

**WORKING WITH FORCES PROMOTING OR HINDERING IMPLEMENTATION OF
STRATEGIES FOR MAINTENANCE
– EXPERIENCES FROM SWEDISH INDUSTRY**

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Abstract: This paper is based on six Swedish companies' effort to define and use a maintenance strategy. Using an analysis tool to define the present situation, the companies can describe, analyze, and evaluate the road from a present situation to a new one. Factors hindering and promoting the implementation of their strategies have been identified. They slowed down work, and also hindered the implementation of targeted and prioritized areas in their strategies! Finally, the paper report about an in-depth analysis of one of the most wanted achievements in maintenance organizations – an increase of preventive work in relation to corrective measures.

Keywords: maintenance strategy, factors promoting or hindering change, change management.

1. INTRODUCTION

Maintenance is a targeted activity area in industry today. In the pursuit of increased profits, the area is under constant cost pressure. The process of maintenance ensures that infrastructures, plants, systems, and components can be used for their intended purpose during the course of their life-length by upholding asset properties such as function and performance. As such, maintenance is an important contributor to sustainability and business economy; and for manufacturing companies in particular it supports repeatable processes that can produce products within specified quality parameters.

The classical role of maintenance is clear – fix something when it is broken, or prevent it becoming broken when it is not. In the search for improvement of the activity in itself, companies try to rectify their purchasing and equipment acquisition processes in order to ensure that their initial requirements will also be realized on the factory floor with sufficient functionality and performance to carry out the specified production tasks at the estimated cost levels and required life-lengths. During production, they try to learn from events and faults, dig up root causes, and use this knowledge to implement preventive measures. Experience, feedback data, and decision logic are thus used locally to systematically select the maintenance tasks.¹ In pursuit of even higher precision in the maintenance work, various condition-based techniques are implemented in order to totally avoid faults on selected equipment.

The number of faults and errors tend to decrease and times between failures increase due to use of modern equipment with better quality. But, modern manufacturing of tomorrow with machining processes working in stricter quality spans, at higher speeds, and with ability to sustain higher forces due to the use of material going beyond present specs in surface hardness requires disturbance free operation in chosen equipment and more precise knowledge when and where to intervene in order to prevent production disturbances. In order to develop maintenance as a professional function and contributor to the success of the complete organization, the usual approach is to continuously measure and evaluate the

maintenance performance and based on the results develop the organization and its working manners according to a strategy. The strategy used should help the maintenance organization to reach the desired goals in areas chosen. Taking the current situation as a point of departure, the strategy establishes requirements on the development activities needed. The maintenance strategy must be connected to the overall strategies of the company and must, to be useable, be accompanied with goals and plans set up at its conception as emphasized by Pinjala, *et al* (2006).

Several authors pinpoint the importance of the strategy as such, the need for the strategy to support overall business strategies, the formulation of the strategy as such, how the content of the strategy should be built up, how progress must be measured, and the importance of the implementation process where people must compile, implement, and use strategy elements and activities in the daily work. The combined efforts in the area also establishes different signs of maturity, as described in Oliviera, *et al* (2012) and Chemweno, *et al* (2013). Hence, models of maintenance maturity may give additional input to the many decisions that must be made when formulating what to do in order to reach a desired situation.

Embracing the strategy as a tool to reach development, it is clear that it is, however, only one part of many different subject areas needed to fulfill a company's business goals. Hence, it may be influenced by other subject areas and their strategies, as well as how individual employees in their organizational function look upon the strategy as such. Hopefully, the maintenance organization understands and implements the activities needed. But, how well the strategy reaches and interacts with other company functions and their strategies is crucial for the implementation pace and results that is anticipated by management and employees.

The success measured in terms of strategy fulfilment and performance improvement is therefore something expected in due time. Looking at individual companies and their experience of former strategy work, many report that it is difficult to reach the desired state of the strategy journey. Why may be connected to a lot of different circumstances. Looking in the scientific literature, many reports exists dealing with that matter in terms of why firms fail to transform organizations as stated by Kotter (1996) and Stanleigh (2008). Others emphasize the importance of change management as an important tool. Rubenowitz (2004) explain that each organization is different and face different challenges during implementation of a change and that motivation is crucial for the engagement of the individual.

Obstacles and driving forces that exists and have been mentioned in the literature about strategy implementation and change management is widely known and summarized by Salonen (2011). In his work covering specific studies of implementation of maintenance strategies he also found some that was not previously reported. Salonen also report that there is a lack of insight and awareness of obstacles for the successful implementation of maintenance strategies.

The aim of this paper is to further investigate the area of maintenance strategy formulation and implementation. The work carried out covers six different companies and of especial interest has been to further study driving and hindering forces that influence the strategy work in more detail. The paper starts with a short description of the companies involved and how the network of these companies have worked together to achieve the results reported. After that, the strategy development model chosen is described. Using the model, the results found are reported, and the paper ends with a short conclusion.

2. THE SMGC MAINTENANCE STRATEGY PROFESSIONAL NETWORK

SMGC is a member driven organization today consisting of over 40 Swedish companies performing, using or delivering maintenance and maintenance services. The work in SMGC is conducted in professional networks where problems, challenges, and experiences are shared in an open atmosphere. One of these networks focuses on strategy work and has 11 member companies together with members from Chalmers University of Technology and University of Skövde. The work has been performed since autumn 2011 and the goals with the work are:

- Highlighting the aspects that may be relevant to consider in developing a maintenance strategy
- Use the experience of other companies in order to better prepare and implement the chosen strategy
- Support the implementation and execution of a maintenance strategy
- Assess your own current situation in relation to the desired position
- Identify and weaken the forces opposing the development to the desired position
- Identify and strengthen the forces contributing to the development to the desired position

- Avoid making the same mistakes that others have made
- Speed up the implementation to reach the desired state

2.1 Strategy development model and analysis approach

The work process in the network is based on a strategy model and is followed by each network member company. The work consists of four stages, see Fig. 1:

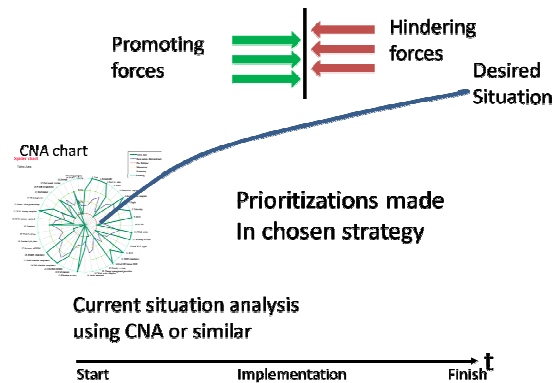


Fig. 1. The strategy model

Analysis of current situation. Each company makes the SKF Client Need Analysis (CNA) to describe a current situation in terms of maintenance operations. The tool consists of 40 questions relating to four different areas. The purpose of the CNA tool is mainly to see who is good at what and be able to do benchmarking within the network as well as in between companies in the same branch using SKF's reference database. After completion of CNA analysis present the results for the group and discuss openly.

Strong / Weak sides. Using CNA several interesting analyses can be performed. One such result is what each company is good and less good at. Particularly interesting is if this is consistent with what the company in question consider about its maintenance operation prior to carrying out the analysis. The companies that are skilled in certain areas as shown in the CNA analysis is used as a source of knowledge and reference to other network members. These strengths /weaknesses are presented and discussed with the group in connection with the presentation of the CNA results.

Prioritization of what areas in CNA that are particularly important for the company. For those companies that already have a strategy for its maintenance operations, the CNA analysis is used to measure their progress in different areas and see if they are pinpointing the right areas and are working with the right things in their strategy. For those companies that are developing their strategy, CNA gives valuable information for the choice of what to focus on. The aim is to be able to show which areas they have chosen to work with and that regarded as particularly important for the development of the maintenance activities in the company. The priorities are presented and discussed with the group.

Forces promoting or hindering the strategy work. The change process is driven by a number promoting forces but thwarted by countervailing or hindering forces. To increase the success of the change process, the emphasis should be to work on strengthening/focus on promoting forces and weaken the restraining forces. In this part of the work, those forces should be identified by the respective member companies. Examples of forces may be short-term focus by management, lack of staff skills and so on. Identified forces are presented and discussed in the group.

2.2 The CNA tool

The CNA gives a picture or foot-print of the maintenance organization as it is, but also in relation to benchmark against companies in the same branch. SKF use the tool both to improve their own organization but also in consultancy services towards SKF's external customers. Over 2000 CNA analyses have been performed by SKF globally, 18 different industry segments are measured and the results are stored in a database.

The maintenance operation is covered by 40 questions divided into 4 different areas. Fredriksson and Larsson (2012) give a detailed description:

Maintenance strategy. The aim here is to measure how maintenance is prioritized, if it is connected to the business goals, how maintenance is measured, and the use, update, and depth of the maintenance system (CMMS).

Work identification. Here, the analysis depicts how the actual maintenance work is carried out. The existing work system or working manner in acute, preventive, and predictive maintenance is followed and its connections to operator maintenance, decision support, work order process, and how the CMMS (Computerized Maintenance Management System) is used. Important is also a work system for changes.

Work control. This area focuses on the work process in terms of preparation and planning including execution issues such as backlog and spare parts handling.

Work execution. The final area focuses on the internal efficiency, i.e., to do the right things and do the things right.

2.3 Use of a pilot company

In the network, one member company was chosen as a pilot company. The idea was to let one company – as it was in the right position to start the work from scratch – use the strategy model and the support from the other network members in order to identify its current position, prioritize areas to develop, formulate a strategy, and implement it. The pilot company hence served as a learning platform as well as a locomotive for the other companies.

The work conducted in the pilot company also established the first comprehensive results using the strategy model, and it also gave opportunities to analyze some issues in depth.

3. RESULTS

The empirical data from the study have been collected from the six participating companies during the time instant that the corresponding activities have been performed during the course of their respective strategy work, see section 2.2.

3.1 Current status footprint according to CNA

All companies participating have performed an analysis of the current situation using CNA. The results have been compared with best practices achieved among all measured companies as well as against commonly accepted best practice targets. Hence, each CNA result consists of individual areas above or below best practice, see Table 1. The total amount of questions for each company is 40, divided in 10 per group, i.e., 10 for strategy, 10 for work identification, etc. Company C1 has 3 red (lowest of all companies) and 1 green (at or above best practice (BP) out of 10 questions regarding strategy. Hence 6 questions are somewhat OK (in between red and BP).

For each specific area in the CNA analysis, each company has certain especially strong and weak parts. These should all be considered in the formulation of the strategy for each company respectively. Some could be left aside, others must be included in the strategy by prioritizations made, see next section.

Table 1 CNA results at or over BP (green) and lowest of all companies (red) for company C1-C6

CNA parts	C1		C2		C3		C4		C5		C6		Σ RED	Σ GREEN
Strategy	3	1	2	4	4	3	1	7	2	3	1	2	13	20
Work identification	2	5	2	4	5	3	3	5	2	5	1	4	15	26
Work control	0	7	1	6	3	2	3	2	3	3	0	3	10	23
Work execution	4	6	5	5	4	5	3	4	3	3	3	3	22	26
	9	19	10	19	16	13	10	18	10	14	5	12		

3.2 Weak and strong parts

As such, they only have a meaning for the individual company. The pilot company therefore serves as a good example, and has been used to initiate discussions around choices made. For the pilot company, the following parts have been reported, see Fig.2.

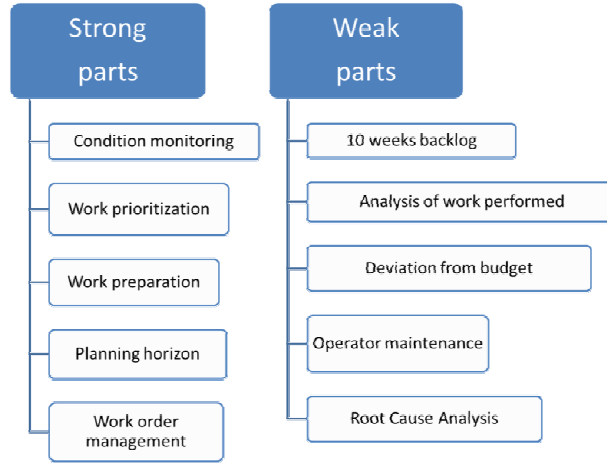


Fig.2. Strong and weak parts reported by the pilot company

3.3 Prioritizations made

Based on the analysis of strong and weak parts, the next logical step is to prioritize among those during the work with formulation of the strategy. Taking the pilot company as a reference, the step from weak and strong parts to the prioritization is depicted in Fig 3.

The next logical step would be target setting of all prioritized areas. The development of each area is then measured and compared to the target. For the pilot, the initial target was set in 2011. During the work with implementing and fulfilling the strategy, the targets have developed as shown in Fig.3. The goal setting has been troublesome for the pilot company. Some of the initial goals have been altered and adapted to more realistic settings. Especially one important goal, the corrective vs preventive ratio has been difficult to affect. Obviously one can assume that some of the goals have been affected by the forces that hinder development – as anticipated in the beginning of the work.

	Oct2011	Spring 2012	Aug 2013
Technical availability on A-machines/Others	GOAL 2014 98%/93%	GOAL 2014 98/95	GOAL 2014 98/95
Maintenance cost/production hour	65 kr	65	80
Corrective vs preventive work	60/40	30/70	45/55
Delivery precision of preventive work	98%	98	98
Amount of stops on A-machines	Max 5/yr	Max 3/yr	Max 3/yr
RCA when breakdown		100%	100%
No of stops on top 10 A-machines		-30%/yr	-30%/yr

Fig.3. Prioritized areas with their goals initially and goal changes made

3.4 Factors promoting or hindering implementation of the strategy

All companies involved in the network report continuously that many factors affect the formulation and implementation of a strategy. The pilot company detected early specific problems when trying to increase the preventive work. The reactions came from many different parts of the own organization as well as from other company functions. In order to find out more about what actually hindered the development, a master thesis project was initiated and conducted by Andrén and Brusing (2013). At the same time, the other companies started to investigate what have hindered and promoted their own strategy work. During spring 2014, the following result could be summarized. The result is reported with the CNA areas as a reference, see Table 2.

Table 2 Factors promoting(P) or hindering (H) implementation of a strategy

Area	Factors
Current situation	Potential for efficiency improvement exists (P)
Strategy	Insight among many that change and success is needed (P) Improvement work has funds (P) Work methods documented (P) Cooperation between production and maintenance (P) Desired situation not clear (H) Desired situation not communicated (H) Prio of activities needed to reach desired situation unclear (H)
Work id	Requirements on maintenance by law and regulation (P) Prioritization of maintenance activities (P)
Work control	Engagement in planning and preparation of maintenance (P) Work planning close to executors (P) Absorbed by short sight activities (H) Activities instead of goal achievements (H) Control of silos – Rewards accordingly (H)
Work execution	Experience feed-back (P) Frequent follow up (P) Measurements and KPI:s create territorial behavior (H) Easier to create something new than finish the existing (H)
Organization	Maintenance activities in one organization (P) Enthusiasts as driving force (P) Personal engagement and motivation (P) New blood in the organization (P) Organization clear with responsibilities etc (P) Low theoretical/academical level (H) Organization not clear (H) Recruitment difficult (H) Not invented here (H) Fear of showing mistakes (H) No cooperation between production and maintenance (H)
Economic steering	Challenges existing governance (H)

3.5 Additional experiences from the pilot company strategy implementation

The thesis workers Andrén and Brusing (2013) performed an in-depth analysis of what specific phenomena and factors that affected the shift from a corrective way of working to a preventive one. Their

studies show, see Fig. 4, that several factors affected the transformation wanted. One of the most intriguing findings where, that many company functions and employees regarded the preventive approach to be of no direct financial value. Investigating the statement further revealed connection of the statement to a category of statements depicting an organizational mindset; When variations in lead time is high and expected, a stoppage in manufacturing of a couple of days do not create a deviation large enough to be noticed. This in turn may lead to insufficient awareness and thereby an inadequate demand on maintenance. Combining these findings with the other two, see Fig. 4, the result first achieved becomes quite obvious; Any deviation from normal production is simply not recognized and worse, effects in economic terms are measured, but way to low.

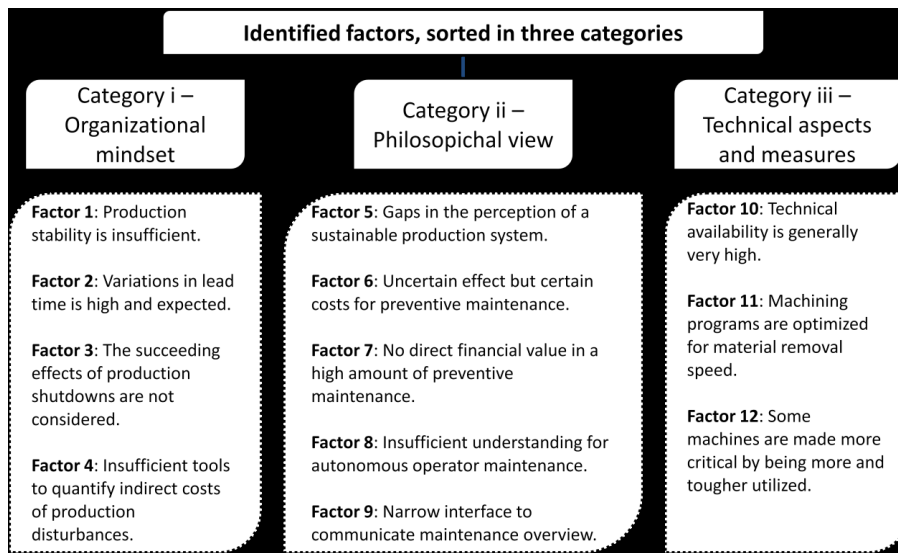


Fig.4. Factors affecting the change from a corrective to a preventive working manner, from Andrén and Brusing (2013).

The work carried out and the changes made to the strategy according to Fig.3 can then be understood. The changes made in the desired situation 2014 reflect the difficulties experienced. The development done since 2011 is therefore interesting to analyze further, see Fig 5. See Fig.3. for explanation of each row.

Oct 2011	Spring 2012	Spring 2012			Aug 2013
Goal 2014	Goal 2014	Goal 2012	Res 2012	Res 2013	Goal 2014
98%/93%	98/95	98/93	97/97	98 / 98	98/95
65 kr	65	65	70	83	80
40/60	30/70	55/45	63/37	61 / 39	45/55
98%	98	98	97	98	98
Max 5/yr	Max 3/yr	Max 5/yr	17	10,2	Max 3/yr
	100%	100%	75	80	100%
	-30%/yr	-30%*	-6%	-35%	-30%/yr

*compared with 2011

Fig.5. The strategy development results in the pilot company

4. CONCLUSION

Implementing a strategy is change. The change in turn must be in the right direction. The direction is set by how well the strategy is aligned to the business goals. With business improvements the contributing parts of an organization can recognize themselves as being a part of a successful whole.

Therefore, the strategy of any business contributing function must be tailored with great care only for the reason of being supportive to business. It must also be tailored with great emphasis to the people actually going to perform the work.

And, as can be seen from the experience reported in this paper, management must be extremely aware of the factors present in the company that could promote and hinder the development wanted. What actually a specific company may encounter in terms of such factors does of course differ. The mere knowledge that such complications exist is enough.

The trip from a current state to a desired one is not easy, especially if the target setting is sturdy. The fact that organizations encounter problems in achieving a goal must not be taken as an excuse to change the goal, but the tradeoff between achievable goals and impossible ones must be corrected. Knowing the weak points must be used in the prioritization and formulation of the strategy. What actually contributes most of all to the business goals must in turn serve as the selection tool. However, it is pointed out by the network members that communicating the strategy as well as cultural aspects may severely influence both speed and outcome of the work as well.

Finally, the factors promoting the work should be strengthened at all times, and factors hindering should be attenuated. What actions to launch could be difficult to specify, since the worst enemy here is “the organizational mindset”. Changing mindsets require drastic or even spectacular arrangements so that what seem to be as natural as a physical law, in the view of the employees, suddenly becomes unacceptable. The biggest obstacle lie in the eyes of the individual viewer, but the most natural way forward must be set for an organization of individuals – a difficult and challenging task that need attention and strengths available in a company

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