Benchmarking in Maintenance

Why we need more conflicts

Frank-Uwe Hess
Chairman and Co-Founder of T.A. Cook.

Benchmarking is a tool that has been successfully used for many years to measure and evaluate the performance of organizational units. In maintenance, benchmarking helps to compare the effectiveness and efficiency of essential work processes. This article strongly outlines the need for benchmarking, defined by selected key figures, including typical problems in implementing a benchmarking project.

Frank-Uwe Hess

Determination of optimal maintenance

The operational function of maintenance is too often underestimated. In a time of growth and globalization, the development of new markets, and the development of innovative products and related investment projects for the top management are of significantly higher importance. In emerging markets such as China, Brazil, or India you can find this attitude. Maintenance often plays a subordinate role in management thinking. The way maintenance is operated under these conditions, corresponds to thinking from the 1960s.

However, in many industrialized countries, where the pace of growth is much slower, there is a different attitude towards maintenance. Specifically in industries where plants are in operation 24/7, 365 days a year, a change has been taking place. Servicing is becoming a top management priority and an important economic factor. The expectation is that maintenance must ensure a requirement-oriented plant availability while being cost-efficient.

Achieving optimal plant availability while complying with business management requirements is a challenging undertaking. This raises the question of if there is a norm that clearly defines how much money the management should spend on maintenance for a defined availability? Unfortunately, there is not a simple answer to this question, because several variables influence the ways in which maintenance is carried out.

In this respect, there can only be company-specific answers depending on the defined objectives. And this is, first of all, positive: It can be determined how much money the defined availability should cost. This leads us to benchmarking, which is an essential tool to manage a cost effective and availability-optimized maintenance.

Overcoming obstacles

Before starting a benchmarking project, the basic prerequisites should be created to enable successful implementation of the findings. This requires first dealing with the basic resistance to benchmarking. The three main barriers are:

- Unwanted feedback
- Supposed „wrong“ comparison partners
- The black box problem

The experience from many benchmarking projects shows that those who have never participated in a benchmark project have clear performance improvement potential. This statement corresponds to the assumption of many first-time participants that the study will evaluate their performance as poor and that their work and methods will not be found optimal or adequate. Most of the time this is true. If we hypothetically take all the companies in an industry into account, we find that a Gaussian distribution of companies applies. Meaning there are not many bad ones, a lot of good midfield players, and only a few top companies.

Benchmarking reflects where the ‘general distribution’ within a company is located. In benchmarking these comparative results are often presented as a quartile. The first quartile is the leading group whose results all others should

align with. The second quartile is the median for all participants. In the third and fourth quartile, the "under-performers" can be found.

Defining the Benchmarking foundations

For the maintenance of industrial sites, especially process and performance, benchmarking is of interest. Benchmarking results are often supported by the following four terms (see Fig. 1):

- Industry Standard – Benchmark results within usual average range
- Best in Class – a leader within your own industry
- Best Practice – leading across industries
- World Class – world-wide peak value

As the term "best practice" implicitly expresses, procedures focus on optimizing (standard) functions/processes which are compared amongst benchmarking participants. This mere function, optimization, according to the motto: "We do what we have always done, only better!" – was questioned by Prof. Dr. Peter Kruse with his Next-Practice-Approach (see Next Practice 2017). He advocates a so-called change of function pattern, the "Next Practice." The old "behavioral/process pattern" should be questioned and new solutions sought. This approach extends the comparative benchmarking with an innovative component. It is of strategic importance, as it opens up the possibility of significantly larger ones within the benchmark to achieve performance gains.

Whether you are looking for best practice or next practice, you can usually say that benchmarking projects always have a positive effect on the performance of companies, as long as a positive attitude towards benchmarking is generated at the beginning of the project. Benchmarks are largely data-based. However, data must always first be collected, processed, and then interpreted before it can serve as „harmonized" information or results.

At this point estimates usually come into play, which are characterized by a certain degree of subjectivity. But even at the interfaces between collecting, processing, and interpreting, subjective assessments are sometimes required. The data interpretation is usually very complex and requires extensive expert knowledge. And most of all, it requires trust. A key figure does not always have to be 100 percent correct. Often a profound understanding is sufficient to estimate the approximate level of a key performance indicator or to draw conclusions about the potential for improvement.

Key messages

- Those who have never participated in a benchmark project have clear performance improvement potential.
- A key figure does not always have to be 100 percent correct. Often a profound understanding is sufficient to estimate the approximate level of a key performance indicator or to draw conclusions about the potential for improvement.
- Maintenance metrics must be selected to meet their respective requirements and demonstrate a realistic view of an organization.

Benchmarking compares key figures among comparable, but never identical conditions.

Benchmarking in Maintenance

There are more than 100 possible key figures for maintenance alone. Depending on the demand, the available KPI offer develops constantly. In different literature sources, the same key figures are often referred to and calculated differently. While benchmarking your first step should be to initiate a harmonization of the key figures to allow comparability. Support can be found in the manuals of the EFNMS Maintenance Benchmarking Committee (see EFMNS, 2011) and the SRMP Best Practice Committee (cf. SRMP, 2017).

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There you will find an overview of the most important key figures including calculation examples and detailed descriptions with application examples. Little by little, best practice values are listed. There are also benchmarking studies (see, for example, RAM Study by Solomon Associates or Maintenance Efficiency Report by T.A. Cook, 2013) and benchmark databases such as MAINDEX™ (see MAINDEX™ by T.A. Cook) or a range of spe-

Type	Object	Goal
Product Benchmarking	Product, Services, Scope	Cost reduction, product improvement
Process Benchmarking	Approach, Backgrounds, Key Processes	Process optimization, performance improvement
Performance Benchmarking	Services	Positioning
Strategic Benchmarking	Strategies, Critical Success Factors	Strategy development, competitive advantage

Fig. 1: Benchmarking models

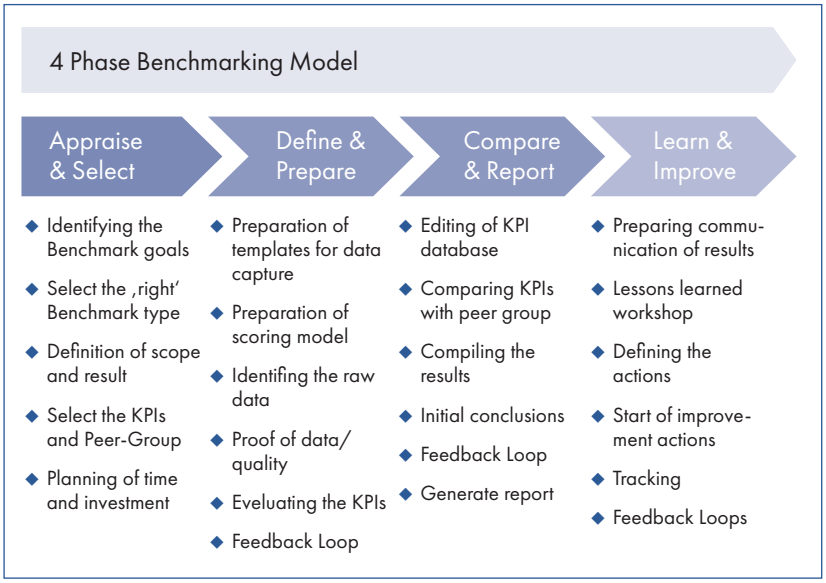

Fig. 2: Approach in 4 phases

Benchmarking projects always increase the performance of a company, as long as a positive attitude towards benchmarking is generated at the beginning of the project.

cific seminars and meetings. When benchmarking, you should either find a vendor that has the appropriate benchmarks, join workgroups that do benchmarking (eg Focus Group Maintenance Benchmarks), or participate in a benchmark study.

All of these variants offer advantages and disadvantages, which have not been discussed here. In principle, larger companies also have the option of organizing internal benchmarking. In doing so, company-internal locations, regions or production areas compare their respective maintenance together. This variant then takes place as a so-called open benchmarking. Thus, the participants know where the individual data came from and can openly discuss with each other and exchange experiences. This variant is advantageous because you do not have to overcome the „black box" barrier. The procedure usually takes place in phases (see Fig. 2). Depending on the number of participants, benchmarking can take place over a few days to a few weeks, or can be carried out over several months.

(Key) operational figures in Maintenance

Maintenance metrics must be selected to meet their respective requirements. That means they should illustrate important facts and connections by presenting essential information in a condensed and quantitatively measurable form. For example: Suppose the maintenance department argues that it cannot work in a proper scheduled way, as many production orders must be executed within the next 24 hours. This is cost intensive. Thus, if you want to reduce the proportion of rush orders, you can work with the so-called rush order rate as a key figure.

If the current share of rush orders is at 35% and the goal is to reduce it by 15%, then the rush order quota is an appropriate measure for production and maintenance to measure and achieve their common goals. However, the rush job rate says nothing about the overall performance of the maintenance, but focuses on a specific aspect of the order system.

The technical availability or OEE (Overall Equipment Effectiveness) as well as the maintenance cost rate are better suitable for performance evaluation. The technical availability or OEE demonstrates the result of the maintenance activity. On-demand availability is the essential „product" of maintenance activities. The maintenance cost rate sets the running costs for maintenance costs in relation to the replacement value of the production plant. Both ratios are related logically. Companies can look at and evaluate both key figures individually. The fact is that OEE and maintenance cost rate refer logically to each other and form as the combined key figure the „Maintenance Effectiveness & Efficiency Index" (see Fig. 3).

The higher the technical availability, the lower

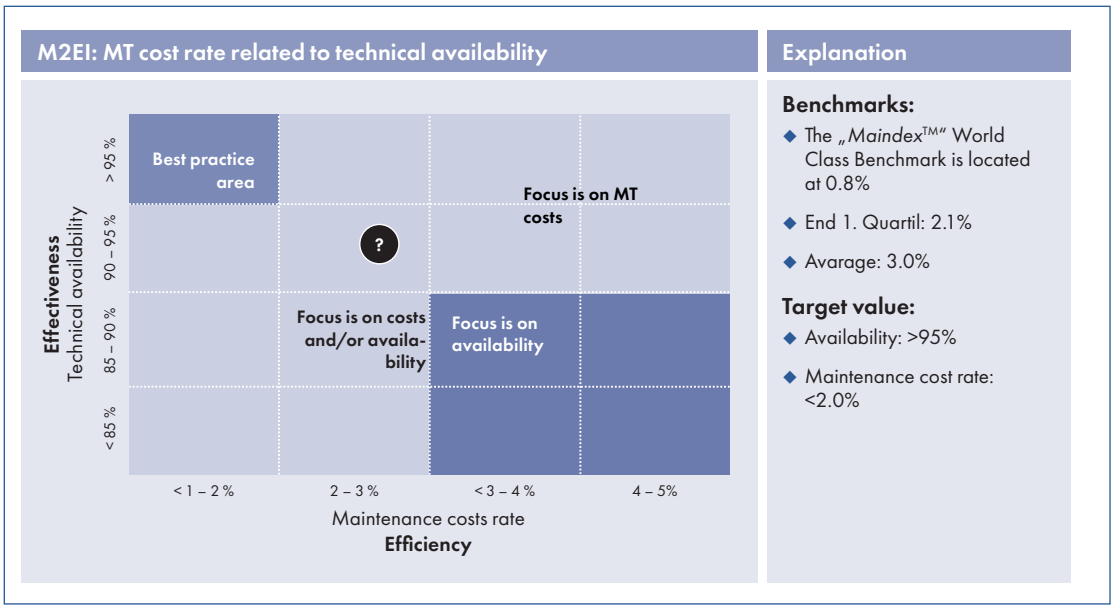

Fig. 3: Maintenance efficiency and effectiveness index (M2EI)

the cost of maintenance and the lower the maintenance cost rate. If management wants to lower maintenance costs, it can reduce costs or budgets. That's easy at first, but not sustainable. Should the maintenance costs be reduced in the long term, the availability must be optimized before the efficiency – i.e. the cost side - of the maintenance is worked on.

It is also safer because it requires less human intervention. For the two metrics mentioned above there are very specific benchmarks, which are trend-setting in the context of a benchmark project. The technical availability should be higher than 96% and the maintenance cost rate below 2% (depending on the plant/sector). Assuming the maintenance budget of a company is 5 million euros with a replacement value of 100 million euros. This means the maintenance cost rate is 5%. If the benchmark is less than 2%, maintenance costs in this case are around 3 million euros above the best practice value.

The Maintenance Performance Index

A good cause analysis for the 3 million euro additional expenditure requires more detailed information than the exact knowledge of the maintenance cost rate. For this reason, a benchmark project must consider the entire maintenance process including its interfaces. In addition to considering many individual key figures, which allow for good conclusions in a 1:1 comparison, a factor analysis is advisable. A factor analysis is a combination of individual key figures which, when put together, define a new, higher-level key figure so that you arrive at an overall key figure that reflects essential performance aspects of maintenance. The measure should therefore consider and evaluate various inputs and outputs of the maintenance.

Furthermore, using the example of an overall performance indicator, the Maintenance Performance Index (MPI), demonstrates how such a key figure can be constructed and what benefits it can generate for management decisions (see Fig. 4). The MPI is composed of 11 key figures and is created by the breakdown of ratios and key figures as well as their relation to each other (see Fig. 5). The individual figures that form the MPI are weighted by a pairwise comparison and receive a specific scoring. Each individual key figure also receives a specific score depending on the defined best practice value. The maximum score per key figure depends on their respective value.

In the example shown here, it is initially obvious that some of the key figures are strong while others are rather weak. This is a typical benchmark situation. The more metrics you have, the harder it will be to get an overall picture. This is exactly where the MPI comes in: First of all, it can be seen that the area under investigation has a very low maintenance cost rate. This is extremely positive and means that the company operates with a low maintenance budget. On the cost side, the management can be highly satisfied.

On the other hand, the technical availability of the systems is rather low, at only 86 percent. This indicates many disruptions and outages. When it comes to order processing and personnel, the company is in a good place. But the productivity is rather low and the degree of maturity underperformed. Within its peer group, the business taken as an example achieved an MPI of 59.7 percent (cf. Fig. 6).

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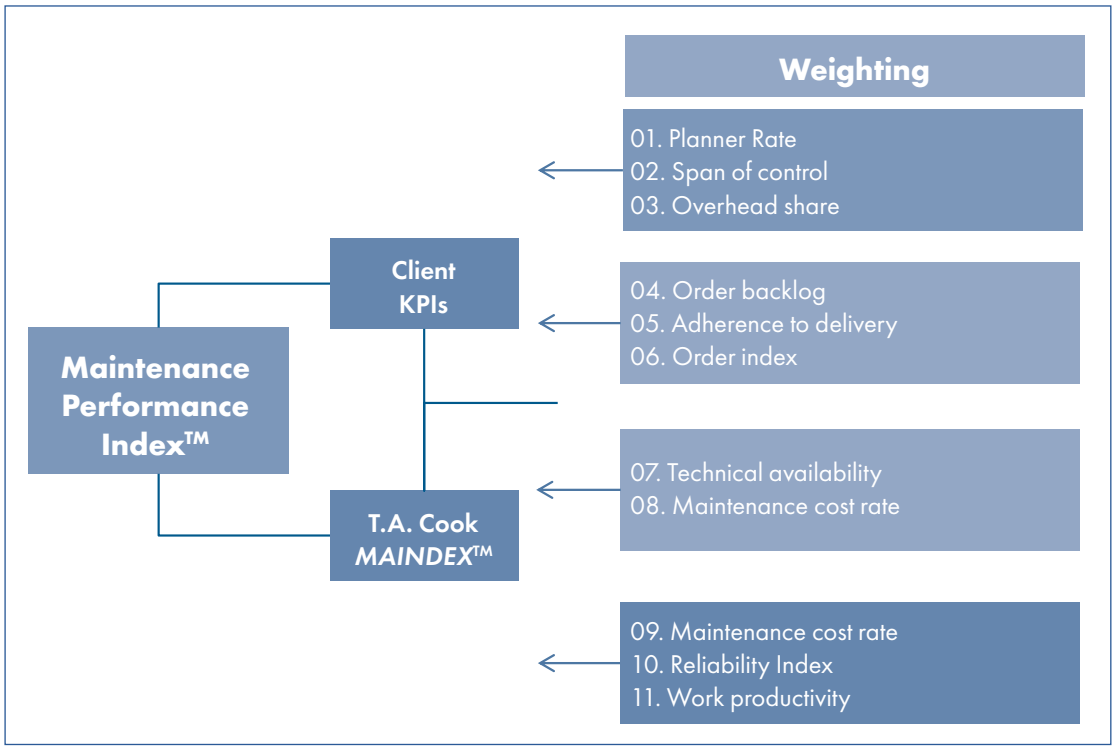

Fig. 4: Maintenance performance index 1

The overall result shows that the MPI is at the end of the second quartile. There is thus further optimization potential for the management. In the further course of this case study, it turned out that after optimizing the weak points, another positive cost effect can be achieved. The customer used in this example ultimately achieves a maintenance cost rate of 0.9 percent as the optimal target value.

Implications for practice

- Data must be first collected, processed and then interpreted bevor they can be used as a ‚harmonized' information or result.
- Even if a company participates in Benchmarking you have to harmonize the key figures bevor a comparison is possible.
- To conduct a Benchmarking one should find a vendor who can deliver the respective Benchmarks, take part in peer groups, that work with Benchmarking or participate in a Benchmarking study.

Why we need more conflicts

The chosen case study shows why developing conflicts within benchmarking are positive rather than negative. In this case, the client assumed that there was not room for improvement on the cost-side. However, benchmarking proved that a dedicated focus on the improvement of technical availability and organization has many additional clearly positive effects. The extensive preventive maintenance program was drastically reduced and in critical areas switched to an increasing condition-dependent maintenance.

As a result, the technical availability increased and the use of resources further educed. The project „Benchmarking" was initially very controversial internally. In the end, it led production and maintenance to harmonize their goals and priorities to create a consistent picture of „their" maintenance.

Maintenance Performance Index: KPI-Satz			Client		Best Practice	
Category	No	Key metric	Value	Score	Value	Score
Input	8	Maintenance Cost Index	1,2%	100	1,4%	100
Output	7	Technical availability	86,0%	30	96,0%	80
Procurement	4	Order backlog	32	60	24	42
	5	Adherence to delivery	95%	6	95%	54
	6	Order index	3,1%	60	5%	54
HR/ Organization	1	Planner Rate	1:22	40	1:25	40
	2	Span of control	1:13	45	1:13	45
	3	Overhead share	1:4,5	35	1:6	50
Service	11	Work productivity	45%	40	65%	90
	10	Reliability Index	2,1	16	4	80
	9	Maintenance level of maturity	2,8	40	3,8	72
		Overall result		59,7%		89,5%

Fig.5: Maintenance performance index 2

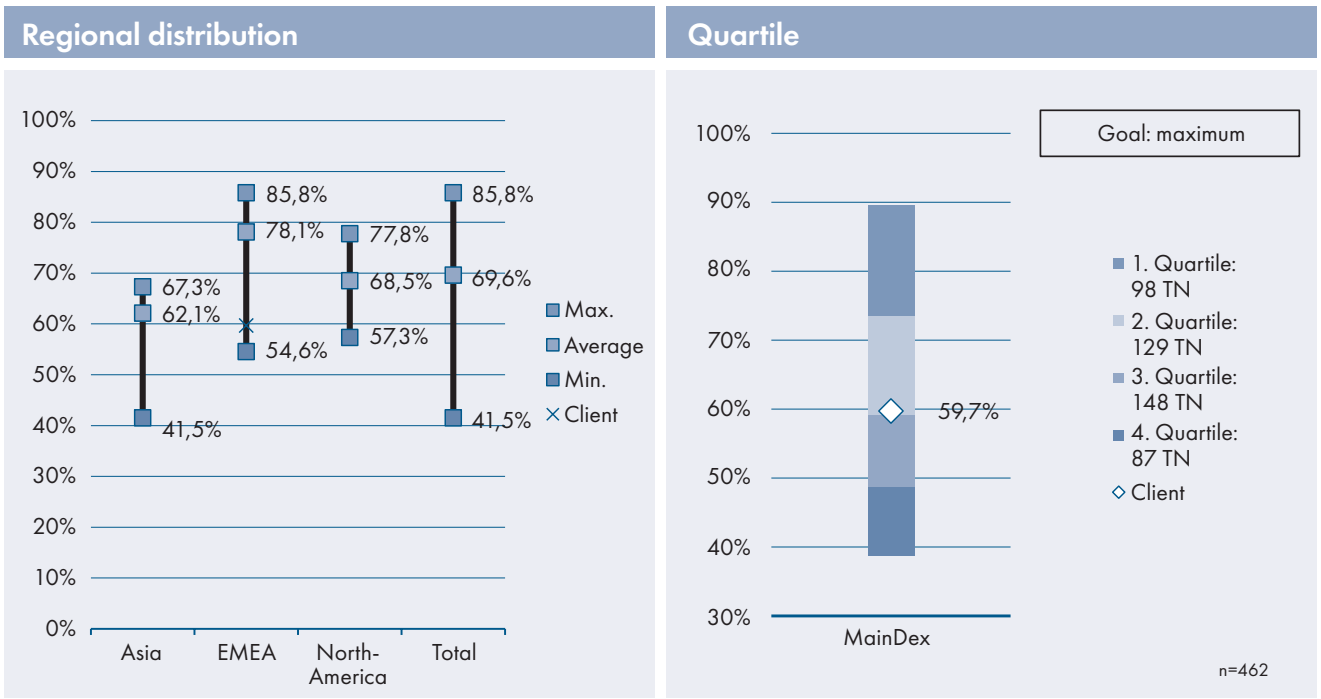

Fig. 6: MPI - Regional distribution and quartils

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