performance. IEC goes further and states: "measurements can be compared (for similar equipment) to industry best practices, or other users, and for use when benchmarking services".

Empirical Study, Results and Analysis

Section 2: What does Benchmarking mean for Statoil?

As mentioned before, this report attempts to identify the most effective method of incorporating benchmarking into an organization's daily operations and procedures in its endeavours to reach world-class performance. Prior to this point benchmarking has been discussed in general terms and the findings can be applied to any organization regardless of size and complexity. However, there is an underlying goal to this study. Working closely with Norway's largest oil and gas operator or E&P company (Exploration and Production), it is of relevance here to examine how such a high-performance organization utilizes benchmarking. To do this, the first step would be to formulate the company's own definition of the term benchmarking; after which, it is useful to understand what objectives Statoil wishes to achieve through this practice.

Benchmarking is not a new practice adapted recently by Statoil, nor is it a fancy corporate statement that doesn't make it past the boardrooms and presentation slides. Benchmarking has become a part of the business in every aspect and within every division of the company in an effort to understand and compete with the world's best. From the "*Benchmarking – basics*" (2003) presentation, the agreed definition within the company is translated as follows:

> *"Benchmarking is **measuring** and **comparing** products, services, processes and functions with the best, to **identify**, **understand** and **implement** better ways of conducting business as part of the company's effort for continuous improvement."*

On the broader level, Statoil's objective, in terms of performance, is to be recognized as a top-quartile performer in the industry. *The Statoil Book* (STB), the company's highest-level publication and a fundamental element of the management system that describes the company's most important policies and requirements, considers benchmarking part & parcel of the operating model with respect to "strategy development and target-setting". Figure 12 explains the hierarchical relation of the company's management system, where it can be seen what *The Statoil Book* encapsulates.

Figure 12. Statoil Management System (The Statoil Book, 2011)

Target setting falls within the "*Ambition to Action (A2A)*" process, which is Statoil's "integrated performance management process, which translates […] ambitions and strategies into […] strategic objectives, key performance indicators, actions and individual goals". The company has recognized the need for a "dynamic and event-driven" performance management process that can promptly respond to opportunities as well as risks. This has resulted in initiatives such as *A2A* and *Beyond Budgeting,* where projects are sanctioned on an on-going basis centred on their value-for-money rather than setting strict budgeting cycles and stringent budgets to be adhered to. From the figure below and the first principle of the *A2A* process, it can be seen that it is quite well-aligned to benchmarking, almost stating the objective of benchmarking at a general level.

1st key principle of A2A: Performance is about performing better than those we compare ourselves with

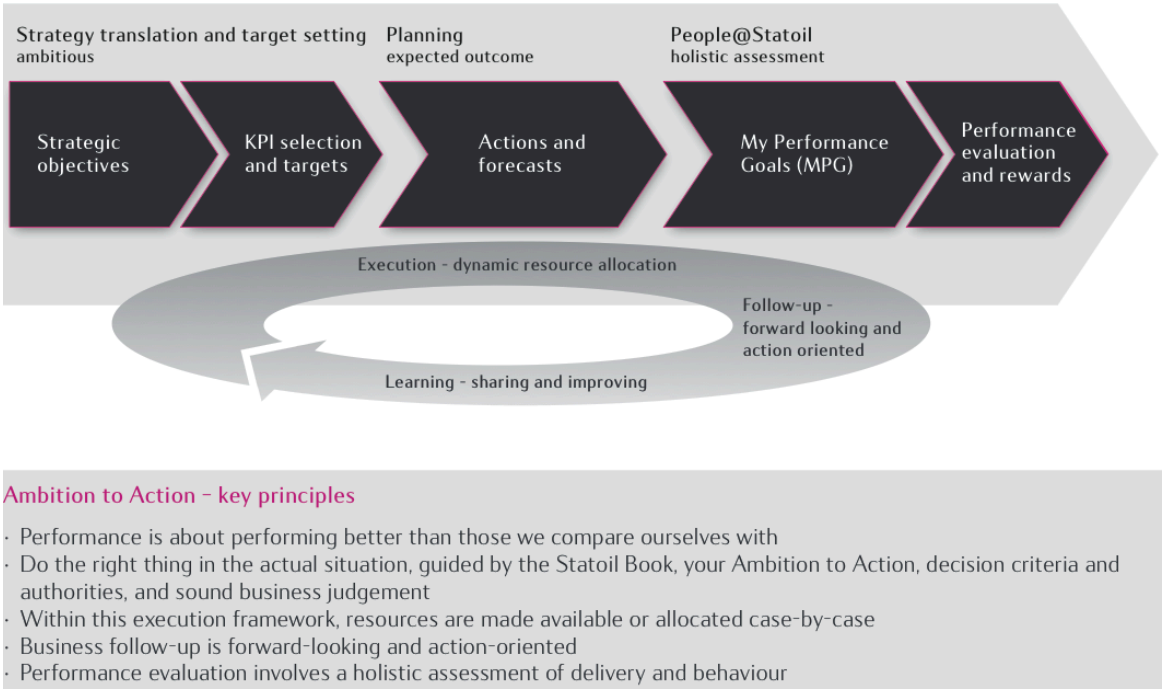


Figure 13. Statoil's *Ambition to Action (A2A)* process (The Statoil Book, 2011)

It is evident that not only does the company hold benchmarking in high regard, but it also encourages and expects both external and internal benchmarking to be conducted to maintain a competitive edge as well as meet stakeholder and strategic expectations. It is further recommended to use benchmarked KPI's in *A2A* in order to promote learning from high-performing entities inside and outside the organization (The Statoil Book, 2011).

The most direct mention of benchmarking in *The Statoil Book* is made with respect to the role and responsibilities of "*Process Owners*". *Process Owners* are managers responsible for supporting the business needs and encouraging standardization based on best practice (The Statoil Book, 2011). They have a global reach, which means that decisions made at a process owner level will affect the organization as a whole. Within Statoil's management structure, each of the significant process areas are managed by a process owner. Examples include value chain processes such as "Drilling and Well", "Operation and Maintenance" as well as "Marketing and Supply" among others; and support processes such as "Health, Safety and Environment", "Supply Chain Management" or "Finance and Control". It is fitting that process owners are concerned with benchmarking and actively pursue it, since their role is to "achieve high operational standards and functional excellence" by capturing best practice and lessons learned and incorporating them into global work processes. One of their numerous "main responsibilities" is to "use benchmarking to drive business performance" ensuring that simplifications and improvement initiatives are carried out across their respective groups (Figure 14).

Develop and improve Statoil global work processes	• Establish and maintain requirements based on criticality • Decide and develop supporting tools and information management requirements	Main responsibilities
Drive simplification and improvement initiatives across the group	• Use benchmarking to drive business performance • Propose improvement initiatives to business areas • Facilitate continuous learning	
Monitor compliance towards Statoil's global requirements	• Establish risk assessment for own process area • Propose monitoring activities based on criticality • Conduct verifications on request from business areas	Supporting roles
Support business areas in deployment of defined positions	• Recommend deployment within process area based on scope agreed with business areas • Advice on competence and capacity gaps within process area	

Figure 14. Simplified and clarified Process Owner role (The Statoil Book, 2011)

The company's highest-level publication puts a lot of emphasis and value on benchmarking, expecting the organization to make use of the practice at all levels. Furthermore, *The Statoil Book* and *Ambition to Action* process are not the only mention of benchmarking. Further down the requirements hierarchy, "*Functional Requirements (FR)*" also captures the value and necessity of carrying out benchmarking, keeping in line with the company's management philosophy.

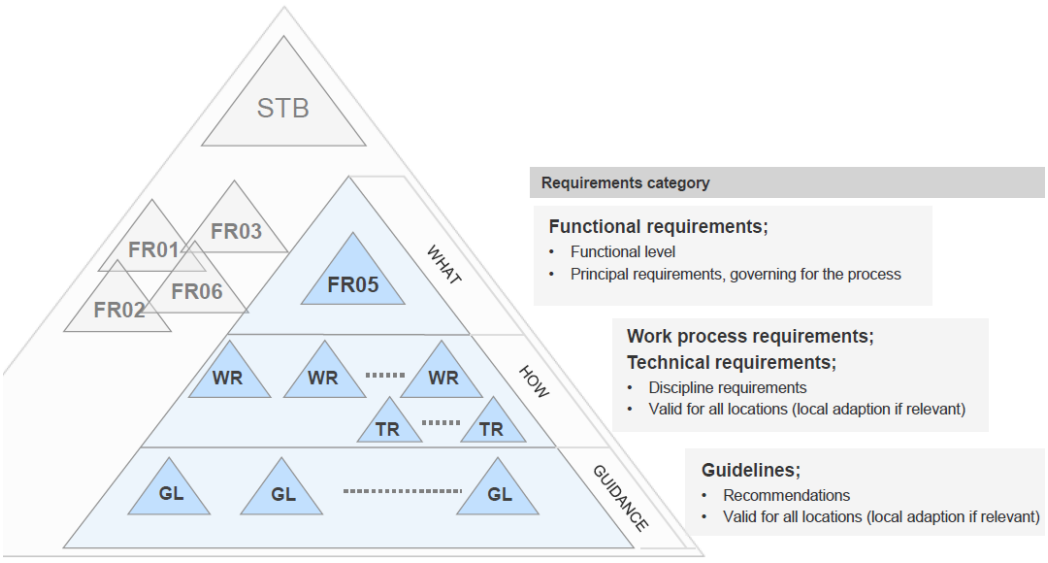


Figure 15. Statoil Requirements Hierarchy (Statoil FR05, 2012)

Statoil's FR06 document, concerned with definition of Statoil's corporate functional requirements for Operation and Maintenance, mentions benchmarking by stating the following:

> *"The main purpose of the O&M function is to deliver safe, reliable and efficient operation and a competitive business for the company […] through: Use of benchmarking and KPI's for follow up and improvement"*

It goes on to place the responsibility of capturing and incorporating best practice and lessons learned into global work processes on the *Process Owner for Operation and Maintenance*. It is clearly indicated that internal benchmarking through "peer assist" shall be considered in order to achieve better compliance with processes, sharing of best practice and encouraging learning across assets and business units. Similar statements can be found within other functional requirements such as FR05 for the Project Development business unit, FR03 for the Drilling and Well business unit, and so forth.

Based on the overarching governing document, *The Statoil Book*, and numerous functional requirements as the one described above, it is evident that the company as a whole embraces and conducts benchmarking to one extent or another. Although there are numerous models, aims as well as objectives within the company and each "value process" has its own culture with regards to benchmarking, there is a high commitment towards regulated benchmarking. In the next section, a review and analysis of some of these different models will be presented to get an overview of how the benchmarking practice can vary dramatically from one department to another within the same organization. A thorough investigation was conducted, trying to get an appreciation of the gap between what is documented in contrast to the actual practice being followed.

Departmental Benchmarking Models

Having demonstrated Statoil's strong commitment to continuous performance improvement and their drive for simplification and standardization through benchmarking, it is appropriate to review, in more detail, how different departments within the organization convert strategy into practice. Initially, the goal was to demonstrate alignment between corporate and the underlying value-chain and support processes as well as amongst the different processes. However, after some investigation it became clear that each of the reviewed processes has a slightly different perspective when it comes to benchmarking. According to the process diagram in Figure 16, each of the value chain processes relies on a set of support processes to enable them to carry out their designated tasks efficiently and effectively. Through interviews, workshops and the internal management system, a review of the highlighted processes was conducted and the essence of each of their benchmarking practices was captured in the sections below. Having a mixture of value chain and support processes offered a broader perspective at two different levels of the organization. The reviewed processes are:

- Drilling and Well (D&W – value chain process)
- Project Development (PRO – value chain process)
- Supply Chain Management (SCM – support process)
- Heath, Safety and Environment (HSE – support process)
- Operation and Maintenance (O&M – value chain process)

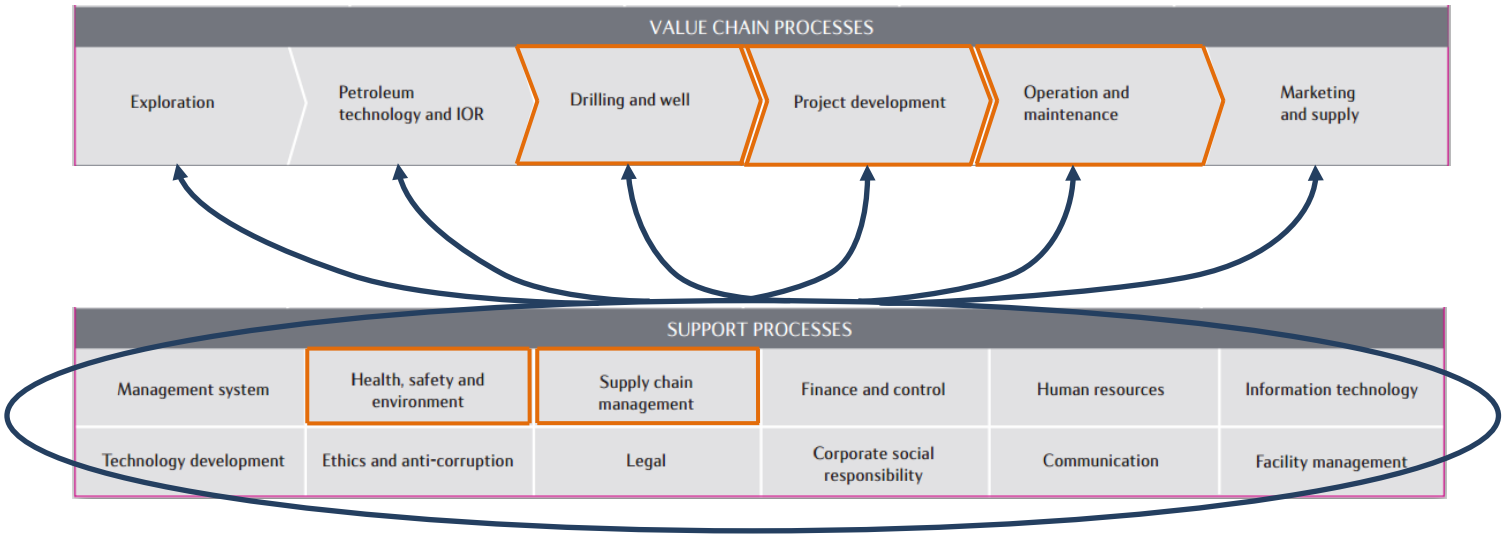


Figure 16. Statoil Delivery Process Structure (The Statoil Book, 2011)

In the following sections, four main benchmarking building blocks are discussed for each of the five business units. First, the objective of benchmarking for each department is presented. In cases where several objectives are present, each associated with a different benchmarking process, then this is clearly highlighted in the description of the benchmarking process. For example, in *D&W* there are two benchmarking initiatives, one internal and the other external, each with its own objective. Secondly, the method of conducting benchmarking is discussed including data gathering, analysis and reporting. The third point is the implementation process. The author believes this to be a critical part of the benchmarking process as a whole and without it substantial improvement will not be attainable. And

finally, the fourth topic includes some of the specific challenges the team faces with respect to benchmarking; this can be in the form of cultural barriers, implementation challenges or other issues.

Figure 17 shows the building blocks of the departmental reviews. In the *Planning* block, such parameters as objective, goals, structure and preparation of systematic benchmarking practice are included. *Methodology* includes *Data Gathering* and *Data Analysis*. Although these are both very important and separate phases, it was clear from the reviews that it is acceptable to combine them. Successful identification and balancing of *Improvement Needs* comes next, encompassing the approach of converting performance gaps into specific, concrete actions that will result in bridging the gap. Without *Implementation of Improvements* the benchmarking effort would be a waste of resources, therefore assessing how departments convert gaps, plans and ambitions into positive outcomes is important to review. Finally, one of the generally neglected aspects of benchmarking, *Feedback and Continuous Improvement*, is not concerned with how each department conducts its business, but rather how they evaluate their benchmarking process and continuously update it to ensure that it adheres to best practice.

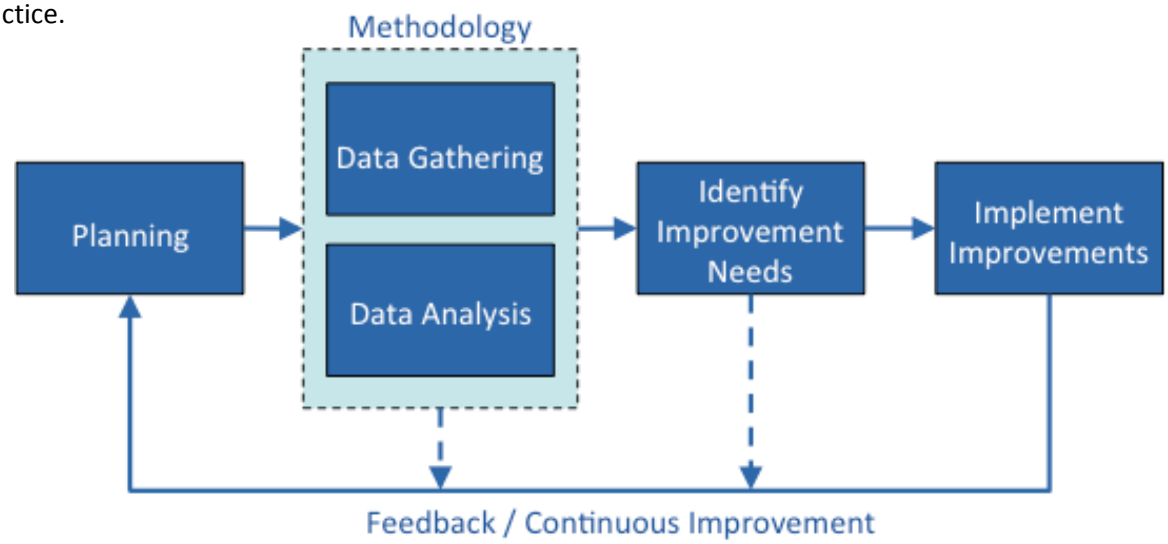


Figure 17. Building blocks of departmental review

Drilling and Well

To start off the review, *Drilling and Well (D&W)* has been selected since this department caries out some of the most safety-critical and cost-intensive activities within the company. It would be expected that this department would be at the forefront of benchmarking, attempting to identify best practice, new technology and improved solutions to reduce the exposure of the workforce to hazards minimize environmental risk and increase efficiency. Indeed, D&W value chain process conducts one of the most thorough benchmarking initiatives with a high focus on lessons learned; however this falls just short of striving to be world-class. Even a clear mission statement was not encountered during the review process.

D&W conduct two forms of benchmarking, an external and an internal campaign. The external campaign is part of a global collaboration run by a third party benchmarking organization that offers unrivalled insight into competitors' performance within drilling, completions and well abandonment. High-level data is generally captured in such review, like the time it takes to drill a well of a certain complexity, cost-per-well in different regions of the world at different complexity levels, etc. The results are then communicated back to company management and in this case are unfortunately only used for planning purposes. Ideally, this would be desirable, if planning was competitive pushing projects to outperform competitors; however this is not the case and plans are generally more conservative favouring predictability performance. For example: a reservoir of a certain complexity, within a certain rock type and at a specific depth that is benchmarked to take the best operators 8 days to drill-to-total-depth would be planned for 10-12 days simply to ensure predictability - counting in enough buffer. This leads to highly predictable plans, which are more conservative rather than competitive, which actually defeats the purpose of benchmarking in the first place. It seems that ensuring a comfortable, predictable performance level somewhere around the top quintile is more desirable than attempting to reach the best and define world-class. Therefore, the objective of the *D&W* department in terms of their external benchmarking effort is to raise awareness of what others are doing within the industry, without a clear objective of attempting to be best-in-class, and for planning purposes.

The other type of benchmarking the *D&W* business unit conducts is internal benchmarking, which has a slightly different focus and objective to external benchmarking. Internal benchmarking is part of the *BOOST* process, which is tied back to *proNova* - a system displaying real-time live data from all rigs and operations on the Norwegian Continental Shelf (NCS). The *BOOST* process offers a closed-loop solution that is dynamic in nature, meaning that it is updated and used on a daily basis allowing for a prompt and direct feedback channel. More detailed data is captured within the *BOOST* system compared to the external benchmarking conducted by the department and is used during morning briefing meetings to provide work crews with the opportunity to improve the current day's plan based on previous day's performance. Through the *BOOST* process, teams can plan daily activities, set targets, follow up operations and measure performance for internal comparison and improvement. Another aim of the *BOOST* program is to align and standardize operations such as conducting morning briefings or reading drilling logs. This is where the *Subsurface Support Centre's (SSC)* role becomes crucial.

SCC is responsible for analysing performance data at a detailed level, and up to a rolled-up, overall company perspective, and thereby introduces improvement initiatives and captures best practice. The

aim of *SSC* through the *BOOST* process is to improve overall company performance by comparing company-operated facilities and raising overall performance to company best. Weekly and monthly rankings are released internally so that rigs are aware of their performance position within the organization, encouraging them to initiate improvement initiatives through the *A2A* process.

As commonly noted amongst most departments, there is no defined process for implementing improvement initiatives, this is left up to the individual teams as part of the *Ambition to Action* management philosophy, where each individual is expected to make a contribution towards strategic objectives. Although this does work out well in most cases and improvements are in fact implemented, learning is confined to a small group without spreading across the organization.

Similar issues on different facilities are not identified and resolved in a similar manner, resulting in significant parallel efforts and wasted resources. As a response to this challenge, *SSC* developed "*The Casebook*". The Casebook is a database populated with lessons learned and best practices. This is a valuable initiative since the *SSC* team is central to all drilling operations. In accordance with operating procedure, whenever an incident occurs during drilling operations, the *SSC* team is contacted and asked to gather the required case data to make recommendations for possible solutions. So, it is very useful that the same team resolving issues, also maintains this lessons-learned and best practices register. Theoretically speaking, this is a very valuable concept, but it seems that "*The Casebook*" has not yet gained the popularity it deserves, and unwanted practices have apparently been recurrent on numerous occasions. A culture change and management backing is required to push the practice across the organization.

Nonetheless, with every good initiative or set of practices there are detractors; one of the significant concerns noted is how rankings are tied to incentives or bonuses. As discussed earlier in the report, this is not advisable and is counterproductive because it creates an unhealthy competitive environment where numbers could be altered, performance masked by other activities, or conflicts instigated regarding measuring and reporting criteria. Maintaining focus on the enabling processes and potential for improvement is the recommended method of dealing with benchmarking to avoid such conflicts.

To sum up: the objective of benchmarking within *D&W* is slightly different and somewhat misaligned with *The Statoil Book*'s vision. In this example benchmarking is used more for planning and for performance improvement up to a comfortable, predictable level around the top quintile range, rather than aiming for world-class. It was also noted that although the company is involved with development of new technology in the field of *D&W*, it is reluctant to use such technology and would rather stick to common, known practices. A good example of this approach is the development of steerable casing drilling, which was developed through sponsorship and qualification by Statoil and has not been actively used since.

Project Development

The *Project Development* (*PRO*) unit is responsible for developing investment projects from the initial phase all through to the final investment decision (Decision Gate 4 - DG4; Figure 18) in a structured approach, maintaining a high level of quality, predictability and competitiveness, while ensuring alignment to the functional requirements and governing principles of the organization. The unit is made up of several sub-processes responsible for different parts of the team's scope including global work processes, process improvement and functional support. In focus, with respect to benchmarking, is the *business process improvement* (*BPI*) group, responsible for supporting individual projects and improving performance company-wide. First, the official, documented process is described, before delving into the actual implemented process found in practice that was identified through interviews and discussions.

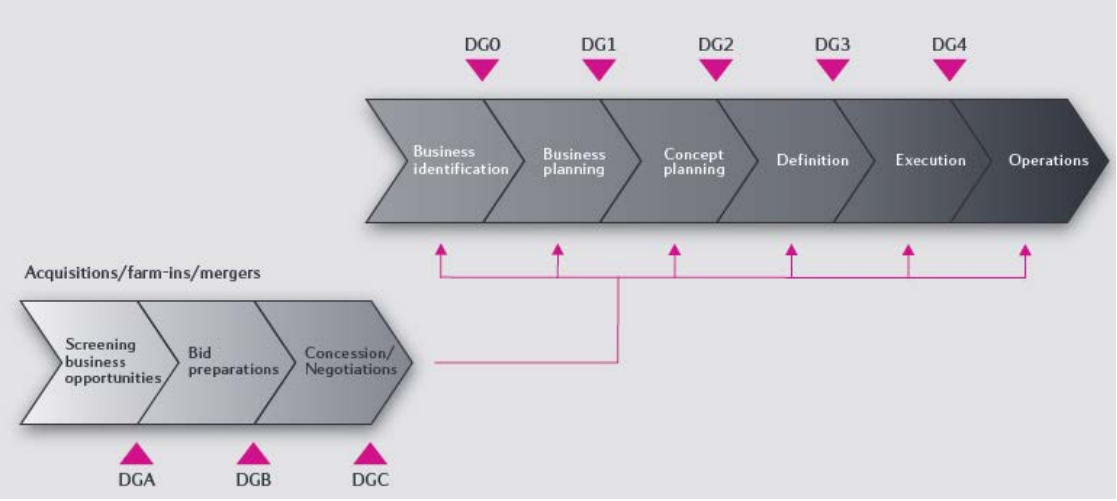


Figure 18. Capital Value Process (The Statoil Book, 2011)

The group carries an overarching mission of "*building a pathway to asset success*"; and regular external benchmarking campaigns, down to the individual project level, enables them to identify performance gaps and initiate improvement activities. The objective of benchmarking is to "measure [internal] performance to improve operational effectiveness" (*BPI* team site). Clearly, in this context, benchmarking is not used to achieve world-class performance or best-in-class status. A more passive tone is taken, where the outcome of the process is to compare similar projects and identify possible needs for resources or corrective actions. Furthermore, it is meant to assist in the assessment of whether ambitions are set too low or, surprisingly, too high. In this sense, the strategic objectives of benchmarking within the *PD* unit and the perception of the objectives by resources actually conducting benchmarking seem to match quite well: compare projects internally and externally to get an understanding of relative performance and implement changes necessary to introduce continuous improvement; not necessarily towards world-class. Furthermore, the functional requirements state that benchmarking will be carried out at set intervals apportioned by decision gates. Internal benchmarking, according to the requirements, will be carried out after each of DG1, 2 and 3. While external benchmarking will be applied to projects with capital expenditure larger than a specified amount and at DG2, 3 and 4 (*Functional Requirements FR05*, ver 6). This seems reasonable; the question is however: Is it actually followed in practice?

Taking a closer look at the practical application of benchmarking within the group, alignment with governing documents can be considered. Firstly, the process used by the *PD* team focuses mainly on external benchmarking through a preeminent project evaluation consultancy that is responsible for gathering and analysing data, producing summary reports and drawing up recommendations based on their findings. Data is gathered internally by the *PD* unit and amalgamated by the *BPI* team before being shared externally with the consultants, who are allowed some access within the organization to analyse the required data. Once the analysis is carried out and comparisons are made, a benchmarking report is compiled including league tables against external competitors, rankings within internal facilities and recommendations for improvement.

Such an effort is conducted four times along the *PD* scope. Once after each of DG2, 3 and 4 and a final assessment one year post DG4, called DG4 + 1. Upon completion of analysis and submission of the report, a meeting gets scheduled to discuss findings and elaborate on implementation strategies for the improvement initiatives. Compiled data and results are used thereafter for internal benchmarking to get an indication of performance within the company and to identify the areas of the highest potential for overall improvement. According to the process, the *Project Performance Improvement Program*, owned at a corporate level, is where improvement initiatives are captured for implementation. This is where Key Performance Indicators (KPI's) are developed and rolled out across the business areas and potential improvement areas are identified and prioritized. In response to Statoil's objective of being within the industry's top-quartile performers, *PD* developed the illustration below, where top-quartile performers' qualities and improvement opportunities are compared for four main indicators.

	Top Quartile Performers	Statoil Opportunities
TEAM	✓ Strong teams and strong management of asset/team interface.	➢ Improve timely allocation of resources ➢ Improve team alignment ➢ Reduce turnover
FEL	✓ Primary means of controlling variance in outcomes	➢ Consistent and timely definition across process areas (PTEC, D&W, OM, PD) ➢ Integrated planning
Competitiveness	✓ Focus cost aggressiveness; less on predictability	➢ Attack root causes for non-competitiveness
Work processes	✓ Focused, consistent and compliant. Clear business objectives	➢ Improve project shaping ➢ Streamlining of early phase

Figure 19. Project Development Road map towards Top-quartile Performance (Info Presentation PPIP, 2011)

Although the documented model seems to be complete and comprehensive, in practice there seems to be a lack of clarity and consistency. The data-gathering phase of the process seems to be fairly straightforward and since a third-party consultant is identifying and requesting the required data, the company only needs to collect it in a systematic fashion. In some cases, data needs to be reviewed and corrected to ensure adequate quality and alignment between projects but generally this is already the case. Occasionally, resources may not be available to provide the required attention to this data-gathering phase and conflicts arise when the rankings are returned. Generally, issues start when the results of the benchmarking study are returned and project representatives contest the outcome or the

ranking by trying to justify their position. This is partly due to two main factors discussed previously and mentioned again in the Departmental Models Summary section, which are related to target setting and linking rankings to incentives.

It is the view of the teams carrying out and following up the benchmarking process, that monitoring of improvement initiatives is carried out thoroughly and effectively at a higher company-level. There seems to be a gap though between the higher levels of the organization and the operational teams down the line. This issue is not as evident within the project development phase because of the manageable size of the teams and short communication lines; however this issue is more visible in later examples discussed herein, such as Operation and Maintenance.

Firstly, management expectations are sometimes set too high and are incoherent with operational limitations and capabilities. Secondly, incentives are often tied to benchmarking results, as seen in other departments; this makes managers more concerned with the ranking than the improvement potential. Of further concern, is when data is manipulated in an attempt to give a better impression than what is actually the case or when "bad news" is hidden. This has been discussed previously in this report and must be carefully considered in light of all other challenges since bad news will always emerge and in some situations be much harder to deal with than they would have been initially.

Reflections: There is no such thing as "bad benchmarking results". If a company identifies a significant gap between themselves and benchmarking partners, it simply means that there is significant opportunity for improvement and potential to achieve even better results – "from good to great" as the motto goes. On the other hand, if they identify that they are in fact "best-in-class", it would be worth identifying what makes them so good and see if they can improve on that even further.

Another notable concern is the "predictability gap", as it is called. When an organization holds a highly visible profile and is continuously criticized, it generally takes on a more cautious attitude. This seems to be the case with Statoil. Unlike other national oil companies that represent the national pride of a country (Total in France, PDVSA in Venezuela or Petrobras in Brazil) Statoil faces frequent and fierce criticism by public forums and the media. This can be regarded as a positive sign/indicator: i.e. expectations are high and the public believes that the company is capable of achieving such high expectations, in addition to the fact that they must always strive for improvement without letting their guard down. On the other hand, this puts a lot of pressure on management forcing them to take on a much more cautious and conservative approach, which could compromise development, threaten the use of new technology and of seizing opportunities that are slightly more risky. Fortunately, this has not been the case for Statoil, yet the pressure did force the organization, at least in Norway, to steer away from a "lean and mean" performance culture towards a stable, predictable operational culture. With regards to *PD*, a more conservative approach is witnessed, focusing on predictability rather than setting aggressive targets or chasing top-quintiles. This means that actual costs, schedules and plans often end up within originally projected targets, even though they are not highly competitive in the industry. Taking the other extreme, Anadarko do not sanction any projects that are not competitive within the industry.

On a more positive note, one very good initiative the project development team is implementing is the concept of trialling initiatives on "front-runner" or pilot projects before rolling them out across the organization. Initiatives are trialled, lessons are learned and incorporated and the process is repeated until it reaches a stage where it can be effectively used across all projects. A more extensive and focussed lessons-learnt-initiative is run post DG4 and close-out of the project development phase to capture all the good practices and challenges encountered during the project. These are then compared to other projects and implementation plans are set accordingly. In a way, this can be viewed as a type of internal benchmarking, although it is carried out after the projects are completed and does not meet all the criteria highlighted above.

Supply Chain Management

Supply Chain Management (SCM) is possibly one of the most interesting models to follow within this multi-national, high reliability organization. In 2008, the company decided, that their strategy was to "*become benchmark within procurement in 2012*" as part of the "Benchmark for the future" campaign. Simply from the title of this campaign and the mission statement, it is evident that SCM took on a competitive and aggressive tone and were focused on using benchmarking to become "best-in-class" within a defined period. Recently however, there has been a strategy update initiative within the company, which is likely to see continuing use of benchmarking within the *Ambition to Action (A2A)* program as a support tool for performance improvement and target setting. The same competitive focus as before is being replaced by a service delivery and customer satisfaction focused strategy rather than trying to be the best within the industry. In addition, benchmarking is being used within SCM generally to develop a sense of urgency within the line organization, motivating them to improve performance through strategic target setting.

There were two main models the SCM support unit followed to achieve their campaign objectives of 2008. Both fit into the "External – Industry – Competitor" benchmarking category shown in Figure 5 previously. The first being an annual benchmarking campaign, through a third-party consulting company, which allows companies to compare their supply management business practices within their industry so that they are better able to set targets based on the resulting differences or perhaps decide to carry out further investigations. Once the data is collected internally from different sources and collated by the *Process Owner Supply Chain Management (POSC)*, they are sent to the third-party consultant who compares this data to other similar companies within the Petroleum industry. Results of the benchmarking analysis are then returned and a meeting is conducted, where the main trends and findings are presented, along with some recommendations and main areas of improvement. The management committee (MC) then reviews and prioritizes improvement areas in alignment with business strategic objectives, feeding the information through to the *POSC* and team of controllers within the corporate business units, who in turn define a single set of KPI's and common targets for the whole organization. Since targets are set at such a high level within the organization, line staff is envisaged to strive to these targets and implement the necessary improvements as part of the *Ambition to Action* process. So this was the main benchmarking initiative as part of the 2008 strategic outlook; annual studies that were used for target setting and definition of KPI's and focus-areas with a mission to become benchmark by 2012, the updated strategy however may have a different outlook.

The second benchmarking effort taken up by Statoil is conducted on a continuous basis throughout the year and focuses on specific areas of improvement, taking a deep-dive into processes and practices that lead to world-class. Detailed benchmarking reviews are again conducted by a different consultancy that helps propel its client companies to sustainable improvements in operational efficiency and effectiveness. Studies are conducted by the consultancy and invitations are sent to different organizations. When an area of interest for Statoil comes up, they take part in the study. The data gathering, data processing and communications processes are similar to those discussed above however they occur at a more frequent rate.

Once the findings are presented, key performance improvement areas are prioritized and selected, and targets and KPI's are set, a team of chief consultant and leading advisors within Statoil are then responsible for initiating the implementation process. This group is placed within the *Business Process Improvement (BPI)* unit within *POSC* and has the objective of "driving performance improvement in collaboration with the SCM network through measurement, analysis and consultation". The group works on improvement initiatives, implementation plans and recommendations for updating business processes and practices to align with strategic objectives and industry best practice.

Although improvement initiatives seem to be well planned and aligned with corporate objectives, the main challenge with implementing them is in dealing with the culture around benchmarking. It is a challenge to get line organizations to accept and take ownership of benchmarking results and use them in performance improvement; rather, a more defensive attitude is taken by the line organization where rankings are challenged and grounds for comparison argued. Helping those actually carrying out SCM related tasks to fully grasp and appreciate the value of benchmarking in what is behind the numbers, is essential in achieving good results and bridging the gap between the management teams and their line organizations.

A further initiative that is led by *POSC*, is internal benchmarking through MIS and A2A; which is essentially meant for benchmarking service providers in an attempt to encourage them to improve delivery performance. As part of the balanced scorecard principle in A2A, the benchmarking study focuses on KPI's within five different measures as shown in Figure 20.

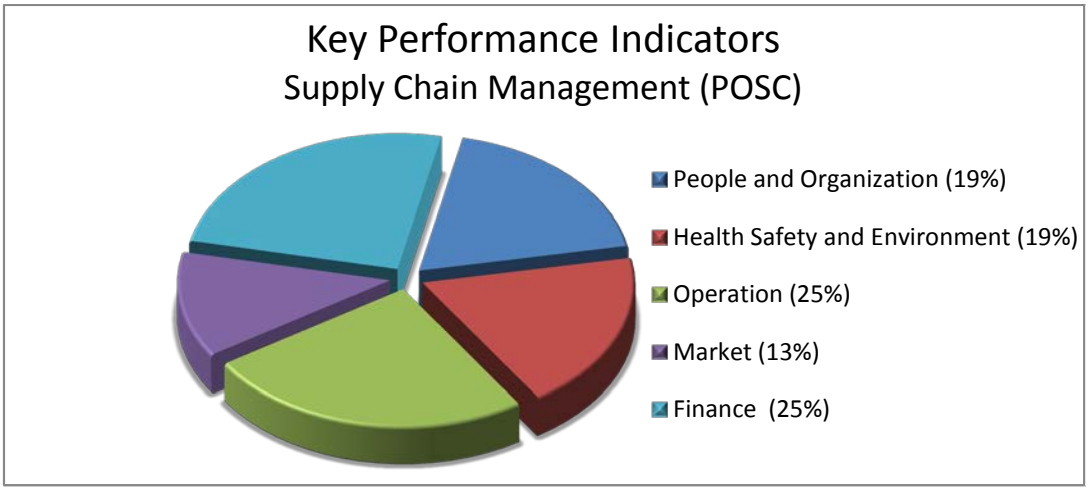


Figure 20. Balanced Scorecard principle in MIS for Supply Chain Management

Health, Safety and Environment

When it comes to benchmarking within Health, Safety and Environment (HSE), some literature suggests that HSE performance figures cannot be benchmarked since generally for *High Reliability Organizations* (*HRO's*) with a visible public profile, "zero harm" is the ultimate goal; some share this view within the company. Since by having a common goal of this nature, company rankings are irrelevant if they are not achieving this target. However, in reality the notion of zero harm has not yet been attainable, therefore it is important for companies to benchmark even within this discipline, in an attempt to learn from one another and reach the lowest hazard and risk levels currently accessible. Taking a look at Statoil's HSE discipline through three different levels of the organization: corporate, competency centers and business area, a review of the benchmarking models used is conducted to get an understanding of alignment both within *The Statoil Book* and corporate vision, and within the HSE discipline itself.

The HSE function within Statoil has its own functional hierarchy whilst the line organization, i.e. each individual project's management hierarchy, owns the risk since they also hold financial responsibility for projects. Within the functional hierarchy, the corporate HSE group is responsible for developing work processes, delivering technical support and advice on work processes and performance related matters as well as setting targets, defining indicators and overlooking the *Ambition to Action* process for HSE within the company. With a mission statement to be "*industry lead in HSE*" and a global reach, the group actively attempts to turn strategic objectives into measurable indicators and targets to help the organization achieve this goal.

As indicated in Figure 16, customers for this corporate division include any entity within the organization that requires advice or support with HSE related matters, as well as the different HSE departments within projects and other business areas such as *Drilling and Well*, *Operation and Maintenance* or support functions such as *Supply Chain Management*. Occasionally, some of these customers request input data for benchmarking studies that they are conducting for their specific business areas, at which point the corporate HSE department are required to collate and deliver such data based on HSE performance within the specified business area. Basically, the corporate HSE department does not have a requirement or a need for benchmarking, as specific needs develop through internal customers, then it is fairly straightforward to gather the required data from *A2A* and through other performance measurement practices required for compliance and authority reporting purposes. As identified through interviews and discussions, the challenge with carrying out such benchmarking efforts is having a clear and well-defined purpose or objective of the study. Often, the requestors only specify what data is needed and to what level without thoroughly communicating how this data will be used or what the expected outcome of the study should be. Without a clear understanding of the goals and outcome expectations of the study, numbers are presented and used for ranking purposes without actually understanding why or how these performance figures are achieved, which in effect limits the possibilities of doing something about them and improving performance towards world class.

> *Reflections:* Paying too much attention to the numbers and rankings loses the purpose of benchmarking studies. Focus should be maintained on what is behind the numbers in terms of processes, drivers and barriers.

Internally, the methodology of achieving strategic goals takes on a slightly different form than benchmarking. It starts with developing work processes and hence performance expectations aligned with strategic objectives. By providing the necessary tools to support such work processes, performance statistics are gathered and trends are established. Based on such statistics and trends, key performance indicators are updated while others are developed, and reports are compiled presenting such data graphically and making it available in tabulated form to simplify its workability. Finally, this is fed into the *A2A* process as strategic objectives, targets and action. One of the most positive attributes of this process is that targets are set both at a corporate level – strategic - and again at a business area and project level, allowing each facility to define their own realistic goals based on previous performance. Actions are then taken for continuous improvement or corrective purposes and the loop is again repeated commencing with updates to the work processes, if necessary. The hierarchy is presented graphically in Figure 21 and shows how the global and local work processes established by the corporate HSE division are the basis for all performance measurement and management activities, ensuring strategic objectives are met.

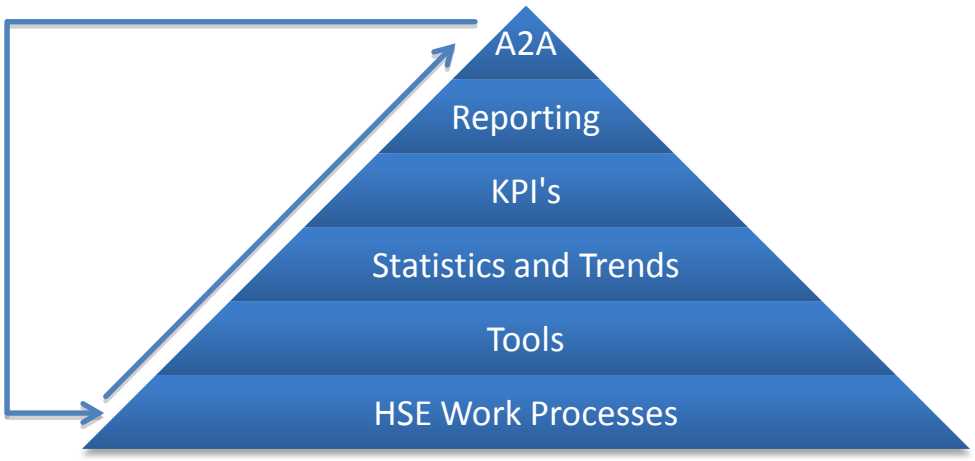


Figure 21. Hierarchy of processes to meet strategic objectives

Therefore it can be concluded that for corporate *HSE* although benchmarking does take place, there is no systematic and continuous benchmarking process, whether externally or internally. The aim of benchmarking efforts is to satisfy customer needs raised from within the organization and results may thereafter be used for comparison purposes. Further, there is a general reluctance by management within the corporate HSE division to make available benchmarking data and charts since the impression is that such data is used wrongly in praising and slating project teams without delving deeper into the details behind the numbers. Another deterrent to presenting benchmarking results on charts is the notion that HSE performance figures vary too rapidly for such reports to hold any value.

Reflections: League tables could be useful and have been used by other organizations as motivation to employees however agreement on data presentation intervals (monthly or weekly averages) needs to be agreed and, as mentioned previously in the report, focus should be beyond the numbers and no relation between rewards and results.

Working alongside the corporate HSE department, competence centers focused on specific areas within HSE are functionally responsible for the technical scope of their respective disciplines such as *Environment* or *Health and Working Environment (HWE)*. Competence Centers also have a global outreach and are responsible for technical support, introducing and promoting best practice and assisting projects with queries related directly to their area expertise. For comparison purposes, the model adapted by the *HWE* competence center is reviewed to assess alignment within the HSE departments.

The group is responsible for initiatives related to industrial hygiene, management of medical cases, fitness-for-task assessments, health impact assessments as well as reporting on work related illness. Specialist and high-level tasks are the focus of the *HWE* competence center, leaving day-to-day tasks to project teams further down the line. As an exception to this rule, the medical center does get involved with day-to-day work related illness cases however this is a special case within the group.

Benchmarking within *HWE* represents one of several techniques used to improve performance and continue an upward trend towards a lead position within HSE. External benchmarking as part of the world's largest global forum of oil and gas production companies is carried out. The forum encourages members to identify and share best practices to achieve improvements in aspects such as health, safety, environment, security and social responsibility amongst others. Later, meetings and workshops are organized to promote inter-industry and cross-industry learning and development. Benchmarking reports issued to each company at the conclusion of the study highlight their own performance in contrast to other undisclosed participants and through a "deep-dive" on a specific topic chosen by the consortium, the main challenges and gaps are identified as well as possible remedies. After careful consideration and assessment by the Statoil competence center's Chief Engineer and Leading Advisors, internal task teams are formed that are responsible for investigating further and coming up with improvement initiatives that are communicated down the line through updating technical requirements and work processes. Post-implementation, trends can then be assessed and an evaluation of the effectiveness of the improvement initiatives can be carried out.

Besides "number of work related illnesses" and financial indicators, most of the other indicators are qualitative and related numerically through subjective scales. In a way this is an advantage since the focus is off the numbers however it does raise controversy over its subjectivity. Either way, as witnessed previously, there seems to be a gap in balancing improvement initiatives with respect to the different elements. Although performance and quality are high for some indicators, the cost associated with accomplishing such results is far too high compared to competitors. A further gap was identified through the interview process, where a lack of professionalism and understanding of principle of confidentiality is apparent. Some key data, in relation to reporting of work related illnesses and other *HWE* indicators, seems to fall through the grid without being captured. Even though the systems for capturing all health related incidents is available, data must be input into those systems by personnel. Under the impression that reporting certain incidents would be a breach of confidentiality or even exposing employees, data is not added sometimes partially and other times completely leaving out cases. This is not good for a comprehensive picture of the *HWE* related incidents therefore a more open and courageous professional attitude needs to be adapted. Understanding that data is only used for performance measurement and improvement purposes, such cases can be reduced and even eliminated. On the other hand, once

improvement needs are raised, the concept of setting up task teams of experts to work through defining and implementing improvement initiatives seems to work quite well. Although it is a costly exercise, positive trends have been identified on indicators that have received such attention such as work place *Medical Emergency Management*. Building such a process into the operating model instead of on an ad-hoc basis will improve overall results and enhance the quality while reducing cost of improvements.

On a deeper level within the organization, the final group within HSE to be reviewed is one of those groups relying on the competency center as well as the corporate HSE division for strategic direction and functional support. This group is the HSE department within the *Marketing, Processing and Renewables (MPR)* business unit who are responsible for implementing strategic targets and monitoring and improving HSE performance on downstream processing facilities and renewable energy installation.

Firstly, through the interviews and workshops it is evident that there is no systematic, definite approach through which benchmarking is conducted. The aim of the practice is more geared towards "data comparison" where relative performance position is identified in hope of instigating improvements. Furthermore it is used to gain access to information about best practices through external benchmarking studies while not necessarily having a distinct method of capturing or adapting such practices.

> *Reflections*: Since HSE compliance requirements in Norway are extremely high, coupled with the *Ambition to Action* program that already encourages and empowers employees to implement improvement initiatives in their workplace, benchmarking only receives secondary attention.

Benchmarking campaigns that have previously taken place have generally been coordinated through several external-benchmarking consultants, each specializing in an area of *MPR*'s scope. While some have access to detailed knowledge of the performance of over 80% of the world's refineries, others have over 20 years of experience focusing more on gas plants and processing facilities. Data is again collated and verified internally before being sent to such consulting firms who then provide a comprehensive, relative performance picture. The resulting report includes:

- performance gap identification at a high level;
- recommendations on general areas of improvement;
- detailed and specific assessment of the root-cause of the gaps;
- and suggestions on how to rectify gaps through a prioritized list of recommendations based on best practices

Such reports could be very valuable for improving performance across a range of areas however it is also very costly and time consuming especially if there is no accepted methodology for implementing the findings. Another deterrent is that the internal data collection process is resource intensive, which means that it must be prioritized by the plant's management team in order to ensure a reasonable quality of data for the studies. Currently this is not the case and gathering data for benchmarking is viewed as more of an inconvenient side task rather than understanding its benefit and incorporating it as an accepted work process for continuous improvement and development. Although at a corporate level there is a process describing how to gather data - *HSE 01.01*, this does not seem to have been effectively communicated down the line and is not recognized by operating teams. Management support needs to

be reiterated and be more evident. Again, it is seen that the implementation phase of the benchmarking efforts is unmethodical and varies from one installation to another. In some cases it is in the form of a detailed improvement project being monitored and followed up while in others it does not involve more than a "check-out". Finally, the willingness to learn seems to be the most challenging cultural barrier to benchmarking within the HSE group in *MPR*. Literature has also documented similar concerns in other organizations (Elmuti and Kathawala, 1997; Amaral and Sousa, 2009; Chinowsky, 2008; Bers, 2006; and Zairi and Al-Mashari, 2005), which could well be solved through stepping up management support and raising awareness of the benefits of benchmarking through thorough communication.

Operation and Maintenance

Reflections: It can be attributed to many factors, however the most comprehensive, active and aggressive benchmarking model within the ones assessed, is that of the *Operation and Maintenance* (*O&M*) team. Perhaps this is due to the fact that the study was deployed by the *O&M* value chain unit and most data was readily accessible; or perhaps because this has the most visible effect on the company's bottom line in terms of operating costs, production volumes which translate to revenue and most importantly profits, so therefore it receives special attention; or finally, perhaps the process is so strictly maintained because of specific interest by key personnel within executive management

The mission statement of the *Process Owner Operation and Maintenance* team within the "*Technology Projects and Drilling (TPD) – Technology Excellence (TEX)*" department is clear and shows the objective of benchmarking for the value chain process: "*Operation and Maintenance towards world-class*". Aiming high and chasing the best-in-class means the business unit must keep close tabs on competitors' performance figures while managing improvement initiatives effectively.

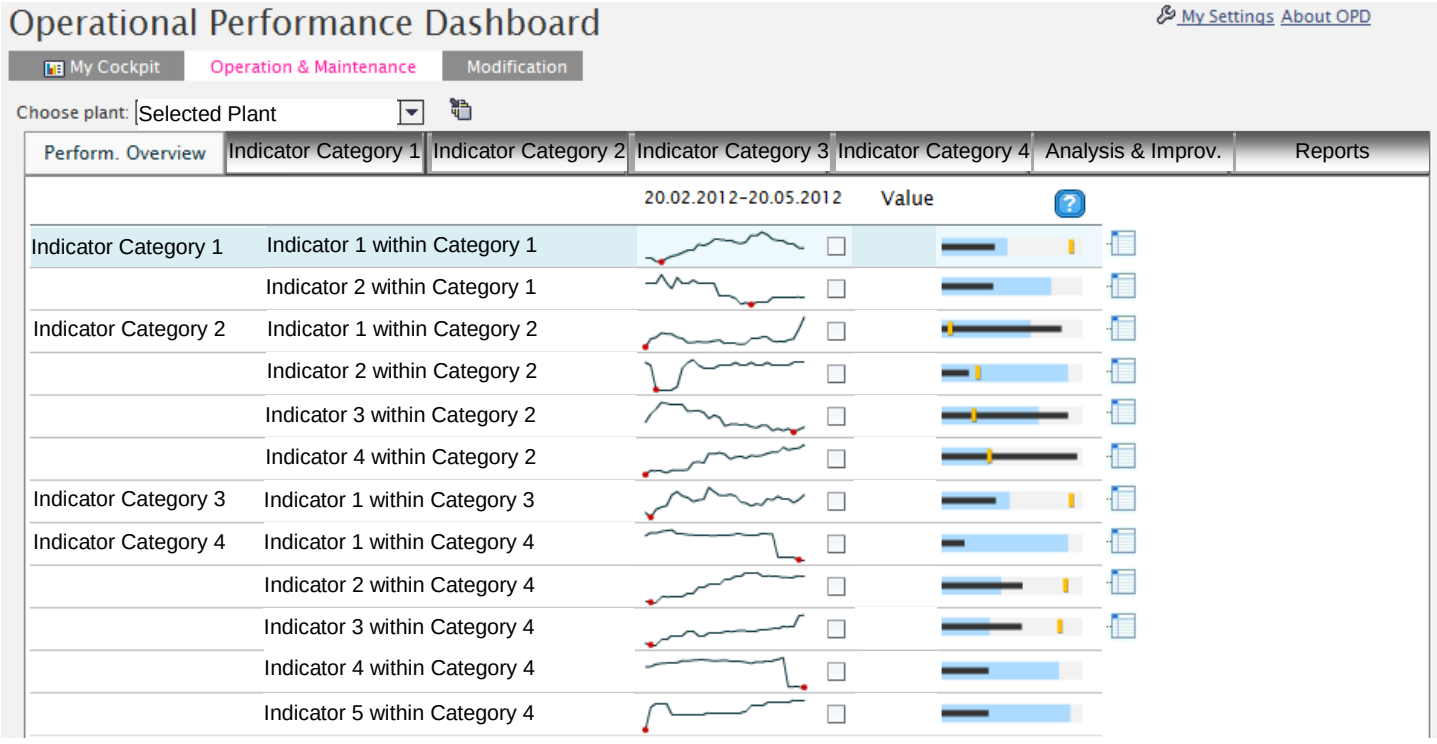


Figure 22. OPD Graphical Interface - Summary Page (Statoil OPD, 2012)

This has led to several benchmarking initiatives including the internal benchmarking initiative: *Operational Performance Dashboard (OPD)*, which is a user-friendly graphical interface presenting benchmarking league tables for key *O&M* indicators. Figure 22 shows the summary page of the dashboard, where all indicators can be seen grouped under their respective categories along with trends and bar indicators. By selecting one of the assets in the top left-hand corner and drilling down to one of the indicators, detailed trends can be viewed along with a bar indicator showing the asset's specific performance level compared to company average and world-class levels (examples in subsequent sections). Light blue represents the company average performance level; the dark blue shows the specific assets performance level while the yellow golden line is the target or world-class level. The "Top-10 performers" list is also displayed on that page with an option to view the expanded list of all facilities based on the same indicator. A brief description of each indicator and what it is intended to measure is also included, to assist with data interpretation. Facilities are thereby able to compare their performance with other assets as well as the company average, and target or world-class levels.

As part of the *Operational Performance Dashboard*, four main areas directly related to *O&M* performance are included:

- Maintenance Program
- Planning
- Scheduling
- Execution

Each of the "indicator categories" listed above contains one or more indicators, however they do not roll up to provide an overall category performance level. Focus is rather placed on proactively and continuously monitoring these "lead-indicators" that enable the organization to evaluate performance, and intervene if necessary while the process is underway. Understanding and adapting lead indicators rather than lag or outcome indicators is one of the strengths of the *OPD* that make it an effective tool for significant improvement.

A further strength of the *OPD* is that it allows staff at a managerial level to identify those areas, where the company is excelling at most (i.e. performing at world-class). Investments can then be made to set up companywide, cross-asset learning initiatives, to capture and spread that knowledge. In contrast, when world-class performance levels are not attainable, even by the best operating assets, initiatives involving an external assessment can then be carried out.

To complement initiatives such as the *OPD*, the company is actively involved in annual external benchmarking campaigns. Through dealing with a global management consulting firm that is not only a trusted advisor for businesses all around the world, but also governments and institutions, Statoil are able to get a fairly accurate view of *O&M* performance within other companies. The process is quite similar to other external benchmarking practices described before, where data is collected by project teams and fed through to the *Process Owner Operation and Maintenance (POOM)* department. Data is then validated and reconciled, in some occasions it must be sent back to projects for realignment and corrections, before it is sent onto the consulting firm. Each year a "deep-dive" is conducted based on major areas of improvement identified during the previous year's study, requiring more intensive resources for more detailed data collection.

After a period of usually 4-6 weeks, the data is returned to the company in the form of a report, highlighting the company's specific performance compared to others within the benchmarking consortium. In alignment with good ethical benchmarking practice, the identity of other companies, besides the one receiving the report, is concealed so that it is not obvious who the top and bottom performers are. Each company is only able to view its own performance figures compared to "anonymous others". The Report includes overall, high-level summary data as well as plant specific data to assist with follow up internal benchmarking. Recommendations are incorporated throughout the report in relation to the main areas improvements; for example: "Concerns regarding cost within Operation and Maintenance – Promote frame agreements". However, no specific actions or best practices are included in the report besides those within the deep-dive section.

When it comes to implementing improvement initiatives and best practices, a team within *POOM*, in collaboration with local process managers and line organizations, is responsible for updating work processes, functional and technical requirements to align the organization and incorporate best practices. No attempt is made at this level of the organization to introduce any specific actions at a project or operating level, since this is done as part of the *A2A* process. Unfortunately, it seems that this is predominantly a theoretical practice and it is more challenging to apply in practical terms. By combining initiatives such as external benchmarking and *OPD*, *POOM* intend to equip the line organizations with the required tools to enable them to review their own performance and carry out distinct improvement projects. Cross-asset learning however, is limited within the organization and especially when it comes to learning from external sources. Leaving it up to projects to implement their own initiatives through the *A2A* process results in location specific, isolated developments without a large-scale comparison or capture of lessons learned let alone systematic application of best practices. A positive element though, is the effort made by a group at a higher organizational level, who coordinate and monitor the implementation of major improvement initiatives.

A central, dedicated department has been setup as a single point of contact relating to all high-priority improvement initiatives that emerge from the annual *DPN* benchmarking process and through other avenues. This department is nested within the *DPN* division under the banner of "*Joint Operations (JO) - Process Management and Development (PMD)*" and is called "*Improvement Projects (IP)*". The leadership team within *DPN* prioritize improvement initiatives and the team within *IP* oversee their effective planning, execution and follow up. Benefits of having such a central group are numerous, including:

- ensure prioritization of improvement initiatives
- minimize parallel effort or re-work by having central control of improvement initiatives
- collate best practice and share knowledge and experience
- develop common methodology for tackling and resolving improvement proposals
- consolidate reporting into an agreed format for all improvement projects
- drive progress and ensure realization of prioritized improvement initiatives
- establish single point of contact for all improvement projects' related information

> *Reflections*: Maintaining responsibility for monitoring improvement initiatives within the same group that is responsible for setting the operating standard through work processes, functional and technical requirements is a more effective solution, reducing the number of levels between the management group and the line organization.

Although only high-priority projects are directly monitored and followed up by *IP*, all improvement projects that affect *DPN* business activities, in some way or another, are registered with the group. This allows alignment and ensures a central point for all groups within the organization to submit and retrieve information related to continuous improvement initiatives related to *DPN*. Handing such scope back to departments who are functionally responsible for the discipline, in this case *POOM*, will ensure that it is handled at the appropriate level where changes to the work processes and operating practices can be made.

Departmental Models Summary

The table below summarizes the models adapted by each of the five business units based on three main phases: data gathering, data analysis including reporting, and finally implementation phase where improvement initiatives are applied as concrete actions.

Table 2. Departmental Benchmarking Methodology Comparison Summary

		D&W	PRO	SCM	HSE	O&M
Objective	**Statement**	-	*Building a pathway to asset success*	*Become benchmark within procurement in 2012**	*Industry lead in HSE*	*Operation and Maintenance towards World Class*
	Empirical	Planning / achieve consistent, comfortable level	Comparison / Planning	Competitive focus on bridging the gap	Varied due to lack of clarity on objective from requestors, identify gap and improve performance	Aggressive focus towards best-in-class
Methodology	**Data Gathering**	*BOOST* & External	Part of FR but no separate process found in ARIS and External	External	HSE 01.01	External, no separate process found in ARIS
	Presentation	*proNova* and A2A	Project Performance Improvement Program (PPIP)	External reports and A2A	Synnergy and A2A	Operational Performance Dashboard (OPD)
	Analysis	No guidelines found	No guidelines found	No guidelines found	No guidelines found	No guidelines found
Implementation		Management strategies and targets translated into A2A				
		BOOST – localized, daily improvements based on short-term data from previous day		*Benchmark for the future* campaign developing specific actions and improvement initiatives	Task teams made up of subject matter experts – leading advisors and chief engineer	
Challenges		- Conservative culture - Results linked to incentives	- Resources shortage - Clarity on source of data - Gap between management and line organization - Results linked to incentives	- Benchmarking culture: getting line organization to accept and take ownership of benchmarking results - Clarity on source of data	- Too much focus on the numbers and not the process / enablers - Clearly defining objective of benchmarking effort - Some data not reported (cultural barrier) - Balancing improvement benefits - Resource shortage - Willingness to learn from others	- Overall understanding of benchmarking process for all involved - Resource shortage - Cross-asset learning - Balancing improvement benefits - Gap between management and line organization - Systematic and structured implementation process

*was the objective between 2008 and 2012, now with strategy update could be different.

Section 3: From Good to World-Class

Generally, when it comes to suggesting an improved model for performance measurement and management, it is important to not only consider what has worked well for other organizations or think about ideal theoretical scenarios, but to also incorporate company culture, operating philosophy and existing practices into that model. The underlying proposition of using "*Integrated Benchmarking*" aims to set a standardized, systematic method of conducting tasks related to benchmarking and continuous improvement that is clear to everyone, from senior staff within corporate business units to the maintenance supervisor guiding the crew on the tools. Many diverse initiatives are already in place, which seem to work in varying degrees of success. Understanding and amalgamating those practices and coupling them with industry best practices would align the company's operating model with industry best practices and reduce the level of change management required. It would take the *O&M* group "from good, to world-class".

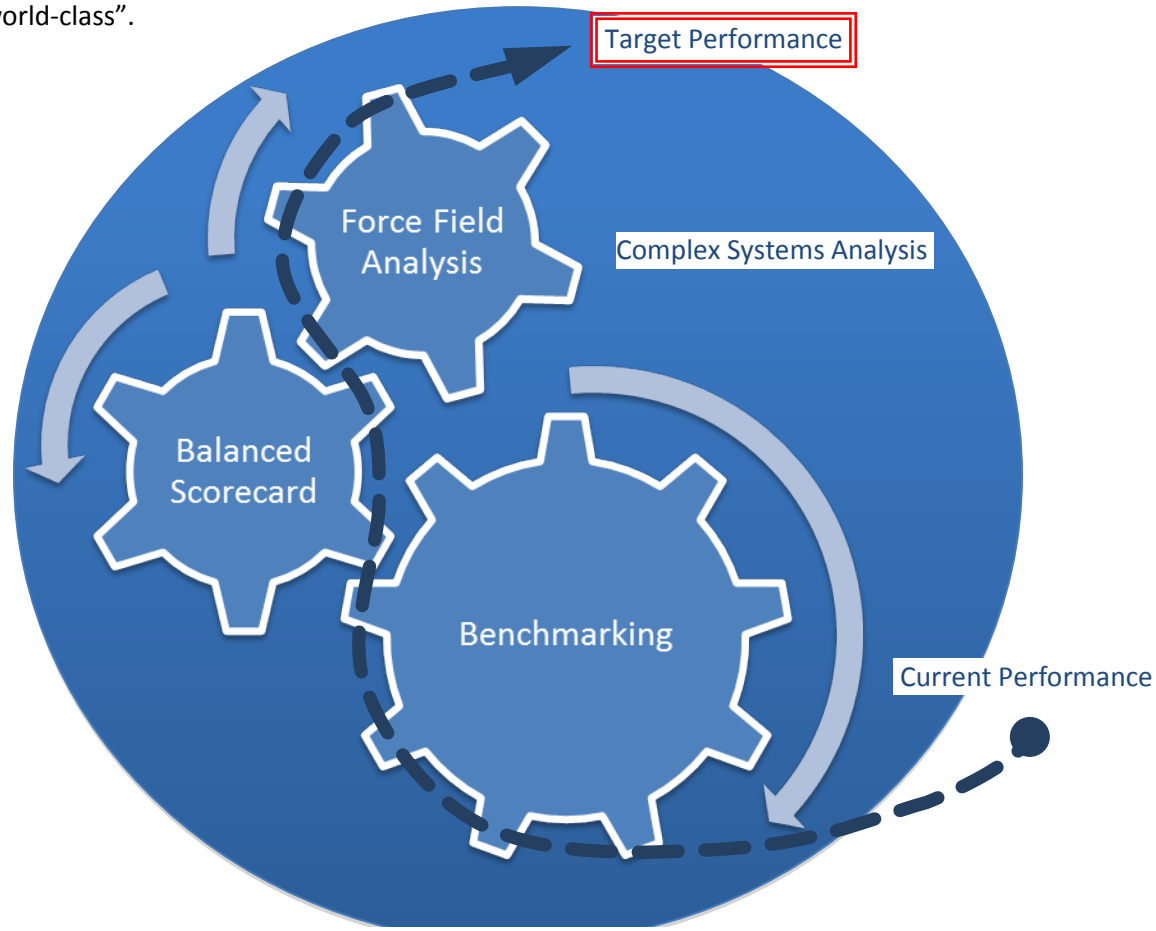


Figure 23. Integrated Benchmarking Model

Table 3. Reference-Model Element Summary

Element	Purpose / Function	Organizational Level
Benchmarking	Identify Gap / Compare Practices	Corporate / Managerial
Balanced Scorecard	Balancing Improvements	Corporate + Line Org
Force Field Analysis	Implementation – drivers and restraints	Corporate + Line Org

Contributing to Main Areas of Improvement

After careful review of the benchmarking model adapted by the *Operation and Maintenance* department, the following are the identified areas of improvement:

- Data gathering phase
- Defining improvement initiatives
- Implementing improvement initiatives
- Feedback (closing the benchmarking cycle)

One way to tackle these challenges is to introduce the concept of "*Integrated Benchmarking",* where benchmarking is combined with other techniques to reap the full benefits of the practice and compensate for where it lacks. The graphical representation of the model is presented in Figure 23. The circular theme in the representation is designed to give the impression of a never-ending, continuous process of improvement. Gears illustrate the intertwining and meshing of the different techniques, which must be managed carefully or else it will diminish the effectiveness and efficiency of the improvement process. Notice the opposite direction of the arrow on the *Balanced Scorecard (BSC)* gear. This demonstrates that using *BSC* gives a different twist to the performance improvement cycle by taking a step back and reviewing what the value is with respect to strategic priorities. Finally, the pathway from the *Current Performance* level point along the different techniques up to the *Target Performance* level is 'dashed' to highlight that this is a progressive process that takes time and needs to be carefully planned, monitored and implemented rather than being a quick fix.

According to the model, the process of striving from *Current* to *Target Performance* level is as follows:

1. Understanding one's own processes, evaluating performance, and identifying the gap to be bridged to reach world-class; all as part of an internal or external benchmarking campaign.
2. Putting a different spin on the analysis; utilize *BSC* to effectively trade-off between improvement initiatives to achieve the best results with the available resources
3. Communicating through dynamic *FFA* the benefits, drivers and restraints from senior management to the line organization and vice versa.

All of these techniques interrelate within a complex system, where each relies on elements of the others in a dynamic and continuous fashion. Next, is a detailed description of how using such an integrated approach, may contribute to the areas of improvement identified previously.

Initially the data gathering and analysis phase is identified as one of the main areas of improvement in terms of staff awareness and training. Staff on facilities, responsible for gathering data, is not kept in the loop as to the purpose of collecting the required data and how it will be used in the bigger picture. Consequently, a challenge emerges when data do not match up at the analysis stage because every department or group participating in a project are reporting based on their individual interpretations and in the way that best suits them. A high-level overview and awareness will enable them to provide data that is better aligned and easier to use. By the same token, the concern that incentives are tied to benchmarking rankings may also result in inaccurate data reporting. Therefore moving away from this reward method and communicating factual benefits of benchmarking toward continuous improvement is advised.

When it comes to defining improvement initiatives, currently through the external benchmarking activities, the company at a very high managerial level receives a summary presentation that includes the areas of potential significant improvement. Next, area managers gather their teams of operations managers to discuss improvement initiatives and implementation plans. High-level initiatives and targets are agreed; the operating team is to come up with detailed plans and initiatives to implement. An aspect of defining improvement initiatives that needs to be enhanced, is balancing different elements to ensure that the best overall results are attained. A recurrent theme was identified through the review of benchmarking models showing that quality is generally very good within the company whilst costs are unacceptably high. World-class performers are characterized by carrying out O&M at high efficiency (low cost) and high quality (effectiveness) as highlighted in the top right quadrant of Figure 24. To get to this optimum balance between several different measures, *Balanced Scorecard* (BSC) can be used. This is actually not a new development within Statoil. The Management Information System (MIS) – a web interface built on top of the enterprise resource planning system database (SAP), is in fact based on *BSC* for the myriad of Key Performance Indicators (KPI's) used within the company. Through a review by the founders of *BSC*, Kaplan and Norton have welcomed Statoil into the "Balanced Scorecard Hall of Fame" in 2008 testifying to the company's *BSC* program, *Ambition to Action*.

Figure 24. Quality vs. Cost Quadrant

Figure 25 depicts the breakdown of the five main measures in the company's Balanced Scorecard assessment for *Operation and Maintenance*. It is evident that financial, along with operational indicators, still carry a lot of weight; however *People and Organization* focused indicators make up the bulk of indicators in line with the *Beyond Budgeting* and *A2A* management philosophies.

> Note: *Beyond Budgeting* is a management philosophy moving away from a financial focus on performance measurement and management towards a perspective including both financial and nonfinancial perspectives. This principle relies on the development of creative, valuable initiatives rather than stringent financial budgets, annual or biannual application-for-funding cycles and focuses more on value creation through worthwhile initiatives, which can be implemented throughout the year as necessary.

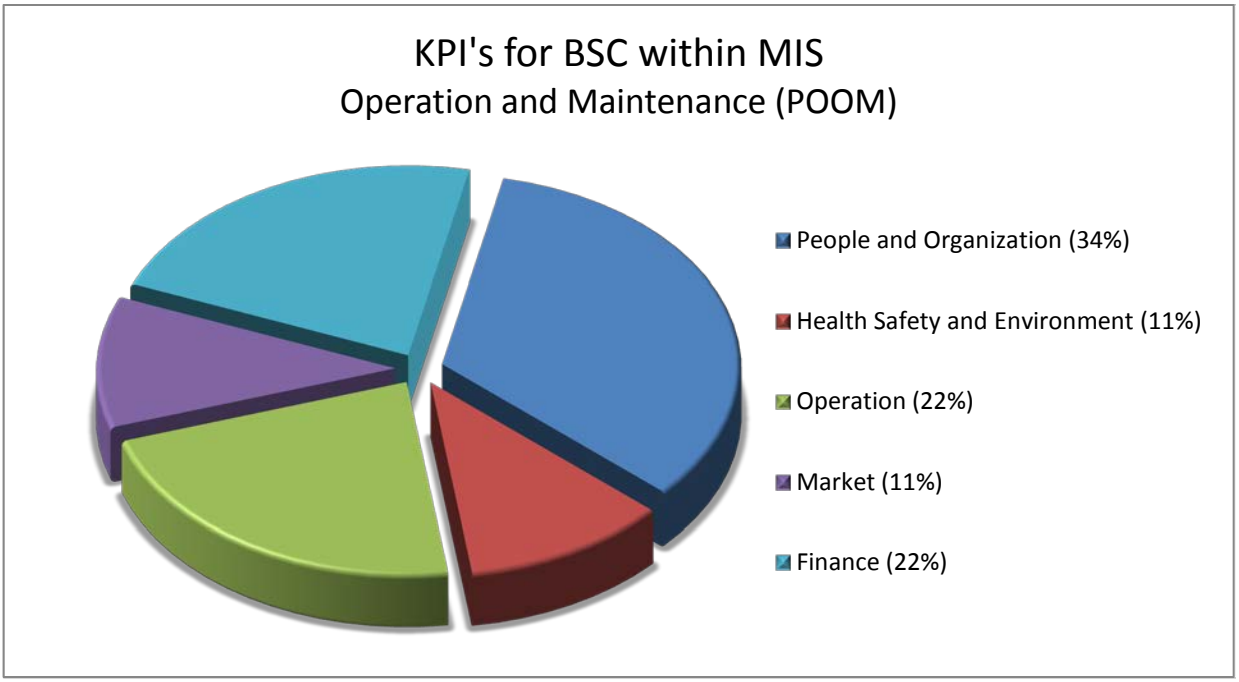


Figure 25. Balanced Scorecard principle in MIS for Operation and Maintenance

Developing the *BSC* concept, already used within the company, beyond *A2A* to using it for prioritizing and defining the most beneficial improvement proposals to be carried out within *Operations and Maintenance*, will ensure that resources are prioritized for those proposals yielding the highest gain with respect to overall performance improvement. Forward feeding the results of the gap analysis, in terms of areas of improvement and associated actions, into the *BSC* assessment, will result in a list of prioritized tasks to be carried out according to balanced gains. Once the list of improvement needs is defined and prioritized at a higher level in alignment with strategic objectives, it is wise to include the line organization in fleshing out the details. At this stage it is very important to appreciate the limitations line organizations have to manoeuvre around. Therefore, trying to decide on how to implement improvement plans without including them would be largely a theoretical exercise. This is one of the issues the organization is currently facing: disconnect between management and the line organization. Therefore *Force Field Analysis* (*FFA*) has been recommended as a downstream process after *BSC*.

During the implementation phase, each department, facility, and business area seems to run individual campaigns to address areas of improvement without necessarily feeding that information back into the management system for cross-organizational learning. Some initiatives and innovative ideas are picked up at the process owner level and implemented organization-wide. However it is difficult to capture the full learning potential this way. During the implementation phase, there seem to be several ways of fulfilling the requirements, which are less aligned and systematic than believed to be. The aim is to introduce a systematic, documented method of implementing improvement initiatives to meet targets. This will not only ensure a more effective process but will also introduce potential for improvement, since it will be easier to compare how different groups carry out this process, which would result in a better quality outcome and true momentum towards world-class operation and maintenance.

Primarily, training, awareness and communication between those carrying out the improvements and those setting the pace and direction, need to be enhanced. Reviewing Kaplan and Norton's (2008) summarization of the *A2A* process in their publication "Balanced Scorecard Hall of Fame 2008", these are the sequential steps:

1. Define strategic objectives
2. Express strategic objectives as Key Performance Indicators (KPI's)
3. Set targets for KPI's based on benchmarking and other techniques
4. Plan strategic initiatives
5. Forecast results
6. Allocate resources (away from stringent annual budget cycles)

Throughout this process there is no specific mention of integrating the line organization into the process or getting feedback or input from them. In the integrated benchmarking model, this would be accounted for during the fourth step: "*plan strategic initiatives*". One of the most effective tools in converting plans, strategies and targets into concrete, specific and achievable actions, while at the same time communicating the challenges and drivers, is *Force Field Analysis* (*FFA*), presented in Figure 26. *FFA* offers a simple but clear way of communicating current performance state, target as well as barriers, challenges and drivers. Driving forces in this case are motivations for why it would be good to achieve the target state (improve HSE performance, reduce cost, become best-in-class, etc.). More importantly though are those actions that are required to reach the target state. On the other hand, restraining forces are those elements or critiques describing what would hold the team back from achieving their goals.

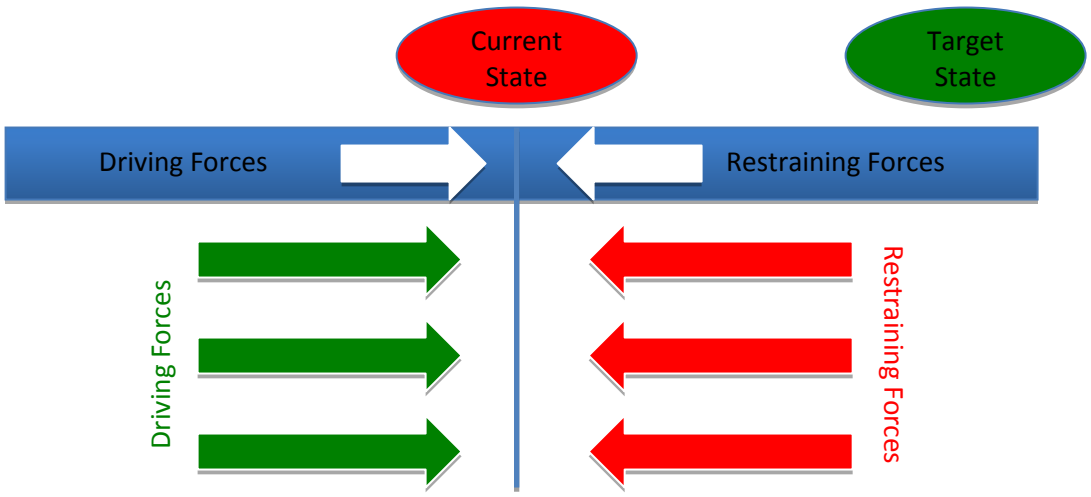


Figure 26. Force Field Analysis (Burnes, 2004)

Finally, the feedback loop currently only exists in the form of future benchmarking data collection, which gives a very late indication of whether the process was or was not successful. In some instances, individuals suggest modifications to the process. This is not a systematic or regular occurrence. By adapting the integrated benchmarking model, several feedback loops are indirectly included throughout the process. These are discussed in more detail in the next section about the road map.

Roadmap for the Reference Model

A rough roadmap envisaging the implementation of the model is described below to demonstrate how the model would specifically fit the Operation and Maintenance value process.

Firstly, run a campaign to educate staff and raise their awareness to ensure that all those involved with the benchmarking process for O&M are aware of the data flow as well as the purpose of their effort. This will give staff a wider perspective and they will understand where they fit within the organization rather than simply being confined to a "box". Also, reassuring staff that benchmarking results are only used for improvement purposes rather than for definition of incentives, and actually following through, will provide them with sufficient security to provide a more accurate picture of performance. At this stage it would also be very important to setup or promote discipline networks. Developing team-sites that include: lessons learned register, discussion boards and links to related work processes and governing documents would enhance communication and visibility. A similar sub-site within the POOM – BPI website dedicated for benchmarking related information is also recommended.

During the data gathering process, wether for internal or external benchmarking purposes, use of the discipline networks should be encouraged, where people could post questions or "tips and good-to-knows" related to what is working well for their team and what challenges they are facing. Such a process would encourage alignment and enhance standardization. It would additionally result in continuous improvement since previously identified challenges will be resolved more efficiently; and secondly, as part of the A2A initiative at Statoil, people at all levels of the organization will be encouraged to introduce innovative improvement ideas. Documenting what data is required, the reason, and recommended data collection practices, as part of a work process, would contribute to ensuring alignment and accuracy.

While data is being gathered and presented continuously as part of the OPD, it must be compiled and analysed at some point in line with reporting cycles or during external benchmarking campaigns. It is envisaged that a thorough internal benchmarking analysis effort would be carried out prior to the annual external benchmarking effort taken on by the DPN business unit. This will enhance the implementation of internal best practices prior to comparing externally, since by sharing the same culture and operating philosophy it is easier to adapt practices within the organization. Once analysis is complete, whether it is carried out internally or externally, or when gaps are identified successfully with the use of benchmarking, Balanced Scorecard would be used to evaluate all the benefits of improvement initiatives in light of priority areas, as shown in Figure 28. By using BSC, the managerial team can identify areas of improvement in light of other indicators and factors such as stakeholder expectation, financial implications, social impact and others.

For efficient and effective communication purposes, relevant to both management and line organizations, it is recommended to sum up performance as well as the outcomes of the analysis on spider diagrams. Serialized spider diagrams provide an effective solution to displaying annual progress of current performance levels versus best-in-class levels. A demonstration of a similar concept is shown in Figure 27; ignoring the indicators and the values, the idea is the same. In addition to what is shown in Figure 27, set target levels can also be displayed for each indicator.

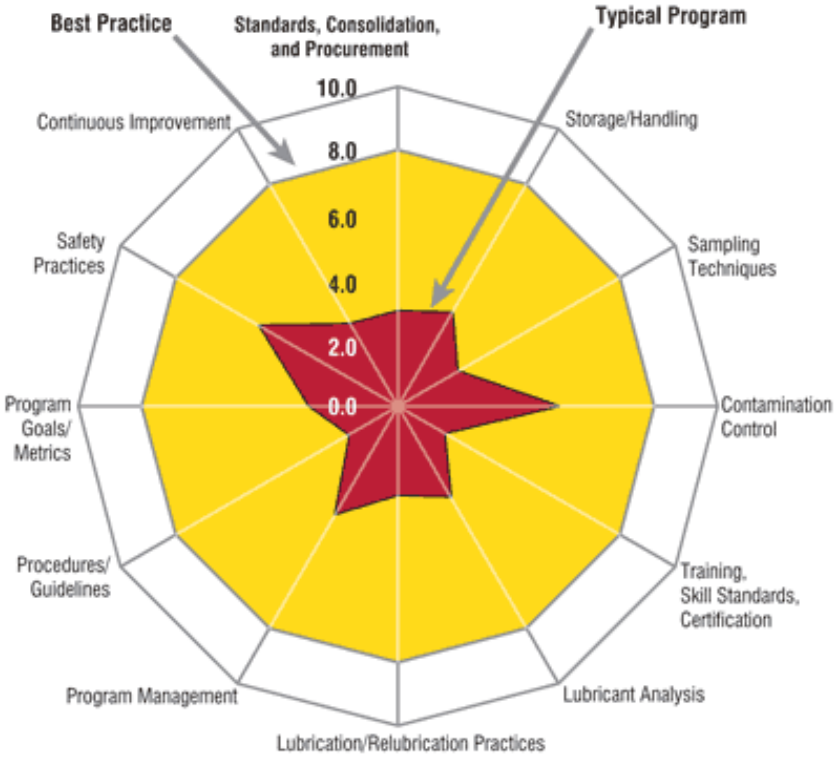


Figure 27. Spider Diagram Sample

Going forward, once the high level decisions have been made in terms of what areas to focus on in terms of achieving the maximum improvement potential, it should be up to business areas and individual teams on each facility to define their own reasonable targets. The *HSE* department managed to principally achieve this; through support from the competence centres and the corporate *HSE* department, line organizations are able to define their own targets in line with corporate target levels. Once targets are reasonably set and clearly defined (note abstract targets are a major concern and hurdle when it comes to achieving results), *Force Field Analysis* (*FFA*) can be used to communicate drivers, identify barriers, and progress from current position to target performance. The technique displayed in Figure 26, presented earlier, should be integrated as a dynamic solution allowing management to communicate drivers and targets while giving line organizations the opportunity to make barriers and challenges more visible so that they can be addressed in a more effective manner. Creating a two-way, clear, open, concise and anonymous communication channel makes challenges surface early and offers a common ground for assets to compare notes and adapt best practices further, thus encouraging alignment and standardization.

It is important to note that when Force Field Analysis is conducted, a report must follow to explain the different aspects and subjective assumptions made both for both the driving and the restraining forces. Throughout the benchmarking study the focus should be on what is beyond the numbers rather than simply taking a shallow perspective of what the numbers tell. Communication is an essential and pivotal feature of benchmarking, both across the organization and vertically throughout the hierarchy. Feedback and continuous development is necessary, defining and implementing a static model will lead to stagnation and will slow down or stop improvement.

This reference-model will provide several inherent feedback channels that allow such communication to take place in a transparent, confidential and effective manner. Through the initial contact between corporate groups managing external benchmarking efforts and the projects there is a clear two-way communication opportunity to voice any concerns or misunderstandings. While management are presenting the objectives, structure and data flow of the process, project staff is able to comment and raise concerns, which are then considered. Next, during the target-setting phase where corporate, business area, and project targets are set, deviations can be picked up offering yet another way of identifying the need for communication and alignment between corporate and project goals and understanding. Rather than being a defined communication channel, it is a way to identify the necessity for mediation. Finally, *Force Field Analysis* offers the most effective communication channel since direct interaction between 'what management wants and why' is answered by why projects cannot practically achieve it. This raises issues to a higher level where they can be successfully dealt with.

It is recommended that a central group such as *POOM* are responsible for maintaining and monitoring systems related to benchmarking since they have a good overview of the entire company and are able to update work processes and requirements according to observed patterns and best practices.

Taking a closer look at the benchmarking results for the *Operation and Maintenance* department specifically, it is evident that Statoil operated plants provide the majority of benchmarking data within the Norwegian Continental Shelf's (NCS) data set; in some cases up to 60-65% of the set. Nevertheless, and contrary to what some believe, it is still necessary to benchmark to maintain awareness of the company's relative performance level. Operating the majority of the fields on the NCS does not mean that they are the best or most effective operators; it simply means that they have the most diverse range of conditions to consider and possibly the highest potential for gains. It is also important to appreciate that with such a vast spectrum of conditions, it is expected to have plants performing at the top of the benchmarking rankings while others are performing at the bottom; no surprises there.

Based on this concept, the following two sections investigate the *OPD* more closely to predict when and how the company should invest resources into internal benchmarking, and when external benchmarking is necessary. The aim is to demonstrate how the model could be applied to some of the indicators, as well as introduce some of the best practice theory associated with them, to improve the company's overall performance within *Operation and Maintenance*.

Internal Benchmarking – internal processes resulting in best practice

The differences, benefits and limitations of internal and external benchmarking are important to understand, so that the company can capitalize on their benchmarking efforts. By grasping when to conduct external benchmarking versus when to focus internally coupled with an effective benchmarking model for each type, will provide the company with the leverage it needs to attain world-class performance.

The sheer volume of the company's operations on the NCS can be used to its advantage where internal benchmarking efforts are focused on identifying those practices that set their best performing assets apart from the rest. Once these practices are evaluated, they can be adapted as part of global work processes and operational procedures to spread best practice. Understandably, internal benchmarking is a far easier learning method compared to its external equivalent. Working to the same governing documents, processes and procedures with very similar operating cultures, means that evaluators can delve immediately into enabling practices that are unique without expending resources on trying to compare relevance. Confidentiality concerns, protection of trade secrets and competitive mindsets fade; whilst the key personnel involved with the best practices are more accessible and cooperative. Generally, internal benchmarking should always be selected as a first measure of improving average company performance, especially when some of the best installations are in fact defining "world-class" performance.

Figure 28 shows the top-10 league table and trend for *Proactive Maintenance Share*, one of the commonly used indicators measuring the maintenance program's ability to predict and identify degradation failures before they occur. It demonstrates that some of the company's operations are performing at, or better than, the industry accepted "world-class" level indicated by the yellow "target" line. In such cases, internal benchmarking should be carried out to identify why Plants A, B and C have been able to reach world-class levels while other haven't.

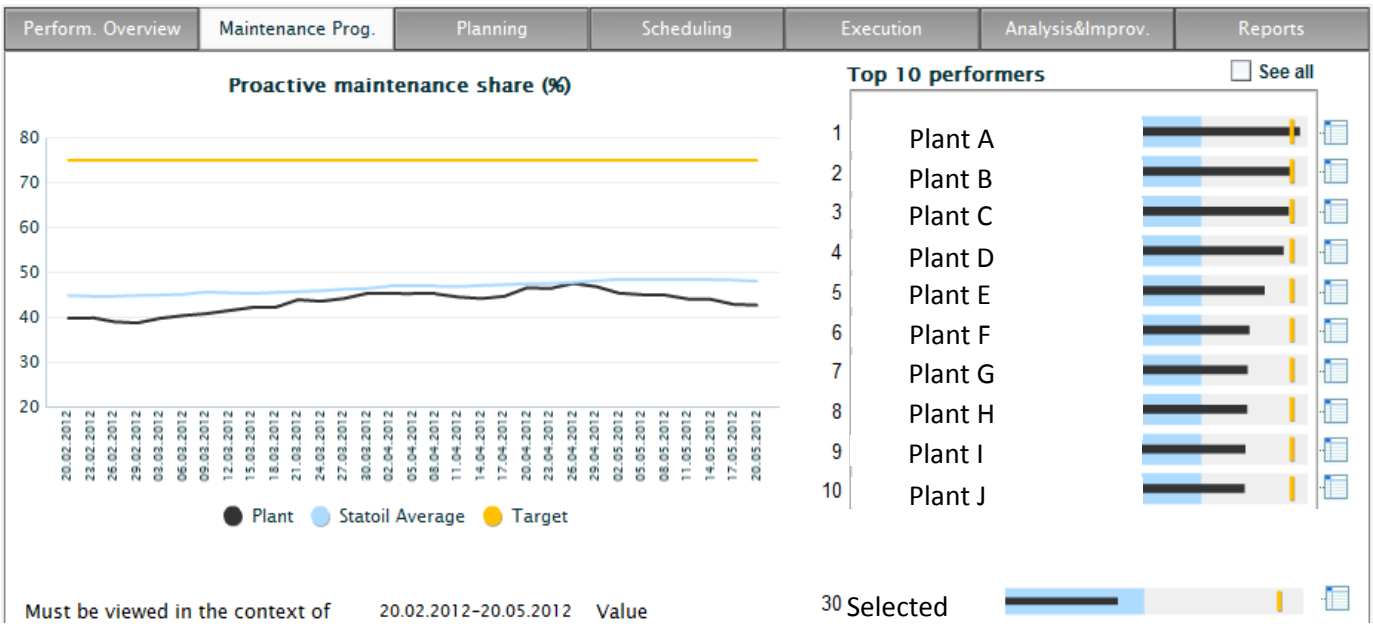


Figure 28. OPD Benchmarking Results for Proactive Maintenance Share (Statoil OPD, 2012)

Still, although the information is available, one of the most challenging aspects of benchmarking is converting an abstract idea or statement into practice. What is internal benchmarking actually, how can performance be improved by use of the reference-model and how is success judged?

As discussed before, internal benchmarking is the practice of understanding the processes and practices of one's own asset, identifying those practices that need to be enhanced and comparing them to other assets within the organization that are excelling at those practices. Improvement initiatives are then developed and prioritized based on strategic objectives in a balanced view. Finally, best practices are implemented that will raise performance beyond that of the benchmarked partners. Simultaneously, the company's best also need to develop in order to maintain their position as world-class performers. This continuous improvement culture is necessary since competitors will continuously strive for the top position. Terry Wireman (2004) describes this graphically in Figure 29, where he reiterates the importance of continuous improvement and development.

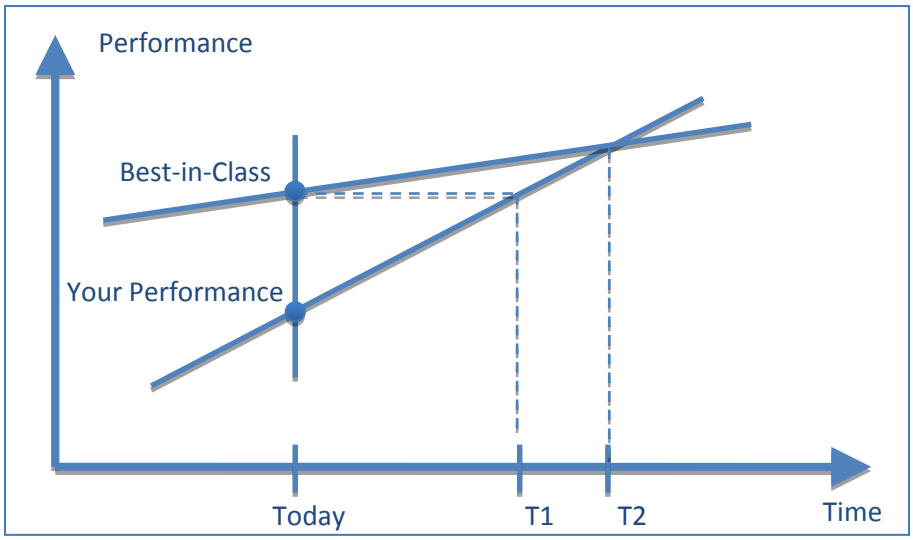


Figure 29. Dynamic Gap Analysis (Concept remodelled from Wireman, 2004)

Through effective implementation of this continuous process, the company's average performance will improve. This means that by simply comparing and developing league tables, overall performance will not improve. Focus should be placed on the enabling factors that the numbers are expressing.

Generally, within internal benchmarking, one channel considered as best practice for enhancing inter-organizational learning is the concept of discipline networks. Such networks exist within Statoil although they are not used to their full potential. Interviews have unveiled concerns by operations personnel within the line organization that such networks are mainly used for "big ticket items" and resolving existing challenges rather than for cross-asset learning and sharing of best practice. This is quite common and has also been the author's experience. Some of the reluctances to use such networks for learning and sharing of best practice is that the staff is too busy carrying out daily tasks and cannot dedicate sufficient time in capturing and documenting best practices or lessons learned. Also, other have the impression that best practices that have worked for one asset are individual to that asset and cannot be adopted elsewhere. Furthermore, practices spurring up within different regions cannot be implemented in others due to the uniqueness of operating conditions, local restrictions and regulations.

These arguments are misconceptions and can be easily resolved by instigating an awareness campaign where success stories of using such networks are shared and management endorsement is expressed. The value of such networks needs to be highlighted and perhaps incentives can be offered such as a monthly prize for the most effective contributor or most valuable contribution. Setting up an interactive forum where participants can "like" and comment on posts can easily secure this.

Another means of promoting internal collaboration and learning is by having an overarching department such as *POOM* facilitate "Lunch and Learn" (L&L) sessions. L&L sessions are short and to the point seminars, lasting for about 2 hours over lunch. Initiatives of this form are not intended to be comprehensive. Rather, they are an effective way of gathering those working on similar processes in a common place where they share best practices and participate in discussions. To carry out such learning initiatives, management buy-in and support is crucial. It is important to illustrate the value of such sessions in light of the costs involved. When considered in the bigger picture, training costs add up to only 1.65-4.39% of payroll, according to a study conducted by the *American Society of Training and Development*, therefore such initiatives are actually quite cost effective (Wireman, 2004).

It is the author's experience that L&L sessions also result in fruitful discussions and develop connections amongst attendees which they later use in setting up further meetings to share experiences. A deterrent to such events is commonly time. Many argue that they are too busy and are not able to attend however combining management support with controlled content ensuring practical, specific information is shared discussed, then attendees will appreciate the value of such sessions and prioritize them. For larger topics or discussions, half- or full-day seminars may later be setup based on interest including discussion sessions and practical demonstrations. Traditionally, meeting rooms and offices have been the most common hosting facilities for such events. More recently, onsite gatherings are gaining popularity. Since all involved are working with the same processes in similar environments, HSE risk is minimized and this ensures that only those who are directly impacted by the theme are present.

By applying the model, the process described at the start of this section can be achieved in a systematic way, enhancing learning and driving the organization towards world-class results. The most applicable part of the model related to the *Proactive Maintenance Share* indicator is evident in two parts of the process. Firstly, when it comes to maintaining a balanced perspective and secondly when considering the implementation phase.

As part of the second step within the reference-model, where priorities are balanced to develop a complete performance picture and present it on spider diagrams, the effect of neglecting the *Proactive Maintenance Share* performance can be graphically emphasized. By including other indicators affected by *Proactive Maintenance Share* for example related to corrective maintenance performance, a sense of urgency would be instigated for line organizations to improve planning and actually follow those plans so that they do not have adverse effects on other areas of performance. Figure 31 is for illustrative purposes only and a pure demonstration of the concept; the numbers are not representative. It also shows however, that it is not necessary for all indicators to share the same target levels and the scale can be representative to allow presentation on a common set of axes.

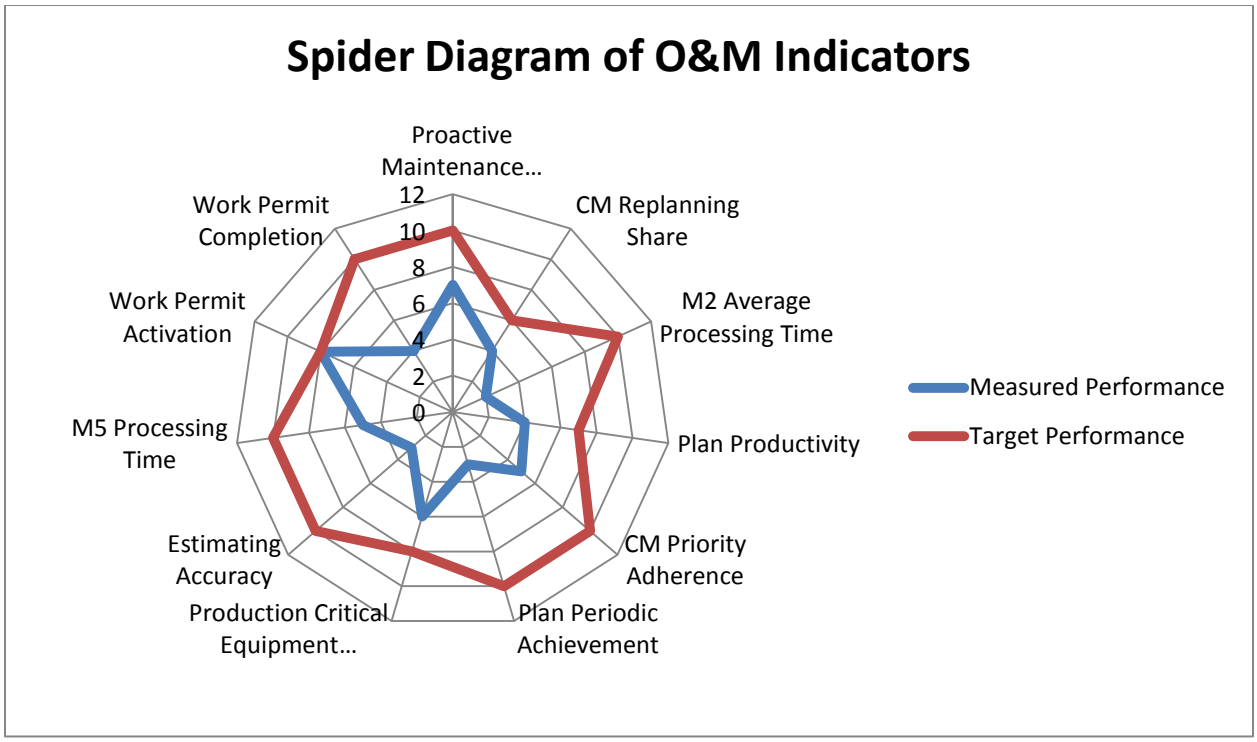


Figure 30. Spider Diagram showing interlinks between indicators (illustrative)

Secondly, during the implementation phase, while using *FFA*, common concerns by maintenance and managerial staff may be raised to gain the attention it requires to be resolved. For example better planning tools, more robust processes and guidelines or staff shortages may be raised, which can then be addressed by *POOM* or a relevant corporate function.

Similar principles apply to other indicators where Statoil assets have demonstrated world-class performance levels. The main message is to focus on enabling practices and operating cultures since the processes and requirements are the same and to maintain open, clear and dynamic communication.

External Benchmarking – why are they better?

In contrast, some indicators show that even the best performing assets within the company are still far off from world-class performance. In this case, an external benchmarking effort is necessary to identify enabling processes, practices and methodologies that set the world-class apart. A strong focus on searching beyond the numbers and further into the enablers must be embraced to be able to adapt such practices and compete with the best-in-class performers.

Plan Productivity is another common indicator, used to monitor the amount of available man-hours used on planned and scheduled maintenance relative to the total number of man-hours worked by the maintenance team. This is an effective measure in capturing several aspects of improvement including the quality and comprehensiveness of the work order plan, adherence to plan and efficiency of the maintenance team.

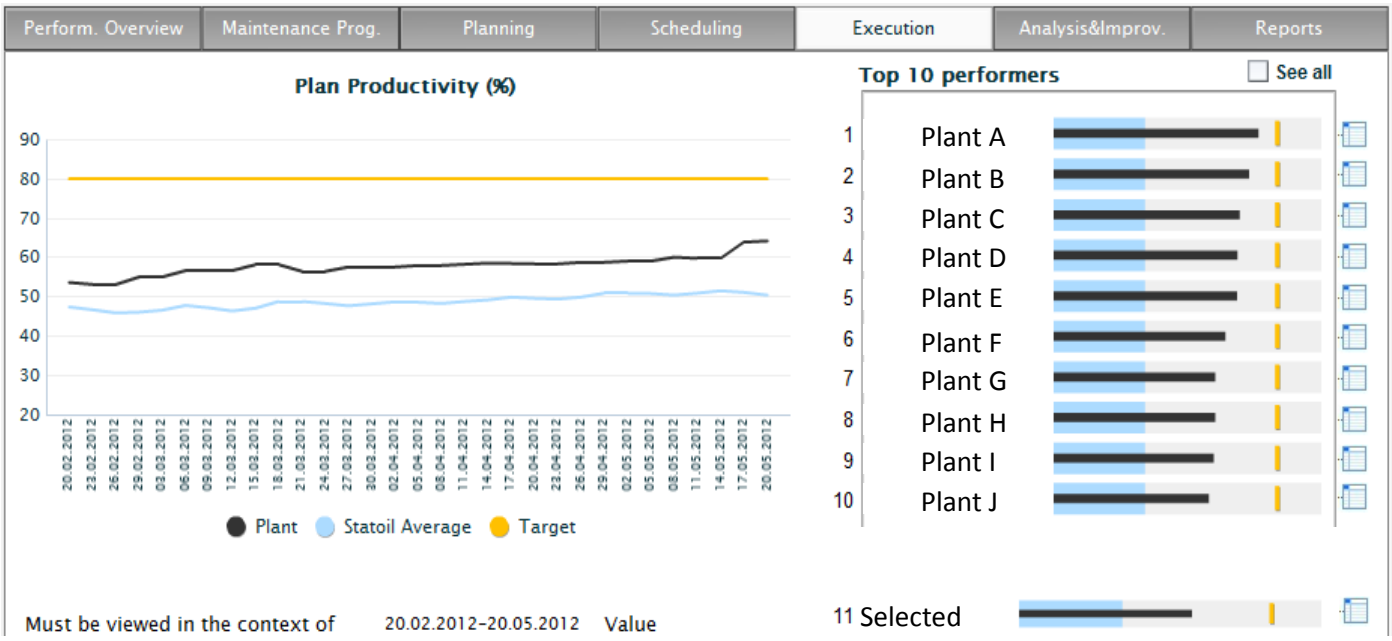


Figure 31. OPD Benchmarking Results for Plan Productivity (Statoil OPD, 2012)

So in a case like this, where even the best performing assets within the company are still not able to attain world-class performance levels, what should be the process to bridge the gap?

Using the decision flow diagram presented in Figure 6, the most effective benchmarking type can be chosen to achieve the objective of learning from world-class organizations. However, the first step in performing external benchmarking actually has an inward focus. It is essential to fully understand one's own internal work process, actual practices adopted on the job (often somewhat different to documented procedures), constraints and limitations before looking externally. Once a clear picture of the processes and practices is formed and the areas of improvement are identified, benchmarking partners can be evaluated. Ideally, benchmarking partners should represent world-class performers in the specific practice or area of improvement in focus. For example within maintenance and maintenance planning it is obvious that competitors will be equally engaged with similar, if not the same indicators and could be performing better. Additionally, high reliability organizations (HRO) such as hospitals, airports, nuclear and space-technology industries would also have maintenance related tasks high on the

agenda. Although easier to compare processes to, competitors should not make up the exhaustive list of considered partners since other organizations within the industry. Even companies within other industries should be considered, as mentioned above, since they may be able to provide more valuable input to achieving even better results than the competitors.

Initial contact should generally be established with those organizations with which there are prior relationships. This makes collaboration and sharing of information easier and more open since trust is already established. Best-in-class organizations within benchmarking consortiums, that the company is a member of, can be a good place to start. Benchmarking consultants are usually able to facilitate this in an effort to share best practices and promote collaboration. Most consultants require, as a condition of being part of the consortium, that companies are willing to share information and practices. Trade secrets are certainly protected, however this encourages improvement of the industry performance level as a whole.

When establishing contact, planning on the benchmarking organization's side is essential in presenting a professional image and demonstrating that they do in fact have the skills and knowledge required to carry out benchmarking both ethically and effectively. A carefully designed questionnaire can be an effective way of gathering preliminary information and breaking the ice. Later meetings are set up to elaborate on the findings and get a deeper understanding of the enabling processes and practices. Sending such questionnaires does not only help in getting a foot in the door, it is also an efficient way of finding out who the right person who knows most about the practice or process in question. Throughout all documented benchmarking experiences, this is identified as the most challenging task. Only subject matter experts with a deep understanding and knowledge of the practice are able to harvest the full learning through this process.

Once the information is gathered and a sound understanding of the enabling processes and practices is gained, it is important to translate those into actions. As mentioned previously in the report, incorporating the findings into company culture, operating model, strategy and current work processes and procedures is necessary to increase acceptance of the findings. It is not possible to re-establish operating procedures every time a better system is revealed. Continuous development and evolution of the existing model is more efficient and yields higher returns. As discussed, there is no end to the benchmarking process since it is a continuous improvement process. Therefore feedback loops and process evaluation windows must be established, as part of the planning phase mentioned above.

Now that the general idea of external benchmarking is described as well as when, why and how it is carried out, it is useful to take a closer look into those performance indicators that necessitate external input within the *O&M* function. By applying the reference-model, the process of improving towards world-class performers is assessed.

Firstly, consider *Corrective Maintenance Planning Time*, measured in days, presented in Figure 32. The main purpose of the indicator is to measure the effectiveness in preparing work orders in a timely fashion in order to maximize efficiency in scheduling and execution. Work orders will generally include a task description, execution plan, relevant drawings, resource requirements, safety permits, risk assessments - such as job hazard analysis - and any other special instructions to the work crew, facilitating the execution of the work. As with other tasks, early planning has a cascading effect on supply chain, execution and in some cases even production, illustrating the significance of the indicator. While the world-class performance level is accepted as 5 days, the company's best performing asset is able to turn around corrective maintenance orders within an average of 11.7 days. Comparatively, this is unacceptable, so what are some of the best practices that can be applied prior to conducting external benchmarking?

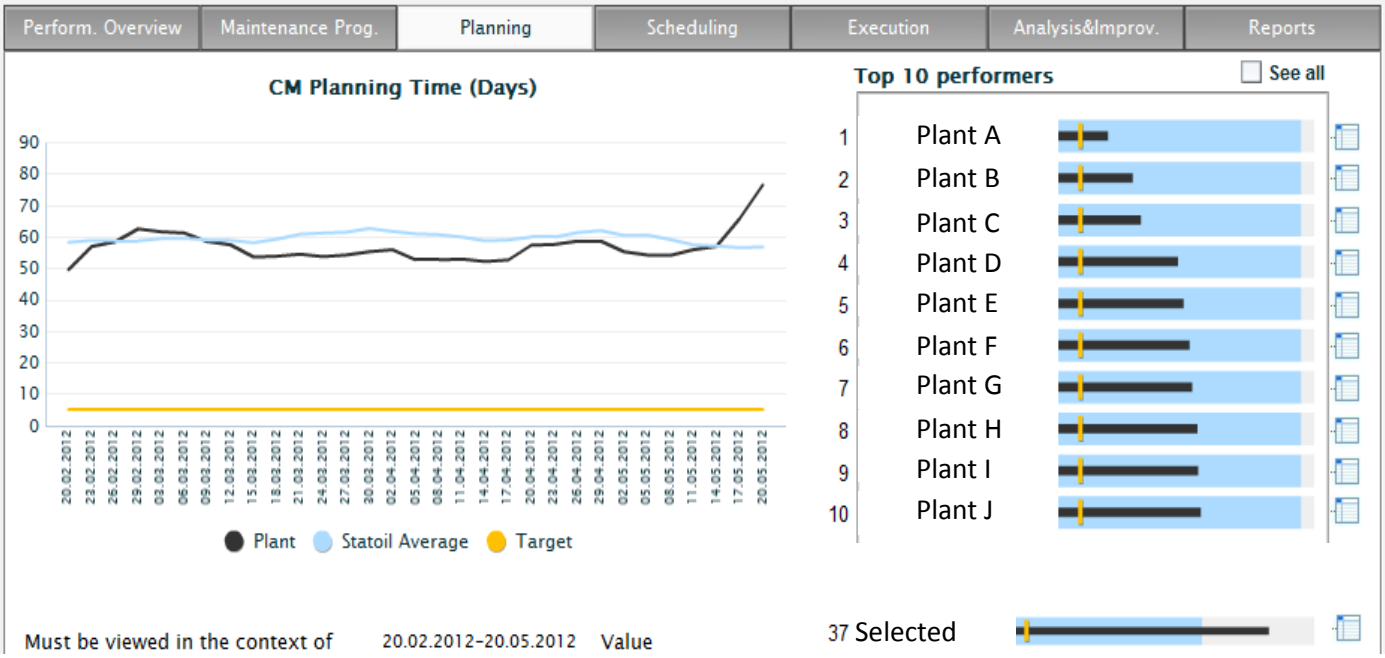


Figure 32. OPD Benchmarking Results for Corrective Maintenance Planning Time (Statoil OPD, 2012)

Peele and Chapman (1984) suggest that to get the optimum balance, 50% of a maintainer's work time should be devoted to corrective maintenance. If such maintenance were to be unplanned, then consequently 50% of a maintainer's work would be unplanned, which would result in large lost time and is unacceptable. Below are two graphs; the first represents the optimum ratio of corrective maintenance to preventive maintenance for independent equipment whose failure only affects its self, while the second displays the ratio for interlinked equipment, where the failure of one machine could bring the entire process to a halt. As equipment within the process are increasingly interdependent, relative cost of preventive maintenance to corrective maintenance eases, making condition monitoring and preventive maintenance the favourable operating philosophy.

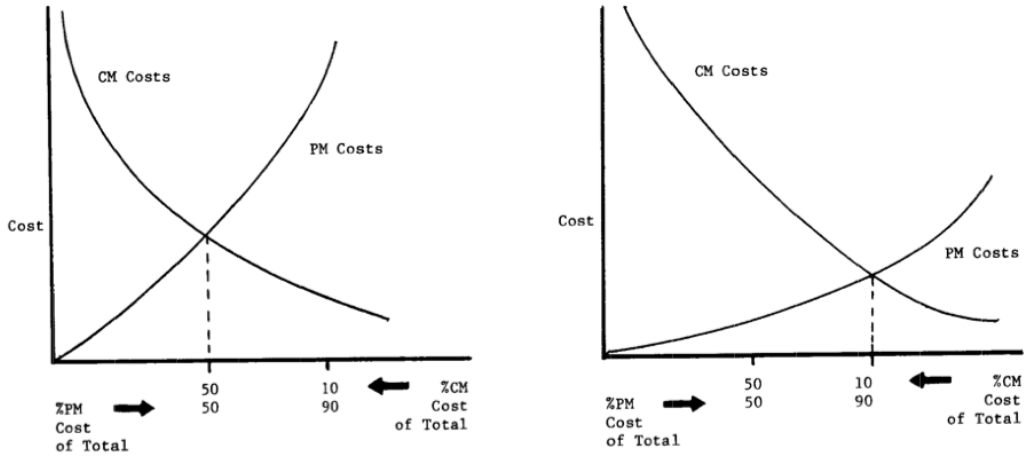


Figure 33. Optimum ratio of Corrective Maintenance to Preventive Maintenance (Gilbert and Finch, 1985)

Therefore the need for planning corrective maintenance during early phases is emphasized. Some argue that corrective maintenance cannot be possibly planned since had failures been known, they would have either been designed out or included as part of the preventive maintenance plan. However, in some cases, corrective maintenance is part of the operating philosophy of some components or equipment and is in fact possible to preliminarily plan. Alternatively, for unforeseen failure there are some preliminary preparations that can be made to execute corrective maintenance more efficiently. Preparing skeleton corrective maintenance plans and work orders for critical equipment and for equipment with long lead-time items is a valuable undertaking, since it considerably reduces planning time at equipment failure. Using Computer-aided Maintenance Management Systems (CMMS), inputs such as contact details of duty maintenance supervisor, equipment drawings, operating conditions and other data elements related to HSE and risk assessments can be called up automatically when a corrective maintenance plan for a specific piece of equipment is in preparation. By conducting thorough Failure Mode, Effects and Criticality Analysis (FMECA), run-to-failure components or equipment is identified for which a skeleton corrective maintenance plan should be established in the case that it is a complex or long lead-time item. Light bulbs for example would not require such an effort whilst custom designed filtering screen supplied by a specific supplier might carry a different spare parts strategy as well as some sort of planning guide for corrective maintenance would be used.

Careful assessment of equipment workload information can also be assessed with respect to machine breakdown information to be able to anticipate corrective maintenance needs and plan ahead in terms of resource requirement, shutdowns or perhaps increased preventive maintenance effort.

Another performance indicator that provides similar signals in terms of the need for external benchmarking is *Corrective Maintenance Priority Adherence,* shown in Figure 34 below. The principle of this indicator comes about due to the fact that it is more cost effective to defer corrective maintenance as much as possible without jeopardizing the safety or operational performance. Work processes define the prioritization rules and maintenance execution deadlines are defined which can then be used for planning, resource allocation and execution of work orders. The indicator shown in Figure 34 monitors the organizations ability to follow such prioritization resulting in cost effective corrective maintenance. In this case, while the industry's target is accepted at 95% adherence, the company is performing at an

average of about 70% with no plants actually reaching the target. What is it that other facilities do that enables them to follow strict processes when it comes to adherence?

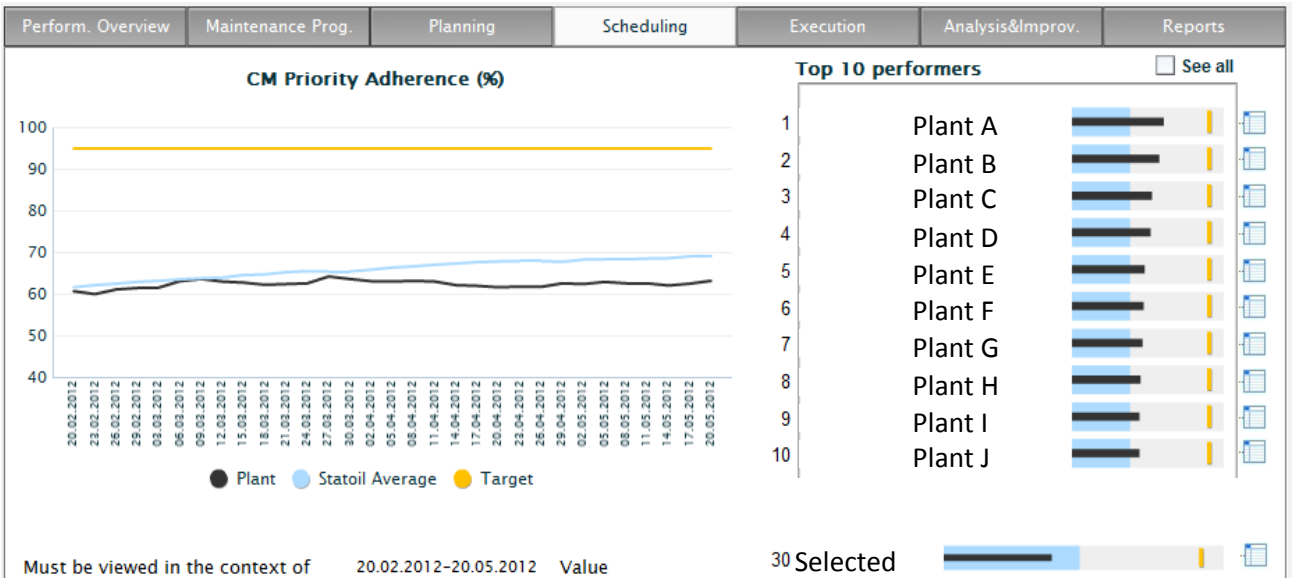


Figure 34. OPD Benchmarking Results for Corrective Maintenance Priority Adherence (Statoil OPD, 2012)

In some cases, deferring corrective maintenance can result in large financial gains as long as the equipment is non-critical, operated in parallel or is one of several redundant units. The example of ElectraNet SA, where corrective maintenance on a transformer was deferred by almost 2 years, resulted in a net present saving of about US$20,000 whilst avoiding the risk of overloading the remaining transformer by means of careful condition monitoring (Krieg and Napolitano, 2000).

It is assumed however, that in this case the maintenance execution dates have been defined based on such deferral analysis and in light of other maintenance activities and shutdowns occurring on the plant, so it is fairly critical to adhere to the maintenance plan to increase efficiency. One of the ways maintenance plans can be controlled to ensure maintainers follow it, is to make them part of the process. During the shift handover or towards the end of the shift when the work crew come together as part of their regular briefing / debrief, outstanding tasks already reviewed by the planning team and carrying similar criticality can be discussed to get the team to agree on a plan for the next shift. Not only does this give them ownership of their work, it also ensures the plans are realistic and aligned with crew skills and capacity levels since they have developed their own targets and plans (Wireman, 2004). Usually the latter is quite hard to get an appreciation for by the planner so the collaboration usually results in improved results overall.

Another way of keeping the crew in the loop is presenting the impact of not carrying out certain critical maintenance activities whether it is on production, safety or other aspects of the plant's operations. Appreciating the bigger picture gives workers a sense of ownership and pride, making sure they own their task and realize the importance of their contribution to the plant as a whole. A common reason for not adhering to schedules such as for corrective maintenance, is the "fire fighting" operating model. Dealing with too many urgent as well as critical maintenance tasks will detract the work crew from carrying out prioritized or scheduled activities therefore prioritization needs to be reviewed to include preventive and / or corrective maintenance tasks that will offset "fire fighting" activities.

Areas of further work

Having become familiar with the operating model and governing systems of the company as well as reviewed some of their benchmarking models, it has been realized that although Statoil is very professional and committed to benchmarking, there are still areas to be addressed that have the potential of taking the company from good to world-class. Instead of suggesting areas of further work and opening up side-tracks, the author would like to recommend two master thesis topics that could be carried out next year to further develop the scope of this work. The two projects relate to:

1. Further developing the reference model in alignment with operation and maintenance practice and Statoil operating model
2. Implement model on internal and external benchmarking needs.

Since a great deal of time was spent on reviewing the literature, identifying and contributing to the gaps, this has affected the level of detail and practical qualification of the integrated benchmarking reference model, as it was not verified. It is recommended that a further master degree student contribute to this as part of their master thesis effort where they take the reference model and verify it with respect to the practical implications, company culture and comprehensiveness. By being involved in the coming year's external benchmarking effort and getting a more in depth understanding of the operation and maintenance work processes, the practical application of the model can be assessed and a detailed implementation plan drafted. Deliverables from the exercise are envisaged to include:

- a review of the external benchmarking effort carried out by *DPN* and *POOM* including documentation of challenges, how they were overcome and other recommended solutions
- a documented summary of the work processes affecting performance measurement and management activities within operation and maintenance, associated challenges and recommended solutions
- review of integrated benchmarking model including strengths, weaknesses and suggested improvements and possible vulnerabilities for successful implementation
- reference model implementation plan

To carry out this task, the candidate would require similar facilities as were necessary for this work in addition to further accessibility to representatives from the line organization to be able to get a first-hand practical account of performance measurement and management, and specifically benchmarking, related activities. Arrangements for the candidate to sit in as an observer on benchmarking workshops and presentations, including those with the external consultant, would provide them with the necessary exposure to get a better idea of the process, challenges and solutions. Through discussions over the course of this work, it has been noted that several tasks the group is involved with could be delegated to the successful candidate in an effort to further include them within the group, use their time more effectively and get a better practical understanding of the *POOM* department's work scope.

With respect to the second project that could possibly be divided into two master theses or combined into the same one, relate to the implementation of the model with respect to specific indicators within operation and maintenance. It is recommended that this work is either scheduled for the coming year or post project 1 since by then the model would have been refined even further.

Through the work leading to this report, it has been identified that it is more valuable for the company to carry out internal benchmarking on certain indicators, where they represent world-class performance, while on others an external outlook is needed. Successful candidates would focus their attention on developing practical techniques, and an associated implementation plan, on how to carry out benchmarking based on the reference model and industry best practice; one for the internal effort and a separate one for the external campaign.

Considering internal benchmarking first, by understanding, reviewing and working with the *Operational Performance Dashboard*, the candidate would identify those indicators where Statoil defines the accepted world-class performance levels. The top one or two facilities would be considered and an assessment of the validity of the results would be carried out ensuring that this is not a special case that would not be possible to reproduce on other plants. Then, through interviews, workshops and site visits if possible, the candidate would get a thorough understanding of the enabling processes and practices as well as the interpretation of work processes and company requirements; this could provide a unique insight into their success drivers. Once enabling processes and practices are identified it is necessary to interpret the results in light of existing company requirements and assess how such knowledge and practices could be best transferred and adapted on other plants. An implementation plan would be developed, after documenting the processes and practices, and time permitting a specific case study would be carried out with one of the poorest performing assets for the same indicator.

In terms of the external benchmarking needs, there are some indicators where even the best performing assets within the company are not reaching accepted world-class levels. For those indicators, the candidate working on this project would firstly need to confirm that this is in fact the case and that evaluation criteria are the same. This can be done through discussions with external benchmarking consultants or experienced staff within the organization that have an extensive history of working on benchmarking projects. Once the results are confirmed, the candidate would need to go through the guidelines of the benchmarking model discussed in the Evolution of Benchmarking and Current Models sections of this report. After analysing Statoil's own practices, an external outlook can be taken by identifying best-in-class competitors or companies within other industries sectors. Again benchmarking consultants, internal experts and published sources would be a good source of information. Contact would be established as part of a collaborative agreement and a similar process to that of internal benchmarking would take place with the external partners where enabling processes and practices are identified. Finally, the most important critical element to the success of that project would be to document the findings and draft an implementation plan for how those processes and practices would be translated across into the Statoil operating culture.

Deliverables and facilities would be very similar to the internal benchmarking project except that the second would take on an external focus. More support will be required to enable the candidate to create the essential external connections and receive the relevant information.

Discussion

Over the past few months, a complete understanding and appreciation has been gained regarding the science and practice of benchmarking. The journey began with an academic review to firstly understand what the technique actually entails and understand its benefits, challenges and process followed by a critique of the literature and contribution to the gaps. Later, an empirical study was to be undertaken to identify internal benchmarking best practices within Norway's largest oil and gas company. By amalgamating the two findings, a benchmarking reference-model would be developed to enable the company to drive its *Operation and Maintenance* performance towards world-class. Implementing the model on several *O&M* indicators was necessary to assess the practicality and applicability of the model.

In the first section of the study, the main trend identified within the literature, was that the majority of publications, over 60%, are geared towards introducing and describing adopted benchmarking models, case studies and specific application of the technique. It seems as though benchmarking was finally hypothesized in the late 70's and without a comprehensive definition of the fundamentals, it was adopted and used. Later publications maintained focus on demonstrating specific applications of the method, with little focus on capturing best practice and continuous improvement of the technique with only 7% of the literature focusing on innovation of the process (Dattakumar and Jagadeesh, 2003). In contribution to this, characteristic phases of benchmarking have been defined to set it apart from other types of analysis such as trending and comparison. These defining phases of benchmarking are:

- ⇒ Initially define the company's strategic direction, objectives and focus
- ⇒ Gain a thorough understanding of one's own processes and practices, strengths as well as weaknesses and define areas for improvement
- ⇒ Use scaling factors, commonly called "complexity factors", to relate one's own performance between internal projects / assets and with other companies' projects / assets identified to be "best-in-class" in that specific practice
- ⇒ Learn about the enabling processes and practices leading to best-in-class performance
- ⇒ Adapt such processes and practices to one's own operating culture, strategy and goals, to achieve superior performance, i.e. attempt to be best-in-class
- ⇒ Continuously evaluate and repeat the process to maintain world class performance

If any of these phases are absent, then the benchmarking process is incomplete. Notice that there is a strong focus on examining what is beyond the numbers since in many cases difference in performance levels can be attributed to specific challenges and limitations that hinder certain assets from achieving equivalent performance outcomes. To some extent, this is accounted for in the complexity factors however it is not ample and detailed analysis is required get a better understanding.

Furthermore, benchmarking is not "catching up to" or achieving current best practice, it is about identifying the enabling practices and processes to be able to perform even better than those one is compared to. Closing the gap and reaching better performance levels that others have already been able to achieve is today part of common business practice, benchmarking involves going further. Also the notion of continuous improvement does not only mean continually improving specific operating

performance, it also involves continuously improving the benchmarking model and process in alignment with industry and operational advancements.

Another aspect of the benchmarking literature that seems hazy and unclear is how to define what type of benchmarking to carry out, when. Most literature delves straight into the benchmarking practice or findings, challenges and success stories companies have encountered without sharing enough of the details involved with planning phase. Therefore, a logical breakdown of the already documented typology by several authors has been developed and translated into a simple decision flow diagram to help guide the planning phase. Figure 6, in context with Figure 5, demonstrates this decision flow diagram for the planning phase of benchmarking which will allow organizations interested in benchmarking to make systematic and consistent judgments with regards to the type of benchmarking they need to carry out. This is especially useful for company's attempting to "get into" benchmarking for the first time.

With a clear idea on the types of benchmarking and how to choose the best method to meet one's own objectives, it is important to take a step back and remind the reader of the ethical restraints that are involved with the technique. There have been many scandals reported over the years about companies "stealing" each other's ideas and implementing them on their products. This is certainly not the aim of benchmarking and unfortunately only a very few of the publications have made statements related to ethical responsibility in their benchmarking practices. An entire sub-heading was dedicated to this topic to illustrate the importance of considering it in light of every benchmarking campaign carried out. Main principles are listed below and the detailed list is presented in Appendix C.

- Principle of Legality
- Principle of Exchange
- Principle of Confidentiality
- Principle of Use
- Principle of Contact
- Principle of Preparation
- Principle of Completion
- Principle of Understanding and Action

Next, some of the reluctances to benchmarking are presented, in an effort to give the opposing view sufficient exposure. Such reluctances are justified and some have had negative experiences with benchmarking due to a combination of lack of planning and preparation plus poor leadership and communication. Ensuring management are well prepared and clearly understand the process of benchmarking will help the organization setup the needed processes and procedures prior to committing resources to the process in addition to maintaining clear and open communication along the way. Figure 8 demonstrates the key elements in overcoming and dealing with the common reluctances in an effective manner, stopping them from developing further and compromising the benchmarking effort.

Concluding the literature review, an investigation into standards, and their expectations with regards to benchmarking, is carried out. It is found that although many different standards hint to the notion of continuous improvement, performance monitoring and management and comparisons with industry best practice however always stopping short of defining the extent of such efforts. No specific techniques are recommended or minimum effort, which needs to be updated to reflect industry today.

Moving into the empirical study, firstly a high level view was taken to assess the company's strategic objectives and direction concerning benchmarking. It has been found that the company, at the highest managerial level, endorses benchmarking and expects it to be used as a tool to drive business performance, as stated in *The Statoil Book*. All through the company's management system are signs of benchmarking including the performance management system *Ambition to Action* (see Figure 13). The alignment between the company's highest strategic publication can only be seen one level down through the requirements hierarchy, presented in Figure 15, down to the functional requirements level, where benchmarking is explicitly mentioned as a tool to ensure safe, reliable and efficient operations. Further down the requirements hierarchy, there have been no work processes or technical requirements identified that specifically guide the process of benchmarking or define the critical parameters related to achieving an effective campaign. This has led to several different perceptions of the objective of benchmarking, numerous data gathering procedures and a general lack of understanding of the main purpose of benchmarking which leads to several challenges including contesting of results and exaggerated focus on the numbers rather than the enabling processes and practices. It has been recently identified, after the conclusion of the findings of this report, that there is an effort currently in the process of materializing that focuses on education and training of staff involved with benchmarking activities to provide them with a better understanding of the purpose, process, challenges and best practices of the technique in hope that providing a better conception of the bigger picture will result in improved results. This is one of the main findings of the report, prior to gaining knowledge of this new initiative, and it is a very positive to know that it is already being considered and addressed.

Another positive find, which recently surfaced as part of discussions after the final presentation of this work was given, that a campaign is currently being discussed to get a better understanding of the different benchmarking models within all of Statoil's departments and business areas to identify best practice and align the organization. A large contribution to this effort has already been accomplished through this report including a structured approach of investigating the various models, critical elements that need to be considered as well as focus areas where it is useful to pay special attention since these are the common stumbling blocks of benchmarking within the company. It has been discussed that the findings of this report will contribute to the upcoming campaign, which will embrace more departments and business areas and go deeper into individual project groups and down to the plant level. The summarized results of the department review has been captured as part of Table 2 and a more detailed description of each entry is provided in the leading sections.

All the effort and work described in the discussion so far has led to a very important development that is both the original aim and the most significant contribution to future work. All the leads have now flown towards a common point where the reference-model can now be defined. The model is both based on best practice theory of benchmarking as well as existing practice within the organization. As mentioned at the start of this report, when introducing improvement initiatives in general, companies need to be very careful in avoiding copying of initiatives and invest the resource into adapting the practices to their own working culture and operating conditions. Far too often benchmarking campaigns cause more damage than they do benefit mainly due to the fact that without thoroughly understanding the enabling practices and processes, some initiatives are simply copied and forced onto the organization.

The reference-model is based on the concept of integrated benchmarking, which is a fairly new and underdeveloped hypothesis, with no publications related to application, where benchmarking is combined with other techniques to get the full benefit of the improvement effort. This could possibly be the first publication where integrated benchmarking has been applied in an empirical setting, albeit a theoretical implementation. Therefore continuing on the findings of this work and actually applying the model within the company at a more detailed and practical level would be very valuable both for Statoil and the discipline as a whole. Figure 23 demonstrates the graphical depiction of the model. A more detailed description of the different phases plus a description of how the model will contribute to the different areas of improvement that have been identified within the *Operation and Maintenance* benchmarking model has been captured in Section 3: From Good to World-Class. A theoretical implementation road map has also been afforded, however in the author's view this must be tried and revised according to practical operating procedures, which due to staff access and site visit limitations was not possible.

Finally, all the findings, including the reference-model, have been input into the analysis for several *Operation and Maintenance* indicators, to demonstrate the model, its strengths and limitations, before defining areas of further work that are essential in maintaining momentum and realizing the improvements stated.

It is acknowledged that the outcome of this work would not have been attainable had it not been for the commitment of some towards genuine improvement and continuous development in addition to the courage and openness of others to share their experiences and thoughts even though in some aspects they showed faults within the company's operating culture. The focus of this report is not to "hang dirty laundry out"; it is to genuinely contribute to the further improvement of benchmarking practice within *Operation and Maintenance* and the company as a whole. It is the author's view that the company already has a very strong improvement culture, represented in their high level focus on benchmarking and *Ambition to Action* management philosophy, and is certainly believed to be capable of going from "good to world-class".

Challenges and Limitations

Challenges have been numerous over the course of carrying out this work scope and while some have been resolved adequately, others required taking a slightly different approach to still be able to achieve the objectives of this project.

Incipiently, the topic was not one of the author's areas of knowledge and although some familiarity with benchmarking had been acquired through the *Performance Measurement and Management* class taken at the University of Stavanger in spring of 2011, most of the knowledge had to be acquired prior to starting the analysis part of the project. During this knowledge-acquiring phase, a further challenge was to find relevant textbooks at the university library due to a lack of stock within this topic. Therefore, contact had to be made with other libraries such as Bergen Høyskole, among others, to loan relevant material, which was imperative in building the complete picture of the subject matter.

Other restrictions that had to be adhered to were confidentiality and access related matters. Firstly, although a confidentiality agreement with the company was signed, there was reluctance for the author to make direct contact with different departments within the company to gain a better understanding of their benchmarking practices. Later, once a trust relationship was established and the intentions of the report in terms of highlighting and contributing to company improvement became clear, such reluctances faded and it was much easier to gather the required data for analysis. Furthermore, as part of initial discussions, possible site visits were considered to enable the author to interview employees actually involved with the benchmarking process from a line organization point of view; this was later dismissed due to safety implications and financial burdens.

With regards to confidentiality, information presented in this report, especially figures and images, had to be masked sufficiently to protect confidential information. Numerous discussions and workshops were conducted to ensure a reasonable level of information could be included without exposing sensitive information.

Main limitations of this work are related to practical implications of the findings, which lead to the inception of the two proposed areas of further work projects. Both due to a lack of time and access to line organizations, the required information was not retrievable to be able to form a complete view of the practical application of the model. Also, although the findings are documented as specific to the *Operation and Maintenance* department, they can be adapted generally to other departments and within other organizations to a lesser extent. This is because the challenges and barriers captured as part of this study have been identified as common amongst several departments.

Finally, due to lack of time, common data gathering procedures, effective and specific key performance indicators and a practical implementation plan have not been thoroughly presented in this report, however best practices have been documented for each.

Conclusion

In conclusion, it has been found that there is a gap in the literature in terms of accurate and comprehensive explication of benchmarking both as a concept and a process. There is a need for literature that characterizes benchmarking versus other types of analysis as well as a more thorough explanation of the process and the details behind the main headings in terms of assessing one's own performance and finding the enabling processes and practices that lead to best practice. Delving deeper beyond the numbers and understanding such enabling processes is the most critical part of benchmarking and in the past it has received very little attention.

In terms of terms of the empirical study, numerous effectual benchmarking processes have been identified within the organization along with a myriad of expertise related to the process, its limitations and challenges. Expertise, however, need to be spread throughout the organization and not only be centralized within the corporate and managerial levels to ensure a completely successful implementation of benchmarking and its improvement potential. Training, awareness and open communication should be enhanced to improve on this aspect, in addition to more accessible systems that communicate all decisions and intentions related to benchmarking.

By combining benchmarking best practice and company know-how, Statoil can readily transfer their *Operation and Maintenance* efforts into world-class performance, achieving their goal and setting the targets for the industry.

More work is required to both assess the practicality of using the model on projects and assets, as well as actually applying the model practically on projects and for assets to enhance performance on specific indicators and streamline the process further. Although both projects are related, one focuses more on the model itself in smoothly incorporating it into existing work practices and processes while the other focuses on *Operation and Maintenance* tasks and uses the model to drive performance improvement.

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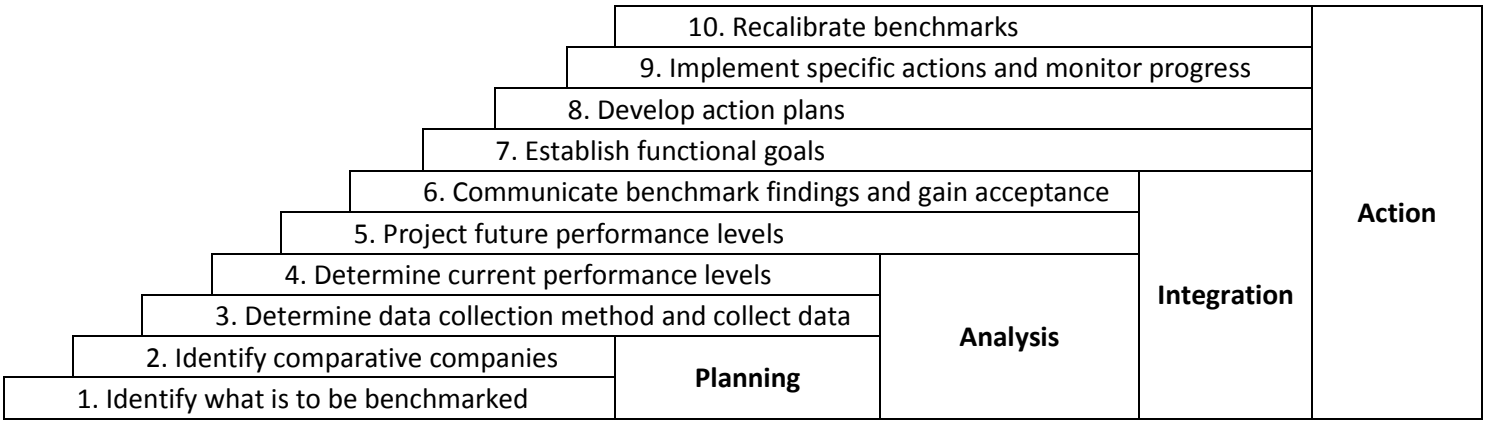
Appendix A

Reconstructed graphical representation of Camp's 10-step process:



Appendix B

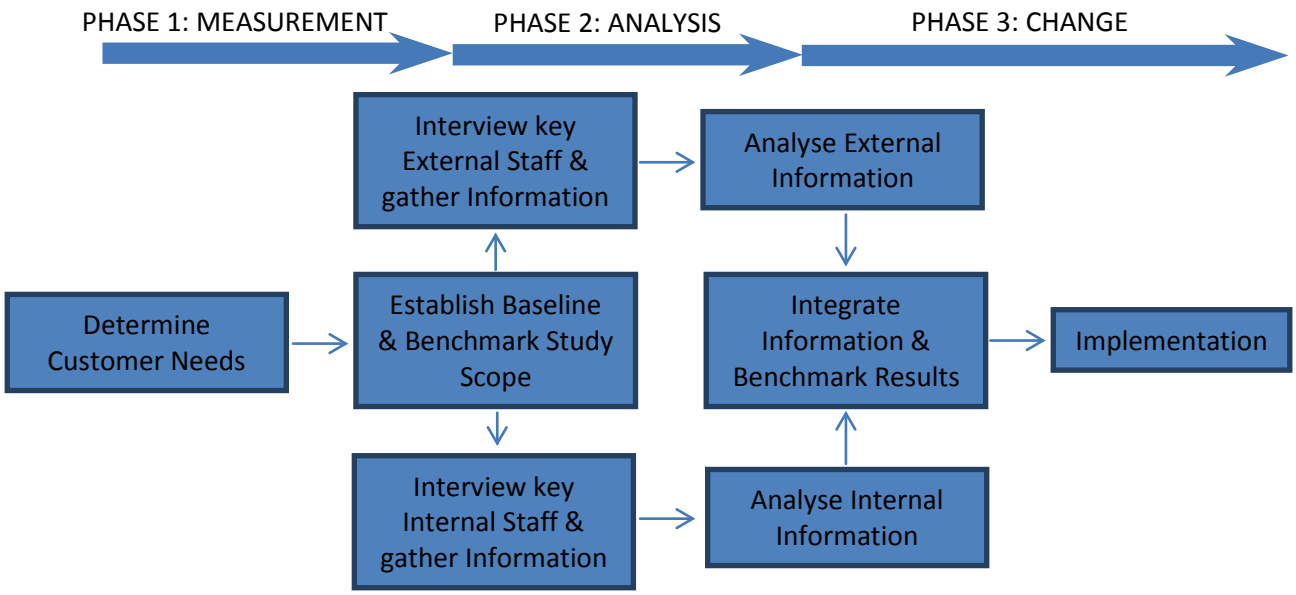


Figure B. 1. Avon Products' phases of benchmarking (McNair and Liebfried, 1992)

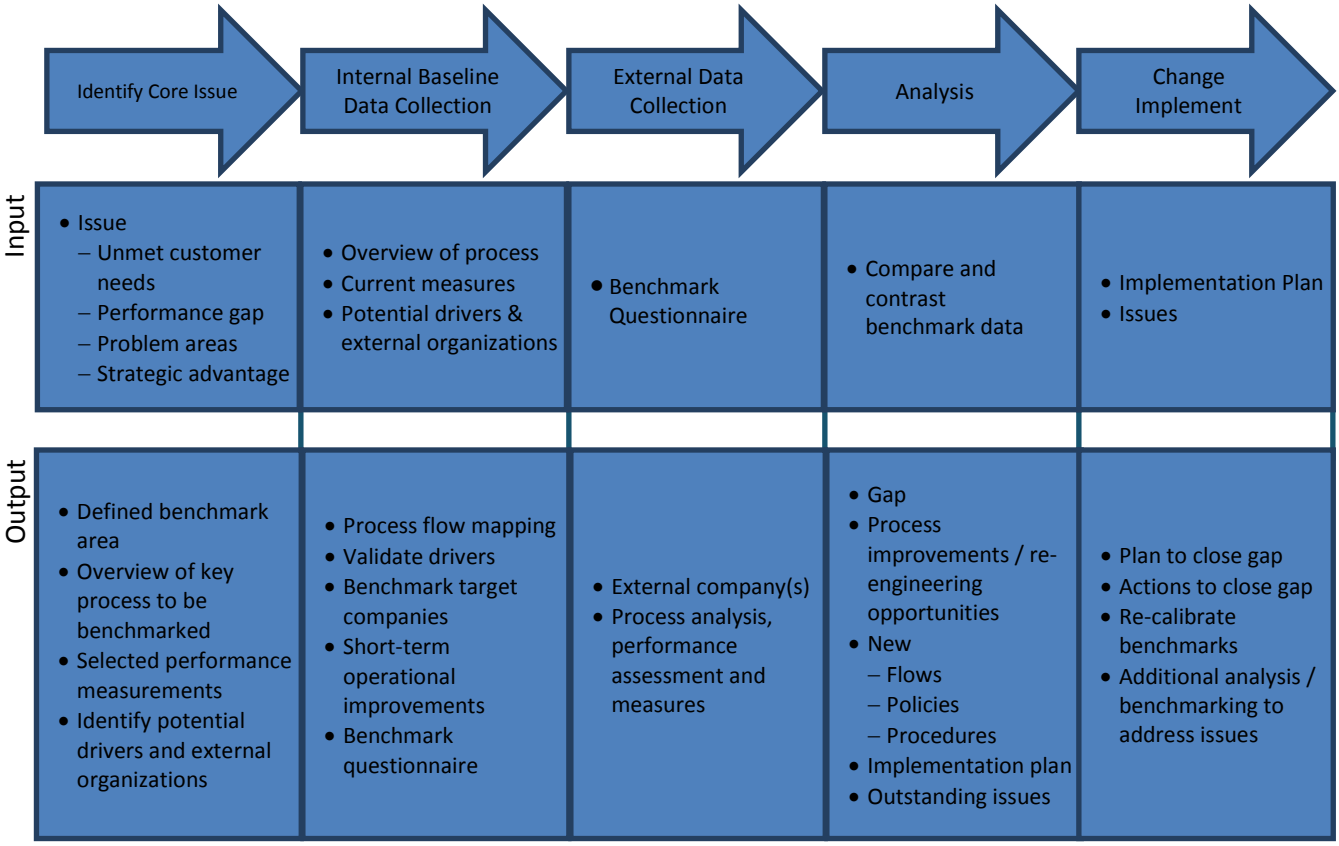


Figure B. 2. Generic framework for benchmarking (McNair and Liebfried, 1992)

Appendix C

American Productivity and Quality Centre's (APQC)

BENCHMARKING CODE OF CONDUCT (2010)

1. Legality
   1.1. If there is any potential question on the legality of an activity, then consult with your corporate counsel.
   1.2. Avoid discussions or actions that could lead to or imply an interest in restraint of trade, market and/or customer allocation schemes, price fixing, dealing arrangements, bid rigging, or bribery. Don't discuss costs or prices with competitors.
   1.3. Refrain from the acquisition of trade secrets from another by any means that could be interpreted as improper, including the breach or inducement of a breach of any duty to maintain secrecy. Do not disclose or use any trade secret that may have been obtained through improper means or that was disclosed by another in violation of duty to maintain its secrecy or limit its use.
   1.4. Do not, as a consultant or client, extend benchmarking study findings to another company without first ensuring that the data is appropriately blinded and anonymous so that the participants' identities are protected.
2. Exchange
   2.1. Be willing to provide to your benchmarking partner the same type and level of information that you request from your benchmarking partner to your benchmarking partner.
   2.2. Fully communicate early in the relationship to clarify expectations, avoid misunderstanding, and establish mutual interest in the benchmarking exchange.
   2.3. Be honest and complete with the information submitted.
   2.4. Provide information in a timely manner as outlined by the stated benchmarking schedule.
3. Confidentiality
   3.1. Treat benchmarking interchange as confidential to the individuals and companies involved. Information must not be communicated outside the partnering organizations without the prior consent of the benchmarking partner who shared the information.
   3.2. A company's participation is confidential and should not be communicated externally without their prior permission.
4. Use
   4.1. Use information obtained through benchmarking only for purposes stated to the benchmarking partner.
   4.2. The use or communication of a benchmarking partner's name with the data obtained or practices observed requires the prior permission of the benchmarking partner.
   4.3. Contact lists or other contact information provided in any form may not be used for purposes other than benchmarking and networking.

5. Contact
   5.1. Respect the corporate culture of partner companies, and work within mutually agreed procedures.
   5.2. Use benchmarking contacts designated by the partner company if that is its preferred procedure.
   5.3. Obtain mutual agreement with the designated benchmarking contact on any hand-off of communication or responsibility to other parties.
   5.4. Obtain an individual's permission before providing his or her name in response to a contact request.
   5.5. Avoid communicating a contact's name in an open forum without the contact's prior permission.
6. Preparation
   6.1. Demonstrate commitment to the efficiency and effectiveness of benchmarking by being prepared prior to making an initial benchmarking contact.
   6.2. Make the most of your benchmarking partner's time by being fully prepared for each exchange.
   6.3. Help your benchmarking partners prepare by providing them with a questionnaire and agenda prior to benchmarking visits.
7. Completion
   7.1. Follow through with each commitment made to your benchmarking partner in a timely manner.
   7.2. Complete each benchmarking effort to the satisfaction of all benchmarking partners as mutually agreed.
8. Understanding and Action
   8.1. Understand how your benchmarking partner would like to be treated.
   8.2. Treat your benchmarking partner in the way that your benchmarking partner would want to be treated.
   8.3. Understand how your benchmarking partner would like to have the information he or she provides handled and used. Handle and use it in that manner.

BENCHMARKING PROTOCOL

Benchmarkers:

- Know and abide by the Benchmarking Code of Conduct.
- Have basic knowledge of benchmarking and follow a benchmarking process.
- Prior to initiating contact with potential benchmarking partners, determine what to benchmark, identify key performance variables to study, recognize superior-performing companies, and complete a rigorous self-assessment
- Have a questionnaire and interview guide developed, and share these in advance, if requested.
- Possess the authority to share and be willing to share information with benchmarking partners.
- Work through a specified host and mutually agreed-upon scheduling and meeting arrangements.

When the benchmarking process involves a face-to-face site visit, the following behaviours are encouraged:

- Provide a meeting agenda in advance.
- Be professional, honest, courteous, and prompt.
- Introduce all attendees and explain why they are present.
- Adhere to the agenda.
- Use language that is universal, not one's own jargon.
- Be sure that neither party is sharing propriety information unless prior approval has been obtained by both parties, from the proper authority.
- Do not share price or cost information with competitor.
- Share information about your own processes, and, if asked, consider sharing results.
- Offer to facilitate a future reciprocal visit.
- Conclude the meeting and visits on schedule.
- Thank your benchmarking partner for sharing their process.

BENCHMARKING WITH COMPETITORS

The following guidelines apply to both partners in a benchmarking encounter with competitors or potential competitors:

- In benchmarking with competitors, establish specific ground rules up-front. For example, "We don't want to talk about things that will give either of us a competitive advantage, but rather we want to see where we both, can mutually improve or gain benefit."
- Benchmarkers should check with legal counsel if any information gathering procedure is in doubt (e.g., before contacting a direct competitor). If uncomfortable, do not proceed. Alternatively, negotiate and sign a specific non-disclosure agreement that will satisfy the attorneys representing each partner.
- Do not ask competitors for sensitive data or cause the benchmarking partner to feel they must provide data to continue the process.
- Follow guidelines from the Federal Trade Commission and U.S. Department of Justice on any survey requesting competitive information. Participants from at least five organizations should report data so that no individual organization represents more than 25 % of the responses and so that information is sufficiently aggregated, which will prevent participants from identifying information from any particular entity. Use an ethical third party to assemble and blind information using data more than three months old.
- Any information obtained from a benchmarking partner should be treated as internal, privileged communications. If "confidential" or proprietary material is to be exchanged, then a specific agreement should be executed to specify the content of the material that needs to be protected, the duration of the period of protection, the conditions for permitting access to the material, and the specific handling requirements necessary for that material.

Appendix D

Masters Project Description

Name Riad El-Wardani

Project Title Developing a reference-model for Benchmarking: Performance Improvement in Operations and Maintenance

Problem / Challenge

Develop a clear and easy-to-use benchmarking model to allow continuous business performance improvement based on "best practice", rather than compliance.

Statoil has a major responsibility of "driving simplification and improvement initiatives" by relying on tools such as benchmarking. The aim is to drive business performance based on best practice rather than compliance. To date, the full potential of benchmarking has not been realized since the concept is not easy to define, let alone follow-up. A great deal of knowledge and practice remains hidden in the Statoil system that can be effectively used to drive performance based on effective Benchmarking, however no major initiative to date has aimed to uncover this information. The presence of many different opinions and methodologies on benchmarking, have confused the process and have made it difficult to compare and rank facilities or projects using a good benchmarking methodology.

Project Scope

Develop a simple-to-use reference model / framework for Benchmarking to be used as a business performance driver for global operations and maintenance (O&M).

Project Tasks

1. Identify existing benchmarking systems / procedures within Statoil, Hydro and Statoil ASA currently or previously used on different facilities.
2. Develop ranking of internal facilities and identify external companies / facilities with similar business processes considered as "industry best practice".
3. Develop register and gain understanding of all Statoil ASA work processes and procedures related to O&M that might be affected by the findings.
4. Develop simple, clear and precise model for benchmarking including information about why, what, how, when and how often, where and who.
5. Finally, a feedback loop and implementation roadmap must be setup to allow for continuous use and performance improvement based on the proposed benchmarking model for Statoil's global operations & maintenance.

Deliverables (i.e. what are expected as outcomes/products from the project)

Deliverable 1: State of the art
Deliverable 2: A simple-to-use Benchmarking methodology and framework
Deliverable 3: Implementation roadmap including feedback loop
Deliverable 4: Presentation to POOM of the newly developed benchmarking framework
Deliverable 5: Master thesis detailing work performed, and outcomes as a reference to support ongoing performance improvement initiatives in Statoil.