

# THE MAINTENANCE PLANNING PROCESS IN TRONDHEIM MUNICIPALITY

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## KEYWORDS

Building maintenance, maintenance budgeting, maintenance planning

## ABSTRACT

**In the field of maintenance planning for buildings there has been a great focus on the survey of technical condition and other methods to map the needs for maintenance and repair. There has been far less focus on how the Facilities Management organization (FM organization) actually can handle the internal process and the work that need to be done to restore the physical damages.**

**This paper gives an example of one way to deal with maintenance planning process. The example is based on a case study of the Trondheim Municipality.**

**The paper focus on how the maintenance planning process has been developed and implemented in the organization. An analysis of the actual figures for planned and unplanned maintenance activities in the municipality in 2004 is presented.**

**The paper has shown “a success story”, where the FM organization expended great effort to establish a solid strategy for the maintenance planning in the municipality. They were able to gain acceptance for the strategy both from the city manager and the city council. The strategy stated that a major increase in budget was needed to fulfil the strategy, and the FM organization got the increase in budget needed.**

## INTRODUCTION

In 2004 the Ministry of Local Government and Regional Development made a survey (Eikeland, 2004) of all the Norwegian municipalities. The aim of the research project was first to find the maintenance level of the buildings owned by the municipalities, and second to identify how the municipalities had chosen to deal with their Facilities Management.

In the report there are some interesting findings about the maintenance process. 85% of the respondents totally or partially agreed that good systems for maintenance planning

are highly important to achieve a satisfactory maintenance level, while only 12% of the respondents confirmed that systems for maintenance planning to some degree were already implemented in the organization. (Eikeland 2004, p89).

The aim of this paper is to give an example on how the maintenance planning process is performed in the Trondheim Municipality. The example from the Trondheim Municipality is chosen as an example of best practice among Norwegian municipalities. Further case studies should be performed to confirm that the Trondheim Municipality represents best practice.

The chosen methodical approach is a thorough document study with special concern for the actual maintenance plan for the municipality in 2004. In addition, four structured interviews with central persons in the Trondheim Municipality have been carried out.

## TRONDHEIM MUNICIPALITY CASE

Trondheim municipality reorganized their FM department in 2000. The new organization immediately started to arrange their maintenance planning process. They established a structured process that covered the whole value chain from the survey of technical condition, through the annual budgeting and planning process, to the detailed planning, ordering and supervision of the work to be carried out.

A strategy for the holistic approach to the maintenance planning process was developed and divided into sub processes for each step in the process. The whole process was supported with a special developed Information and Communication Technology tool (ICT Tool) by the vendor Itema AS. The maintenance planning process was developed and implemented in the municipality from the end of 2002.

I happened to work in Trondheim Municipality at the time of the process development, and was leading the working group (Gissinger 2001) which was responsible for suggesting the strategy for maintenance planning for the management team. It has been challenging to establish the needed distance from the work which the scientific approach demands, but I have tried to collect as much hard evidence as possible to achieve the needed objectiveness.

Two central procedures (Gissinger 2002 b, c), were developed and approved by the management team in the FM organization 04.02.2002. The first procedure covers the planning and budgeting process, and the second procedure covers the needed steps from detailed planning through the procurement process and finishes with the control and economical reporting for each of the planned maintenance activities through the year.

The aim for the maintenance of the municipality owned buildings in Trondheim is:

*“Maintenance of the buildings portfolio owned by Trondheim Municipality should always be on a proper level both technically and economically. Maximum benefit should be achieved for all the money spent on maintenance”* (Gissinger 2002 a, authors translation)

As a policy instrument to achieve the aim of the organisation several concrete measuring points are listed in the strategy report. Among these measuring points we find:

- Normal level for the maintenance activity should be raised to NOK 100,- pr m<sup>2</sup> (actual level 2002 NOK 68,- pr m<sup>2</sup>)
- An additional amount of NOK 100,- pr m<sup>2</sup> should be granted for a period of 10 years to raise the general level of technical standard.
- The whole building portfolio should be subject to a survey of technical condition in accordance with the Norwegian standard (Standards Norway 1995) till the end of 2006.

Later on in the strategy report a timeline for the needed planning and ordering activity is presented. The most important milestone for the planning activity is the turn of the year, when no changes in the planned activity are permitted without the approval of the management team in the FM organization. Two exact dates are pointed out for revision of the planned activity (last of May and last of September).

For the ordering of the enterprises that are needed to carry out the actual work of the maintenance activity, the most central milestone is the last of October. No orders are allowed to be placed beyond this date.

After the strategy report was approved by the management team, the FM organization kept implementing the strategy in the organization. The FM organization was also making great efforts to achieve the framework condition from the city manager’s organization and the city council that were needed to carry out the maintenance strategy. The efforts were rewarded by a extra general grant of NOK 200 millions for the period 2003-2006 from the city council to increase the general technical standards of the school buildings (Noreide, 2003).

To carry out the planned survey of technical conditions, the FM organizations engaged students from NTNU during the summer holidays from 2003-2005. The first 6 students worked the summer of 2003. They managed to carry out a technical survey for almost 500 000 m<sup>2</sup> of buildings, and discovered more than 3000 defects, which they registered in the new developed ICT tool; Idrift. In the autumn of 2003, the permanent staff worked through the register defects and gathered them into maintenance activity which were planned for improvement for the period from 2004-2007.

In 2004 the FM organisation had a permanent staff of 12 persons with the main task to plan and order activities on the maintenance plan. The former situation for the FM organisation was that there were no room for planned maintenance activity, and some of the permanent staff had problems in adapting to the new situation (Hassel, 2007) where the level of planned activity had raised from next to nothing to about 80% of the total budget. The total budget responsibility for each employee increased significantly in the same period.

An important aspect when dealing with maintenance in a municipality is that the city council, through their annual budget, gives the city manager the commission to deliver in accordance with the budget, which means that in an ideal situation the money budgeted for maintenance in an actual year should be spent for this purpose. There will always be discussion as to whether or not such strict regimes are wise in a greater perspective, but in this paper the annual budget has been taken as an absolute constraint for FM organisation.

To make sure that as many as possible of the maintenance activities were carried out as planned, a monitoring of the accumulated week to week ordering volume was registered in 2003 and 2004.

To give an impression of how the FM organisation performed in their aim of spending money in accordance with the maintenance plan, some key figures are shown in the table below:

**Table 1**

	No. activities	Budget	Act. cost	Result
Unplanned activities	11	20,5	12,2	8,4
Insurance	8		3,1	-3,1
New activities	45		14,5	-14,5
<b>Sum</b>	<b>64</b>	<b>20,5</b>	<b>29,7</b>	<b>-9,2</b>
Finished activities	198	65,4	60,7	4,7
Postponed activities	51	31,9		31,9
<b>Overall performance</b>	<b>313</b>	<b>117,8</b>	<b>90,4</b>	<b>27,4</b>

Table 1 shows that the FM organisation was able to finish maintenance activities for a total amount of NOK 90,4 mill which is 27,4 mill less then budget. In the total budget for postponed activities, two schools (Nardo and Utleira) were

planned with a budget of 23,6 mill which, when let out, decrease the aberration to NOK 3,8 mill (3,2 %). This may be seen more as a stroke of good luck than the result of wise decisions throughout the year.

The two schools were taken out of the maintenance plan and transferred to the long term plan for refurbishment. The work at Nardo school has now (2007) just started. Utleira school was refurbished in 2005/2006.

What may be more important is that the key figures between the budget and the actual cost for the 198 finished activities are only 7,2 %, which normally would be considered as good precision in budgetary control.

The method for calculating the budget of each of the planned activities is mainly based on the experience of the permanent staff. No accurate calculation has been performed. As a result of this practice the discrepancy for each of the planned activities varies greatly, as can be seen in Figure 1.

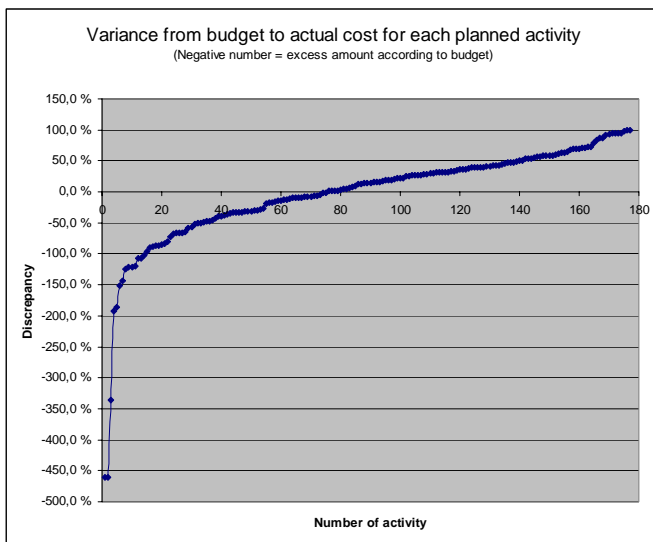


Figure 1

Before the graph was drawn, some adjustments on the basic data were performed. The main adjustment is that activities with only budget and no registered actual cost are removed. The reason why this phenomena may occur could in many cases be explained where several activities have been gathered into a single activity when reporting into the database.

The activities which show a 100 % correspondence between budget and actual cost (i.e. Budget 100 000 actual cost 100 000) will also best be explained with inaccuracy in the registration process, and these values have also been let out.

Except for the right end of the graph, which may be explained with inaccuracy in the reporting process, the spread of the single discrepancies seems to be well distributed, which indicates that the discrepancy may be seen as an independent

variable. The possibilities to use quantitative methodology in further analysis of the data set may be an interesting idea.

If we look at the single activities we find that the actual cost lies between one third and the double of the budgeted cost for 141 of 174 (80 %) of the finished activities. The rest of the activities have greater aberration. This may be greatly inaccurate, but still not “way out”.

The most important findings are nevertheless that the number of overestimated and underestimated activities seem to be balanced in such a way that the overall difference tends to be very low (both in numbers of activities and values).

## THE INTERVIEWS

In this case study, I have chosen four informants which have been working in the FM organization for the whole period of time this paper investigates. The four informants are: The former executive director, the former information officer, the deputy director for maintenance, and a maintenance planner.

The four informants were subject to a structured interview with 12 questions, covering aspects such as: the change process from ad hoc based to structured maintenance planning, important factors to achieve an increase in the maintenance budget, the survey of technical conditions, the ICT tool, and the budgetary control of the actual maintenance work.

Each of the interviews lasted for about one hour, and was videotaped, but the findings from the interviews are based on the notes made during the interview. No full transcription has been made.

In general there is great agreement among the informants about most of the questions addressed in the interview. All the informants confirmed that there has been a radical change from unplanned to planned maintenance, the general budget has increased significantly, and the most important reason for the increased budget is caused by the clear communication to the city manager and the city council. The importance of documentation through the survey of technical conditions was mentioned as important by all the informants both for direct use to support the planning and budgeting process, and also to give the printed maintenance plans better credibility.

The only point with a tendency toward minor disagreements among the informants concerns the capability for the maintenance planner to adapt to the new situation. The two informants, Hassel and Moen, claim that the change from unplanned to planned activity was difficult for many of the maintenance planners, while the only maintenance planner among the informants did not find the change difficult from a personal view. An interview among more of/all the maintenance planners may be needed to clarify this question. This may be a bit difficult since only three of the original twelve maintenance planners are still working in the organization.

When it comes to the drivers for the organizational change and increased budgets, Hassel would give most of the honour to the focus from the senior management of the FM organization, while the three other informants claim the information work between the city manager and the city council were of greatest importance. They are probably both right.

### BALANCING THE BUDGET

Both from the document analysis and the interviews we find that the rate of planned activity in the maintenance process in the Trondheim Municipality has increased to about 80%. The results have shown good control of the overall cost, which mean that the maintenance has been in accordance with the available budget.

The available budget has to a great deal been in accordance with the maintenance strategy which was approved in 2002, and there has been a significant improvement in the technical condition of the building portfolio in the Trondheim Municipality in the period investigated. (Nergård and Moen 2005)

In Tore Haugen’s doctoral thesis (Haugen 1990) figure 3.9 The “Ideal model” of the maintenance planning process is given.

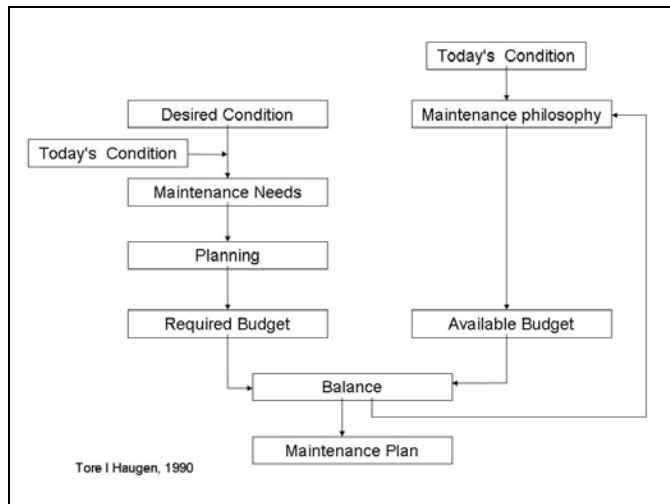


Figure 2

From the above description of the Trondheim Municipality case it seems that the maintenance planning process is carried out in accordance with Haugens model.

The most important action to balance the available budget with the required budget was to limit the major repairs to 1/4 of the buildings each year. If the difference between the available budget and the required budget had been greater a reduction of major repairs to 1/5 or 1/6 of the building portfolio each year may had been enough to balance the budget.

What was emphasized by one of my informants, was that the dissatisfaction among the users would increase with increasing length between the major repairs, and a period of 4 years may be as long as the users were patient enough to wait (Moen 2007). To satisfy the “waiting users” a system with “handymen on wheels” was implemented. This system consists of 4 groups of two persons in one service car that moves around among the users to perform minor repairs.

According to Svein Bjørbergs figure, this practice, as long as the periods between major repairs does not exceed the limits for rapid growth in the physical damages, may be a reliable way to balance the budget.

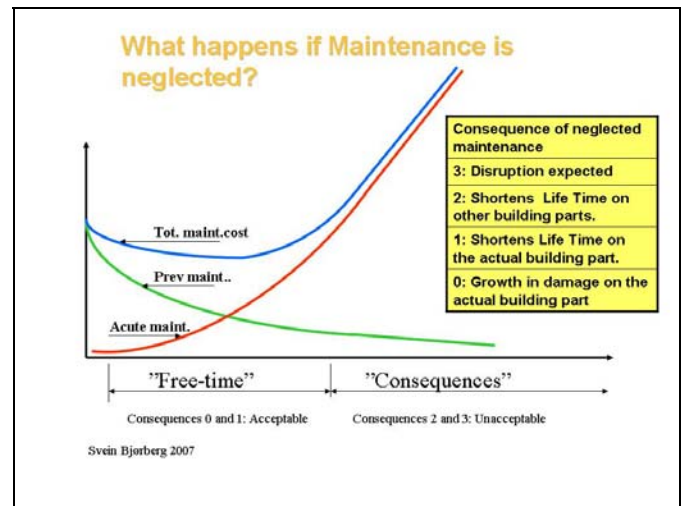


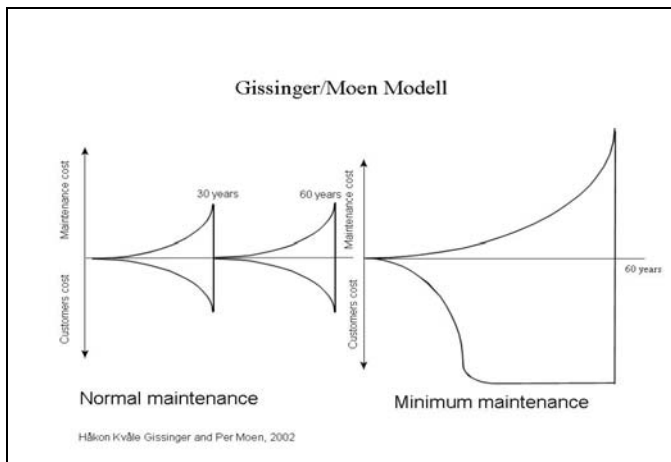
Figure 3

One alternative way to balance the budget is to accept an overall lower level in the technical condition. This means ignoring any aesthetic defects and minimizing all other demands towards the absolute minimum requirements from the legislation and Bjørberg’s “limit for accelerating defects”.

The results of such minimum requirements are that it should be possible to lower the total cost of the maintenance budget significantly, but such a strategy may lead to a great deal of dissatisfaction among the users, loss in productivity, reduced prosperity, and in some cases an increase in sick leave. These are all cost components which certainly should be taken into consideration before the final choice of maintenance strategy.

There have been several attempts to calculate the cost of the factors above, but a common conclusion is missing. It may be very challenging to give quantitative proof for the connection between the choice of the maintenance strategy and the factors above. In many cases the responsibility for the well being of the users is placed in other branches of the organizations, and sub optimizing is likely to happen.

What the FM organization in Trondheim Municipality did to address the challenge mentioned above was to illustrate the possible connection with Figure 4.

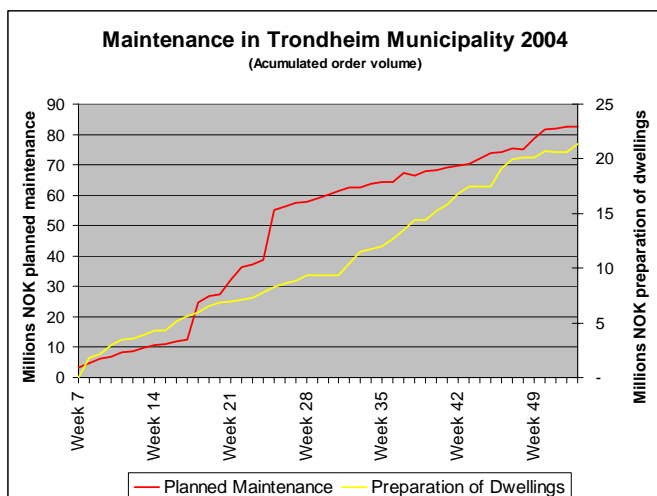


**Figure 4**

Figure 4 shows that the cost in the user organization may exceed the maintenance cost several times, if you choose to go for a minimum level in technical conditions. On the other hand the growth in cost for maintenance when you are doing major repairs later in the lifetime of a building may be over estimated. The idea is given support from a case study from four Norwegian municipalities from last summer (Horjen, 2006), which concludes that in three out of four cases where total renovation was carried out, and the situation before the renovation was really bad. There were no evidences that preventive maintenance earlier in the buildings lifetime would have lowered the total maintenance cost. Thus the most important argument for well arranged maintenance plans, should be searched for in the users organization and not in a narrow perspective on the technical conditions alone.

### CONTROLLING THE BUDGET

Making sure that all the planned activities are carried out within the end of the year is seen as a critical success factor for the FM organization.



**Figure 5**

From Figure 5 we find that the ordering volume of planned activity seems to have a non linear progression, while the curve for preparation of dwellings seems to be fairly linear.

This may be explained with the moving in and out of different dwellings are evenly distributed over the year, and the orderings naturally follow the nature of the movements. The ordering volume for the planned activity follows the internal procedures in the FM organization. The permanent staff are waiting for the final approval of the budget at the turn of the year, before the detailed planning and the procurement process starts. This takes some time and the ordering volume shows a weak rate of growth until around week 17. From week 17 to around week 26 the growth is clearly more rapid, which may be explained with the importance of starting the different activity as early as possible to be sure the activity is finished before the end of the year. For the rest of the year the curve flattens out, which may be explained with the smaller amount left of the total ordering volume.

In some ways the curve have similarities to the well known S-curve for building projects, which may make it possible to calculate the trendlines for the expected total cost by using the earned value methodology (Fleming and Koppelman, 2005). If you consider the whole maintenance plan with all its activity as a single building project which starts at the beginning of the year and ends when the year is over it may be natural to compare the management of the maintenance plan with ordinary project management. Research on this hypothesis should be carried out in future work.

To manage the budget is an essential requirement in public administrations, and an important presumption to achieve this aim is a thorough monitoring of the ordering volume. In an FM organisation, as in all other organisations, some of the expenses are fixed or in some other way hard to control. The easiest expenses to control for an FM organization are the planned maintenance activities (at least in the first half of a year where not all the orders have been placed). Simply by stopping those activities that have not yet been ordered the balance in the budget can be restored. On the other hand, if accounting trendlines show that there will be money left on the budget at the turn of the year new activities, for example from next years budget, could be set in order.

Some may comment that this kind of random delay and/or acceleration of planned maintenance activities will not cause the most efficient use of the maintenance budgets in contrast to a more throughout mathematical analysis of all important factors to ensure that consequently the activities with the best cost benefit ratios are chosen as suggested by Sharp and Jones (Sharp and Jones, 2006). The Figure from Bjørberg may suggest that to strive for the optimal priority is of less importance as long as the border of rapid growth of the damage is not exceeded.

One moment that may lead to more efficient use of the maintenance budget is to try to move the S-curve to low cost seasons if such seasons exist. Some might suggest that the market situation in the beginning of the year is in a state of far lower pressure than during summer time. If the organisation starts the detailed planning of maintenance activity in the last

quarter of the year, the contractors may be able to start working early in January to lower costs. On the other hand, major repairs on school buildings should be carried out during summer vacation to minimize the disadvantages for the users.

The possibilities to juggle with the timing for when to carry out major repairs know almost no limits as long as the system implemented in the organisation gives the best overview possible, which is essential to be able to carry out wise decisions.

## **ADAPTING THE ORGANIZATION**

In 2004 the Ministry of Local Government and Regional Development made a survey (Eikeland, 2004) of all the Norwegian municipalities. The aim of the research project was first to find the maintenance level of the buildings owned by the municipalities, and second to find status of how the municipalities had chosen to deal with their Facilities Management.

In the report there are some interesting findings about the maintenance process. 85% of the respondents totally or partly agreed that good systems for maintenance planning are highly important to achieve a satisfactory maintenance level while only 12% of the respondents confirmed that systems for maintenance planning to some degree or high degree were already implemented in the organization. (Eikeland 2004, p89).

If we go back to the numbers from the governmental survey (Eikeland 2004), Trondheim municipality should be placed among the 12 % most developed Norwegian municipalities in dealing with the maintenance planning process and the ICT support for this process.

To help out the 88 % of other Norwegian municipalities that struggles with “getting the process right” I would like to emphasize some key issues.

### ***Organizational conditions***

In the interviews several of the informants emphasized the importance of the major organizational changes that were necessary to move from the former ad-hoc based maintenance process to the new methodical approach. This change was very demanding to implement both in the FM organization and among the users. The users of the buildings and the employees in the FM organization were used to doing temporary repairs, and both the groups were resigned when it came to the thought of getting proper repairs done. Nevertheless, the “price to pay” for getting proper repairs done was that in the 3 year period between the major repairs even less maintenance was carried out, which of course is a very challenging situation (Moen 2007)

### ***Information***

To succeed in getting the needed increase in the overall budget, great efforts were made to inform all the stakeholders. Maintenance plans on richly illustrated glossy paper were one

of the instruments for communication purposes. These instruments were used both for politicians, people in the city manager’s organisations, users in all the buildings, and internally in the FM organisation (Hassel, 2007). In addition, presentations to the same stakeholders were given by the executive director of the FM organisation.

The information was based on a very rich and detailed description gathered among others from the survey of technical condition, which made the information very credible, or at least hard to argue against.

### ***ICT Tool***

Several of the informants have emphasized the importance of the ICT tool Idrift as a catalyst for the process of changing from working at an ad hoc level to the new methodical approach. It’s important to notice that the ICT-Tool itself would have very limited value if not supported with the other important aspects mentioned above.

### ***Governmental money***

In addition to the work done in the FM organisation, we may also have to mention that extra money to increase the technical condition of the Norwegian school buildings was granted from the government in the investigated period of time. The FM organization may also get some good arguments due to changes in the legislation for school buildings (Lovdata, 2003).

## **CONCLUSION**

The Trondheim Municipality case study is meant to give a practical example of how the maintenance planning process is taken care of in a typical Norwegian FM organization. The overall approach for the paper is mainly of a descriptive character.

The paper has shown “a success story”, where the FM organization expended great effort to establish a solid strategy for the maintenance planning in the municipality. They were able to gain acceptance for the strategy both from the city manager and the city council. The strategy stated that a major increase in budget was needed to fulfil the strategy, and the FM organization got the increase in budget needed.

Where the needed money were present the FM organisation managed to budget, and to a certain degree, carry out planned maintenance activities in accordance a structured maintenance plan. In other words, every step in then maintenance planning process was carried out in accordance with Haugens theoretical model from 1990 (Haugen 1990).

Another aim for the paper is to suggest some key topics for future research. From the description of how the work is carried out in the Trondheim Municipality, I have chosen three key topics which may be addressed in future work.

1. Adapting the Organization
2. Balancing the budget
3. Controlling the budget

Each of the topics is described under these headings previously in this paper. The content under these headings are partly based on the Trondheim Municipality case, and partly on the author's suggestions for subjects for further research as addressed in the author's project description for a PhD thesis on the field of maintenance planning (Gissing, 2005).

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