
HY Lee, Hackman* and D Scott**

ABSTRACT

Building maintenance operation processes are not noticeable and not attractive. With the development of facility management, there are impacts on the building maintenance operation processes in terms of cost, quality and process. Top management at the strategic level always challenges operation process efficiency from the planning stage to implementation. On the other hand, maintenance personnel at the operational level must face the challenge of insufficient maintenance resources and lack of support from top management. These misalignments do not help the effectiveness of maintenance and operation. This paper is part of a research study focusing on the development of a conceptual framework among the main aspects in building maintenance from the strategic and operational perspectives. The discussions include arguments on the maintenance policy, challenges of strategic maintenance decisions, and impacts on the maintenance operations from the influences of facility management as well as performance management. The aim is to uncover the grounds for the development of research questions in identifying the gaps between the top management at the strategic level and maintenance personnel at the operational level for improving the efficiency of maintenance operation processes. Main research questions are developed based on established overall conceptual framework, which consists of investigation about development of building maintenance objectives, types of challenges of building maintenance strategy, impacts of building maintenance in the context of facility management and improvement of building maintenance operation processes.

KEYWORDS

Building maintenance
Maintenance policy
Strategic maintenance decision
Facility management
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* PhD graduate, University of South Australia. This article is part of his 200X doctoral thesis, “Building Maintenance in the Sports and Leisure Facilities, Hong Kong”, submitted to the School of Business, University of South Australia
Email: hackman_lee@hkfc.com

** Professor and Head, Department of Civil Engineering, Curtin University of Technology, Australia
INTRODUCTION

Traditionally, building maintenance is a labour intensive activity and its operation processes are not noticeable and not attractive (Seeley 1976; Jones and Collis 1996; Wood 1999). However, as times change, top management from the organizations’ leaders as well as senior managers are now more concerned because building maintenance is a supporting activity for core business (Mak 1997; Chan et al. 2001; Tranfield and Denyer 2004; Osgood 2004). Furthermore, maintenance costs are escalating. One of the core competencies in facility management is building maintenance operation, which is regarded as an important function (Best et al. 2003; Chotipanich 2004). There are misalignments existing between organizational main business and operational sub business. As a result there are arguments about maintenance strategies, standards and resources between top management at the strategic level and maintenance personnel at the operational level, which hinder organizational effectiveness. These deficiencies are due to the lack of justification of the building maintenance objectives.

Management of building maintenance operation process is also changing pace with the development of facility management, which is focusing more on operations related to cost, quality and process aspects. However, maintenance practice in Hong Kong concentrates on time-based and failure-driven processes without a comprehensive maintenance approach (Tse 2002). Apart from the criticism of the effectiveness of planned preventive maintenance strategy (Wood 2003a; Horner et al. 1997, Spedding 1987), there may be similar challenges to other types of maintenance strategy.

Facility management also has impacts on the building maintenance operation processes from three different dimensions; organizational facility management strategy, cost and quality aspects. These are considered as important information for the maintenance personnel at the operational level (Amaratunga et al. 2000; Pitt and Hinks 2001). Furthermore, building performance management is a key to managing building maintenance operation processes successfully (Loosemore and Hsin 2001). These processes need participation from all levels within an organization. However, there are gaps between the implementation of organizational performance management strategy and maintenance personnel.

Building maintenance operation processes require effective interactions between top management at the strategic level and maintenance personnel at the operational level in order to achieve organizational common goals with better operational performance. Therefore, understanding the justification of building maintenance objectives, types of challenges of maintenance strategy, impacts on building maintenance operation processes and integration for better performance management strategy is vital to both strategic and operational levels. It also provides more insights for the improvement of maintenance operation processes and specifically helps to minimize the gaps between strategic and operational levels for the benefits of an organization.
FOUR MAIN ASPECTS IN BUILDING MAINTENANCE

The three components for the development of maintenance policy in the context of building maintenance management are maintenance strategy, acceptable standards and maintenance resources. These components are categorized as the main dimensions in the strategic management of building maintenance. Various studies (Seeley 1987; Spedding 1987; Lee 1987; Barrett 1995; Chanter and Swallow 1996; Horner et al. 1997) define maintenance policy as a management framework, which incorporates employing different types of maintenance strategy to ensure that the building facilities are maintained properly. Maintenance policy varies depending on the types of building facilities. However, it is difficult to agree on maintenance resources. Maintenance policy cannot be implemented effectively without sufficient maintenance resources (Oberg 2002). There are trends to rely on using technology but without matching organizational objectives (Madu 2000; Tse 2002). Managerial influences on the building maintenance policy such as decision making on strategic maintenance planning, formulating of maintenance plans and allocation of maintenance resources, are important for the study of building maintenance. The application of maintenance policy and strategy influences the building maintenance operation processes.

Strategic management involves the directions from the top level of an organization. The senior management usually dominates them. Building maintenance is categorized as a sub-business of an organization and is a supporting function. The strategic link between the strategic and operational levels is conceptualized as an essential component for successfully accomplishing organizational goals (Transfield and Denyer 2004; Drejer 2004; Lasher 2002). Thus, this link between strategic and operational levels is also becoming important for better planning of maintenance activities and resources allocation. Effective strategic management is essential to every business due to the business fluctuation and rapid changes of the external environment (Collins 1993; Lasher 2002; Drejer 2004). According to Tranfield and Denyer (2004) and Osgood (2004) that managing infrastructural assets including real estate, building facility is becoming more important because it is recognized as an important component of organizational strategy and the alignment of corporate and infrastructure strategy is the key for achieving organizational goals and objectives.

However, strategic management is not only the concern of top management. Madu (2000) emphasizes that it has to involve all staff employed in the development of organizational policy because there are gaps in the objectives between the organizational level and its sub-business units. Such gaps create obstacles to maximizing organizations’ revenue. Zavadskas et al. (1998) suggest that efficiency-building lifetime strategy is based on the integration of functional considerations, financial optimization and the application of performance. This explains the importance of strategic management in building maintenance as strategic decisions influence building maintenance operation processes. However, the simulation requires strategic and operational analysis and decisions.

Facility management activities encompass most of the supporting
activities in the building-related business. According to the International Facility Management Association (IFMA) and the British Institute of Facilities Management (BIFM) facility management is in general required to manage people, premises and environmental aspects respectively. The similar concept is recognized by some of the researchers (Chan 1997; Chotipanich 2004). Furthermore, facility management is the management of infrastructure resources and is related to the support of organizational goals. Because of this broad scope, building operation and maintenance is therefore categorized as the sub-function of facility management (Nutt 2004). Amaratunga et al. (2000) argue that facility management is not only to minimize the running costs and maximize space, but also requires focusing on the building assets for people, operational processes and business performance. Facility management influences the building maintenance operation and is involved with several strategic issues by incorporating a strategic approach at the top management level and operational strategy at operational levels.

Measuring performance is becoming essential and it has been developed for helping organizations increase competitiveness and profitability. It is more important in identifying an organization’s strength and weakness. Arguments exit on the methodology for performance measurement and it is necessary to identify strategies to achieve goals and objectives (Coetzee 1999; Tangen 2003; Amaratunga and Baldry, 2002). Building performance is one of the key issues for the need for performance improvement and must have contribution to business (Amaratunga et al., 2000). The factors related to building performance are facility efficiency, hygiene standards, indoor air quality, energy efficiency, lighting standards, thermal comfort, safety and information technology. There are challenges in the measuring methods of the performance in buildings. There is a direct link between facility management and performance management. Without knowing these, the performance of buildings is not known and improvement in building performance cannot be identified. In the development of facility management, performance management is essential and influences building maintenance operation.

The development of a conceptual framework follows discussions on maintenance policy, strategic maintenance decisions, facility management and performance management. Operation and maintenance of building maintenance is becoming important to a business and, due to its nature, it is a broad area to cover. The maintenance activity is no longer a standalone activity but requires careful planning of the maintenance processes. There are arguments about the maintenance policy and strategy, which are normally governed by the top management. In the field of facility management, building operation and maintenance is one of the competencies and impacts directly on the building users. The level of satisfaction on the performance of buildings is an indication to the maintenance personnel for improvement. Thus, the four aspects in the context of building maintenance all have direct and indirect connections and influence the building maintenance operation processes. The diagrammatic conceptual framework developed for the study of building maintenance is shown in Fig. 1.
ARGUMENTS ON THE THREE MAIN COMPONENTS OF MAINTENANCE POLICY

The three main components of maintenance policy are maintenance strategy, maintenance standards and maintenance resources, which are developed from the principle of understanding the length of time for which the building requires maintaining for the present use, the life requirements of the buildings and their fittings and services, the standard to which the buildings and its services are to be maintained. The reaction time is defined as time between a defect occurring and the legal and statutory requirements (RICS, 1990; Seeley, 1987; Lee, 1987; Barrett, 1995; Chanter and Swallow, 1996). The maintenance policy is to integrate different maintenance strategies including corrective, preventive and condition based, the development of the recent five types of maintenance strategy is developed from the corrective, preventive and condition based (Horner et al., 1997; Chan et al., 2001).

Maintenance strategy depends on various factors such as standard, resources and the objectives of the organizations. There are arguments in adopting appropriate strategy recently, in particular preventive maintenance, which is receiving more challenges among other maintenance strategy (Wood, 1999, 2003a; Horner et al., 1997; Spedding, 1987). Loosemore and Hsin (2001) argue that the understanding of the relationship of planned preventive maintenance to facility and the core business objectives is inadequate. On the contrary, there are some suggestions for the better use of planned preventive maintenance (Shen and Lo, 1999; Tse, 2002; Chan et al. 2001). Coetzee (1999) suggests basing it on the detail design of the maintenance cycle processes for the specific organization.

There are arguments about the maintenance standard (Then 1996; Zavadskas et al. 1998; Wood 2003a), which could not be solved in a similar way as the maintenance strategy. It depends on the maintenance resources available, the degree of maintenance standard and business objectives. Then (1996) argues that the maintenance
Standard is fundamental to the maintenance process, which is limited by health, safety and use. The author focuses on the two basic components that will affect the maintenance standard, users of buildings, and users’ perception of the internal environment of the space occupied. Zavadskas et al. (1998) suggests understanding more about organization and management may raise the maintenance standard. A balanced approach between top management at the strategic level and maintenance personnel at the operational level is required.

Top management is interesting in focusing on the maintenance resources to see if there is any ways to minimize the facility maintenance cost. This boosts recent studies in cutting facility operation cost. Maintenance at the operational level argues that the maintenance budget is always below the needs (Tse 2002; Lo et al. 2000; Lam 2000; Shen and Lo 1999, Pitt 1997) while the top management at the strategic level criticizes the inefficiency of the maintenance, which contributes to the wastage and makes it difficult to get more resources. El-Harm and Horner (2002) identify a number of common factors that affect maintenance costs such as building characteristics, tenant factors, maintenance factors (technical and administration), and political factors. Zavadskas et al. (1998) suggest an effective managing of available resources and Then (1996) suggests that it is necessary to justify the maintenance objectives before getting more maintenance resources. Although technology could help to improve the maintenance process, it is necessary to understand more about the management and operational context and the relationship between a building and its users (Wood 1999).

A conceptual framework is developed from the arguments of maintenance policy. The challenges of the maintenance strategy such as planned preventive maintenance, maintenance standard, and maintenance resources come from the inadequate information about the justification of building maintenance objectives. It is also necessary to justify the effectiveness of using technology in building maintenance. Building maintenance has connections with the organizational objectives, thus understanding the development of building maintenance objectives is important. Otherwise, the arguments and problems continue. The diagrammatic conceptual framework developed for the study of arguments about the maintenance policy is shown in Fig. 2.

**Fig. 2 A conceptual framework developed for the study of arguments about the maintenance policy**
There is a trend for having a common organizational strategy in an organization with multiple businesses. A strategy map is defined as a diagram to describe how an organization creates value by connecting all strategic objectives among sub-businesses in an organization (Tranfield and Denyer 2004; Drejer 2004; Lasher 2002). Each individual level sub-business within an organization will have its own strategy by defining the products or service that it will offer. However, there is mismatch when the links are not known and not clearly defined. Thus, some of the studies suggest studying these links among them, which is known as strategic alignment model (Osgood 2004; Madu 2000; Tangen 2003). The concept of the alignment model is to identify the key strategic elements between the organization and its sub-level business. In addition, Osgood (2004) agrees that it is also recognized as an effective tool for collecting, analyzing and communication information. Okumus (2003) suggests that organizational strategy involves all levels of management in an organization.

The major criteria in making decisions on building maintenance activities are building status, physical condition, importance of usage, effect on users, effect on fabric, and effect on service provision. The major common factors influence maintenance personnel in setting priorities for planned maintenance including technical, political, financial, social, economical and legal related (Shen1997; Shen and Lo 1999, Pitt 1997; Alani et al. 2002). Shen (1997) identifies the priority system as including safety, habitable (hygiene, security), operable and the appearance. The author also suggests having further investigation of managerial inputs and under what circumstances that a maintenance item is assigned. There are lots of criticisms on the maintenance personnel, who are rely too much on their technical knowledge and experience and are not concerned with the organizational goals and objectives (Chan et al. 2001; Alani et al. 2002; Amaratunga et al, 2000; Lo et al. 2000). This has an impact on the performance of the buildings. Therefore Madu (2000) suggests having a better communication channel among all levels of an organization.

The development of a conceptual framework follows the studies of the strategic management and building maintenance. There is a mismatch between the strategic and its sub-levels businesses. Top management challenge giving priority to maintenance decisions. Moreover, the managerial influencing at the maintenance operational level is based on technical and personnel experience but without any links to the organizational level. The diagrammatic representation of the conceptual framework developed for the study of challenges of strategic maintenance decisions and influences is summarized in Fig. 3.
THE IMPACT OF FACILITY MANAGEMENT ON THE BUILDING MAINTENANCE

There are various definitions among studies (Thomson 1990; Avis 1995; Barrett 1995; Nutt 1999, 2004). The broad scope of facility management depends on different organizations as they may have different facility management strategies. Because of this, it does not have clear definitions among the studies. In principle, the facility management functions encompass all property related supporting activities. Operation and maintenance of building is one of the facility management functions. Three major aspects in the context of facility management are cost, process and quality, which also have impacts on the building maintenance operations. Thus, a model for building maintenance in the context of facility management is established and illustrated in Fig. 4.

Fig. 3 The conceptual framework for the study of challenges of strategic maintenance decisions and influences

Fig. 4 Model for building maintenance (BM) in the context of facility management (FM)
According to Chotipanich (2004) the two focuses in the facility management are strategic issues and operational issues. Operational level is related to strategic management of operation and maintenance of building and strategic direction of a long-term strategy for better relationship with the building users. However, there are three major aspects of facility management. Like the maintenance policy and strategy the facility management requires integrating different strategies for better facility management operation. They are concerned with facility cost, operation process and the quality.

Apart from these three major aspects, it is necessary to understand the organizational needs for facility management functions. Therefore, in the context of operational process, facility objectives are also important. Due to the nature of the broad scope of the facility management function, a contingency approach is required as suggested by researchers. As facility management concerned process, the link between facility management strategic directions and the organizational core business is also essential to successful facility management operation (Alexander 1994; Krumm et al. 1996, Then 1999, 2003). Customers play important roles in the facility management functions and have an impact on the strategic and operational level of facility management. With the nature of the context of building maintenance, a lot of criteria of building elements impact on the facility users such as environmental factors including air quality, ventilation, building defects, cleanliness of the physical environment. Studying the financial impact is also important in building maintenance (Pitts and Hicks 2001; Chotipanich 2004).

With the development of facility management, there are three main impacts on the building maintenance or building maintenance organization. It is believed that outsourcing of building maintenance activities is to maximize maintenance operational efficiency. There are questions of whether there is a cost saving, and a direct connection to the improvement of cost and quality. Like the building maintenance strategy perceived in the facility strategic level, facility strategy governs the building maintenance strategy, therefore it requires two different levels for management of facility management: strategic and operational. There are two purposes in quality, the first is concerned with the customers’ satisfaction and the second is to improve the gaps in facility management services if necessary.

The development of the conceptual framework follows the studies about facility management and building maintenance. The building maintenance is the sub-function of facility management and influenced by facility management strategy, cost and quality aspects. Furthermore, there are links between facility management approaches and organizational core business. Since building maintenance is within the scope of facility management, thus facility management has an impact on the building maintenance operation with respect to facility management strategy, cost and quality. The diagrammatic representation of the conceptual framework developed for the study of the impact on facility management is shown in Fig. 5.
There is no argument that customer satisfaction is important in the building management processes. However, the concerns about care of the building users are inadequate. It requires managerial inputs including the support of the top management as it involves the strategic and operational processes (Tangen 2003; Coetzee 1999). According to Wood (2003a) there is a link between a building facility and the needs of the end users. In addition, there is an association of maintenance strategy with the requirements of the building performance.

Then (1996) identifies two factors influencing the maintenance standard, users of buildings and users’ perception of the internal environment of the space occupied. Some of the researchers (Horner et al. 1997; Wood 1999 and Madu 2000) conceptualize the important dimensions between maintenance approaches and the users’ satisfaction. There are fewer studies investigating the relationships between the quality and the building maintenance. As time changes, the studies for the key performance indicators in the context of facility management are changing as well and are based on both financial and non-financial performances.

Loosemore and Hsin (2001) use approaches based on physical, functional and financial aspects in measuring building performance. Shohet (2003) uses the similar framework developed from McDougall and Hinks (2000) to establish quantitative indices for the evaluation of the efficiency of building maintenance in a building, in which the study concentrated on three major components of building performance, physical - building performance, functional - functional conditions, financial - maintenance efficiency. However, the link of the overall organizational effectiveness to performance measurement is outstanding.

Cooke (1996) focuses on four main perspectives for performance measurement. They are internal, competitive, non-competitive and best practice. Amaratunga et al. (2000) conceptualize a similar framework based on financial, customers, internal
processes and innovation. They are focusing on the comprehensive approaches as they use approaches of innovation and best practice concerning the organizational and operational improvement. Thus, the integration of Cooke (1996) on internal and best practices and Amaratunga et al. (2000) on the internal process and innovation are of a similar nature. They are categorized as essential components for the study of improvement for the building operation processes from the building performance aspect.

The conceptual framework is developed from the studies about performance management and building maintenance. Most of the studies adopt performance management as based on physical, functional and financial aspects. This study focuses on the improvements of the gaps between top management at the organizational, and maintenance personnel at the operational level. Thus it follows the four perspectives developed from the previous studies and in particular focusing on the internal process improvement. The diagrammatic conceptual framework developed for the study of improvement of internal operational processes in building maintenance is shown in Fig. 6.

**Fig. 6 Conceptual framework developed for the study of improvement of internal operational processes in building maintenance**
OVERALL CONCEPTUAL FRAMEWORK

The overview of a conceptual framework focuses on the integration of the following:

- The four main aspects in building maintenance
- The arguments of the three main components of maintenance policy
- Challenges of strategic maintenance decisions and influences
- Impact of facility management on building maintenance
- Building maintenance and building performance

It is concluded that the maintenance objectives are important to the maintenance organizations and the maintenance management is essentially connected with the strategic level and different sub-businesses levels within an organization. The challenges from the top management in maintenance strategy, maintenance standard and resources indicate that there is a mismatch between them. Most of the previous studies suggest investigating this connection. The development of facility management influences building maintenance in terms of facility management strategy, cost and quality aspects. The building maintenance operational processes are also essential considerations in facility maintenance services. Furthermore, understanding building performance is important to the facility, which has a direct impact on the customers and directly impact on the organization. The differences of performance management between organizational performance strategy and the improvement areas recommended by the maintenance personnel can be integrated for better improvement of building performance. Thus, the overall conceptual framework developed from this summary is shown in Fig. 7.

Fig. 7 Overall conceptual framework developed for the study of building maintenance operation processes
DISCUSSIONS

The four main aspects: maintenance policy and strategy, strategic management, facility management and performance management in the context of building maintenance have connections with each other. Previous studies identify that there is a gap between the organizational strategy and its sub-level strategy, which is a barrier to improvement for maximizing organizational efficiency. There are suggestions to study the maintenance strategy and its relationship with the top management at the strategic level. Moreover, previous studies summarize that there is mismatch between the strategic and operational levels. Maintenance organization at the operational level is also finding ways to improve it. However, maintenance personnel are criticized as being too reliant on their technical experience and behaviour and for not connecting with the business objectives.

There are different facility strategies adopted by different organizations in terms of building maintenance in the context of facility management. Most of them are concerned with the cost only, but there is a lack of concern for quality and processes. Outsourcing activities have not been properly managed. There is a gap between the organizational and facility management strategy. As building maintenance is the sub-function of facility management, building maintenance is also concerned with cost, quality and process. Performance management is important to the building management organization. However, previous studies summarize that there is a lack of studies of the building users and the care for human factors. The main concern of the building performance is to improve the supporting services by integration of improvement of the strategic process and the operational process. There is also a lack of information about the relationships between performance indicators and the business objectives. It does not help to improve operational processes for further improvement.

DEVELOPMENT OF BUILDING MAINTENANCE OBJECTIVES

The maintenance objectives should be considered in connection with the organizational objectives. However, there is a limited number of studies on how building maintenance objectives match with the organizational objectives in the organizational strategic level. In addition, types and characteristics of different managerial inputs from the operational level are not known. There may be difficulties in agreeing on the maintenance objectives and this has an impact on the efficiency and effectiveness of the organization. On the financial issues, most of the previous studies argue about the budget for maintenance activities, identified as always being insufficient and they suggest shifting the focus to the study of organizational needs (Tse 2002; Lo et al. 2000; Lam 2000; Shen and Lo 1999, Pitt 1997).

Previous studies seldom investigate the reasons for the allocation of maintenance resources. Maintenance management decisions depend on strategic directions as well as available resources. However, such information is missing. Prior to studying the relationship between the two levels, an investigation of how the maintenance personnel justify their maintenance objectives is suggested. Moreover, there is lack of study about how planned preventive maintenance is connected
with organizational objectives. It is helpful to understand how maintenance objectives are related to maintenance strategy, which may have influences on the facility management operation processes. There is a gap in the previous studies about the extent to which facilities support core business and the reason why.

Maintenance objective is one of the organizational sub-business objectives and is governed by the organization strategy. The planning of maintenance objectives have an impact on the facility management operation in terms of maintenance strategy, which influence the cost, quality and process directly and indirectly. On the contrary, there is a question of whether the top management is concerned with the maintenance strategy. Maintenance objectives are the fundamental element to explain the scope, the purposes and the aims of the maintenance activities and the relationships with the organizational objectives. However, maintenance personnel are criticized for narrowly focusing on the technical issues and not being concerned with the organizational goals and objectives (Chan et al. 2001; Alani et al. 2002; Amaratunga et al. 2000; Lo et al. 2000). The links between building maintenance operation and organization are important for achieving organizational goals effectiveness.

Investigations about how the maintenance objectives are established and the relationships between building maintenance and the business objectives are limited. It is also important to know how the relationships between the strategic level and the operational level are built up. Therefore some researchers study the alignment map between these two levels in order to have a better planning of maintenance activities and resources allocation (Tranfield and Denyer 2004; Drejer 2004; Lasher 2002). They argue that the mismatch between the two levels is increasing when the basis of the links and the maintenance objectives are not known or not clearly defined. Most of the organizations have not clearly defined their maintenance objectives and some organizations are even without maintenance objectives. In summary, arguments among maintenance strategy, standard and resources are due to the lack of justification of building maintenance objectives. This does not help to minimize and improve the gaps between the two different levels and thus this does not help to establish rational maintenance standards and the maintenance resource allocation.

MAINTENANCE STRATEGY CHALLENGED BY THE TOP MANAGEMENT

Previous studies identify that there are different approaches in adopting a maintenance strategy (Wood 1999, 2003a; Horner et al. 1997; Spedding 1987; Loosemore and Hsin 2001). Like the maintenance standard and maintenance resources, maintenance strategies are different among different types of organizations. However, most of the previous studies have not addressed the identification of the types and the factors influencing the choice of strategic maintenance decisions at the operation level. It is particularly important to understand more about the two levels of strategy. The investigation of the types of maintenance strategy adopted by the maintenance personnel at the operational level and the reasons for choosing them are not known. This would contribute in-depth knowledge on why the maintenance strategy is adopted. Apart from planned preventive maintenance, which types of...
maintenance strategy currently received more challenges on its efficiency and effectiveness are not known.

There is no further information to tell if other maintenance strategies receive similar challenges as planned preventive maintenance from the top management. Are they based on cost, quality and process? The investigation provides better understanding on why the top management challenge on certain types of maintenance strategy and the reasons behind. It helps to identify ways to improve the gaps between them. In addition, there is no further investigation of how maintenance objectives are related to maintenance strategy. It is considered necessary to show how important the maintenance strategy is related to the maintenance objectives. It helps to improve the effectiveness of the organizational business. It would also reduce the gaps between them. The study on how maintenance planning is linked to the measuring process is also needed.

A recent study considers the relationships between maintenance strategy and maintenance performance (Wood, 2003b). There are studies focusing on the major common factors influencing setting priorities for planned maintenance (Shen 1997; Shen and Lo 1999; Pitt 1997; Alani et al. 2002). However, maintenance personnel are criticized for being too reliant on their technical experience, and some of them are focusing on the major criteria influencing priority setting by using an analytic hierarchy process in quantitative analysis.

There is a strong argument, in particular from the senior management, that there are challenges to the effectiveness of planned maintenance (Wood 1999, 2003a; Horner et al., 1997; Spedding 1987; Loosemore and Hsin 2001). Some of them argue that there is no information on how the maintenance personnel at the operational level make decisions on formulating maintenance strategy in terms of planned maintenance, corrective maintenance and condition-based maintenance. In addition, there are suggestions for studying the different approaches that affect the strategic level at the top management for maximizing its maintenance efficiency. The more understanding there is about the challenges of the maintenance strategy, the more it helps to minimize the gaps between top management and maintenance personnel.

IMPACTS ON THE BUILDING MAINTENANCE OPERATION PROCESSES IN THE CONTEXT OF FACILITY MANAGEMENT

Barriers exist between strategic and operational levels (Pitt and Hinks 2001). However, the study of how these barriers can be improved, which are obstacles in achieving organizational goals and objectives efficiently and effectively, is limited. The internal factors influencing facility management operation processes have direct impact on the building maintenance operation processes, but there has been no further investigation of how these factors influence the building maintenance process in the context of facility management. The methods for improving the operational processes are important but have not been addressed in the previous studies. In addition, there is no information to explain how the effectiveness of the maintenance organization is measured in carrying out the maintenance activities.
Better management of the facility processes including building maintenance help to improve the operational processes. Furthermore, there is a general perception that cost saving for outsourcing activities in the facility management context is the priority. Previous studies demonstrated that there are unsuccessful cases (Brown 2002; Copeland 2001; Crocker 1999; James 2000; Van der Werf, 2000). Facility management influences not only cost but also the processes and quality. There is no such information about how the building maintenance is affected in terms of quality and processes. As there are different ways of influencing among three major aspects on building maintenance, therefore understanding about the ways influencing among the three major aspects on building maintenance is important to the operational level for providing facility management services.

Building maintenance is under the strategic management of facility management and has impacts on the development from facility management strategy. Most of the previous studies indicate some organizations are focusing on cost saving only and do not concern about quality and processes, which does not help to the improvement of facility management services (Amaratunga et al., 2000). Quality concerns with building users while processes are related to the different approaches to manage different levels of strategy for implementation the facility operation. Majority of previous studies investigate the methods for cost saving including outsourcing activities (Pitts and Hinks, 2001; Chotipanich, 2004).

However, there are limited studies to address the management of quality and the operation process. Process improvement is important to the building maintenance in the context of facility management. It is sensitive particularly to the types of hospitality buildings. There are lacks of information on what the impacts on building maintenance are in the context of facility management in terms of the three major aspects. Cost is related to the facility operation and maintenance cost. Process considers with the long term strategy. However, facility management also concerns with short term and daily issues and require contingency approaches.

IMPROVEMENT OF BUILDING MAINTENANCE OPERATION PROCESSES

One of the deficiency areas in the building maintenance operation is inadequate communication between the two different levels, organizational and operational level. Maintenance personnel are too reliant on their field of experience in particular on the technical issue. There is no further investigation to address the problems of building maintenance operation processes in connection with the management of different levels of strategies. This will provide richer information on how the process is improved at the operational level. The more understanding of the two levels strategies, the more opportunities there are to reduce the two barriers at the strategic and operational level for accomplishing common goals. There is also the question of how maintenance planning links with the measuring process such as management of measuring approaches (Tangen, 2003; Coetzee, 1999).

There is little understanding from previous studies about the types of factors and criteria influencing the relationships between strategic and
operational issues as well as the reasons behind them. Understanding internal factors influencing the facility management operation process helps improvement when an item in the building maintenance operation is identified. Knowing more about facility management processes helps to improve the operation process. However, there is no such information available about the ways to manage the facility management function better. There has been no investigation to address the ways of the management of the processes if improvement opportunity is identified. The improvement strategy may come from top management at strategic level. The study of influencing characteristics by the three aspects of facility management function (cost, quality and process) is not known. These are related to physical, functional and financial, which is important for minimizing the misunderstanding between the two levels (Loosemore and Hsin, 2001).

In the context of facility management, maintenance activities are no longer stand-alone activities. Facility management and building maintenance are required strategic directions with consideration of not only cost effectiveness, but also concern with quality of building performance. However, there is the question of the management of operational processes, which requires more input from the maintenance personnel at the operational level. The process involves strategic planning of maintenance strategy, implementation, supervision, monitoring, measurement and reporting. Therefore most of the previous studies were concerned with the performance management, which is important to the building maintenance operation. It identifies where the processes need to be improved. The result of the measurement is important to the building maintenance operation. Otherwise, it does not help the organizational effectiveness.

There is a link between performance and buildings users (Wood 2003a). There are various developments for establishing the key performance indicators in the building maintenance. The measuring of the efficiency of the building in the performance management is to justify if the building user is satisfied, the results may show areas for improvement. However, the fundamental elements are to improve the strategic process and the operational process. Moreover, there may be variations, conflicts from the organizational level’s internal processes and maintenance personnel during the improvement processes. It is essential to integrate these for better improvement. However, there is no information about how the appropriate processes and procedures are formulated.

CONCLUSION AND RECOMMENDATION

The previous work related to building maintenance and its deficiencies between the operational and organizational levels are summarized. These include challenges of maintenance decisions and its influences due to lack of justification on building maintenance objectives. In the main aspects in the building maintenance operation, there are challenges from the top management on the maintenance efficiency and allocation of maintenance resources. With the development of facility management, it has more expectations from the organization and the customers. The challenges of maintenance strategy are influenced by the three major aspects of facility management as well as
the impact on building maintenance operation processes. The performance management helps to improve building operational processes. Based on the development of a conceptual framework and the subsequent discussions, the following are the recommended objectives for further studies:

• Define and identify problems in the building maintenance operation processes
• Understand how the maintenance personnel plan / justify building maintenance objectives
• Identify the categories of challenges of maintenance strategy
• Identify the categories of the impact on building maintenance operation processes due to facility management
• Improvement of maintenance operation processes from building performance management
• Develop ways for improvement of gaps between top management at strategic level and maintenance personnel at operational level

As discussed earlier, there are gaps between the top management at the strategic level and maintenance personnel at the operational level in managing building maintenance operation processes. The maintenance operation processes are also influenced by the aspects of facility management. The recommended research objectives could specifically study these areas to identify the types and characteristics of the gaps between the top management and the maintenance personnel. The findings could be grouped, categorized and summarized as follows for closing the gaps so as to improve the building maintenance operation efficiency.

• How do maintenance people at the operational level develop the maintenance objectives?
• Which types of maintenance strategy are more challenged by the top management and why?
• What is the impact of the building maintenance (BM) operation process in the context of facility management (FM)?
• How to improve the operational process if the performance measurement identified that there is an opportunity for improvement?

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