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The Application of Facility Management tools to office building's technical maintenance

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Extended Abstract

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Extended abstract

1 INTRODUCTION

1.1 Initial considerations

The management and maintenance of buildings is an area of study that, in the past, was very underestimated, being seen as a phase in the construction process that generates costs. Over the years, this lack of interest is due, mainly, to the fact that different players think only in the short run relatively to durability and economic aspects (Mills, 1994). Currently, the trend has been changing and, it is increasingly common to find people responsible for the management and maintenance of buildings, that understand it is necessary to have concerns over the management and maintenance of buildings. These concerns lead to the analysis of the technical and economic aspects throughout all the buildings lifetime.

On the other hand, these activities are more and more developed in an outsourcing recruiting system, being, therefore, necessary that the organization's leaders carry out a check on the provided services. Because of this, it's inevitable that those responsible need to use tools in order to provide services in the best standards possible. These tools can be included in the area of study known as facility management (FM). Among the tools that are available to those responsible and analyzed in this paper, are the service level agreements and, associated with them, key performance indicators.

1.2 Objectives

The objectives of this study are, beyond the bibliographic study of the concepts and tools applied in this area, study the organization sensitivity to the practical application of tools of facility management in management and maintenance of buildings.

To achieve this objective were conducted and analyzed surveys to organizations that provide and receive facility services, trying to inquire some of those whose housing stock consists of office buildings.

2 MANAGEMENT AND OFFICE BUILDINGS

2.1 Office buildings

It is common for organizations to have office buildings. These buildings are used, generally, by administrative departments and require a specific construction for this use.

However, management and maintenance of buildings does not end with the construction, being necessary to perform it during the use phase of the building. This task is quite complex, with clear advantages for the users and, consequently, for the organization. This complexity is introduced by the fact that it's necessary to provide and maintain certain characteristics such as: functionality, operability, flexibility, comfort, security and energy sustainability.

2.2 Management and maintenance of buildings

2.2.1 Building management

The importance of building management has increased considerably. This multidisciplinary area can be defined as the set of actions and procedures that take place after construction and, that should be allocated to a building in order to optimize its performance (Rodrigues, 2001). Being an area of intervention responsible for several activities, it is necessary to divide it into three main areas of action, namely, technical, economic and functional management. This division facilitates the understanding of the several objectives and targets in each of the primary activities. Combination of all activities allows you to establish an effective management and, with that, a building with adequate performance.

Technical management includes evaluation assessment, intervention and correction of several aspects of the building, and so minimizing, small losses of performance, both from the building or some of its elements.

Among the different processes belonging to the technical management we have the building maintenance, as being the main activity. Besides this, in technical management, there are processes of cleaning and hygiene, technical emergencies and accidental security of goods

and people and, also, issues relating to legal compliance and functional fit.

The application of these processes to office buildings provides an attractive challenge to the manager of the building because of its specific use features. Thus, the manager should be able to propose a technological answer to be adopted.

The idea that a building only requires a large initial financial outlay is already an old-fashioned concept. Over time, the perceptions of different stakeholders, especially landowners, have been changing because there is a growing concern in exploiting the high initial investment. This profitability is often caused by the effective economic management actions on the deferred costs associated with the use of buildings.

These deferred costs must be controlled by the person responsible for building management so the activity that develops there can be as profitable as possible. These charges are related to the cost of maintenance, operation, use, finance charges and tax. The application of this activity to the specific use of office buildings does not vary much from other possible uses of the building, being necessary to create the financial conditions to develop a correct process of maintenance, use and exploitation of the building.

Finally, the functional management is related, mainly, to the connections between the various users of the building and, therefore, it is also known as social management. This activity has as main function to promote the technical management, in other words, ensuring that the processes that compose it are carried out.

In office buildings, the functional management is extremely important, because it is necessary to provide in the same space working conditions and public treatment.

2.2.2 Building maintenance

The maintenance, an activity belonging to the technical management of buildings, can be defined as a combination of technical and administrative actions which during its lifetime keep the building or its components, in order to perform the required functions (ISO, 2000).

The management and, consequently, the maintenance of buildings should not be solely developed after the construction of building, but throughout the construction process. This

process consists of the phases of design and use and, since its beginning should include actions that, in the immediate or in the medium/long term facilitate maintenance activity. During the activities of planning, design and construction, which comprises the design phase, decisions must be made for strategic planning of the chosen maintenance policy namely choice of strategy to be used, definition of accessibilities, future needs, maintenance needs, materials and processes to be used in order to satisfy these users not only in the short term, but over the lifetime of the building. On the other hand, during the operation and maintenance strategies planned during the design phase, must be applied making only minor adjustments to planning.

The need to define and plan actions of management and maintenance leads to the study of different options. So, we can refer to the existence of two major strategies: proactive and reactive, the main difference being the time of action when compared with the appearance of anomalies/failures.

The proactive strategy has as its main purpose to avoid the appearance of many anomalies so that the several elements do not reach levels below the requirement established. This strategy can be divided into: i) preventive maintenance, where the goal is to implement a set of activities based on planning and fixed intervals, allowing a reduction in overtime and consequently, less interference with the normal use of the building; and ii) predictive strategy, which consists of performing maintenance activities on the basis on analysis of the state of degradation of the several elements, planning in the first instant, inspections and not activities, allowing a greater ability to know when and where intervention is necessary (Flores, 2002). On the other hand, there is a reactive maintenance strategy. This is applied subsequently to the onset of pathology and, thus, ensures that all types of anomalies can be repaired (Falorca, 2004).

It should also be noted that no strategy is individually perfect, being necessary to use a combination of several to try to improve and optimize the process and the final costs associated with maintenance. In office buildings the maintenance strategy should preferably be used proactively, because these are buildings of work so, long speeches and great depth should

not occur because they require the shutdown of services. To complement this strategy, the reactive strategy, should be used whenever necessary.

2.3 Facility management

Associated with the technical management of buildings a new area of study appeared, named, facility management. This new area of research can be defined as the integration process within the organization, to maintain and develop services to support improvement and efficiency of primary activities of the organization (CEN, 2006a).

The facility management is, nowadays, a tool to be used by organizations as a way to optimize the services it provides. This area plays, increasingly, an important role in the functioning of the organization and its business. The integration of this area of study should be vertical, so as not to negatively influence the performance of the organization.

According to the Royal Institution of Chartered Surveyors (RICS, 2009) the process of implementation of facility management should be cyclical and consist of several stages, starting with the strategic definition, resources planning, operation, review of results and continuous development. The strategy used in planning the facility management is, now, seen as one of the most responsible ones for business efficiency. This strategy should be included in the main objective of the organization and, thus, provide real commercial returns resulting, mainly, in strong efficacy of this activity.

During the strategic definition, people should developed strategic plans which define the main choices made and the goals and objectives (benchmarking) to be achieved. In terms of resources management it is important to make an assessment of necessary resources, both short and long term. In operational step, facility management is responsible for creating all the conditions for the organization's core business to be carried out as efficiently as possible. When reviewing the results and continuous development of this process, the values obtained in the operational phase must be gathered and compared with the benchmarks defined in strategic plan, and, subsequently, carry out small adjustments to optimize the process and bring the strategic plan to the operational phase.

There are several tools of this area of research that can be applied to building's management and maintenance, specifically in the management of contracts. From these tools we can highlight facility management agreement, service level agreement and key performance indicators.

3 FACILITY MANAGEMENT IN BUILDING'S MANAGEMENT AND MAINTENANCE

In this context, the several tools belonging to the study area of facility management to help optimize the actions of building's management and maintenance are:

3.1 Facility management agreement

This is one of the concepts closely connected with the facility management, defined as an oral or written agreement, which lists the terms and conditions of service between the receiver and the service provider (CEN, 2006b). This type of agreement can be established with one or more service provider organizations and has several features that should be reviewed by the parties involved.

EN 15221-2 (CEN, 2006b) states that general and specific characteristics of these contracts should be reviewed, indicating the following as general:

- Definition of preparation time and resources to be used: time and resources to be used in the preparation of each contract, must be adequate to size, importance and complexity of the agreement, always trying to ensure the expectations of the actors;
- Definition of strategic objectives: both the receiver and the service provider must share a common vision of strategic objectives to be achieved, when this does not happen, they should promote the dialogue. Before finalizing the contract checkpoints and interface as well as information flows between client and supplier should be established;
- Definition of mutuality of benefits: It is important that, before deciding to proceed with the signing of the agreement, the parts conduct their own economic analysis in order to understand the viability of the agreement or not;
- Definition of the necessary components to the agreement: all legal compliance needed

such as regulation, exclusivity and subcontracting among others;

- Definition of evolutionary criteria: to work out an agreement we should take into account that the organization can evolve. Therefore, criteria must be analyzed for flexibility, continuous improvement and innovation. This point is particularly important as the durability time of the contract to perform as an objective or goal acceptable today, may not be so in a few years.

The same standard features as specific characteristics of the service provider's contract, the following (CEN, 2006b):

- Needs of the organization: in drafting a contract to provide services what the main needs of the organization must be thoroughly checked. These needs may arise at the strategic, tactical or operational, and the agreement to establish can suppress them. The provider company can have all the responsibility, acting at different levels, or only at certain levels, usually the tactical and/or operational;

- Investment strategies: this feature concerns the strategy chosen for the ownership of the equipment needed to provide services. There are three possible choices. At first, the organization provides all investment and gets the equipment; secondly service provider finances some of the equipment being, usually, associated with a futures building's management contract; and thirdly, the responsibility lies with the service provider, which includes funding, planning, management and operation of different assets necessary, and after some time, the control passes to the organization. Before the transfer, the provider company is permitted to establish tariff for the use and lease of properties in order to recover the initial investment, and offset the operating and maintenance costs of the project;

- Prices and rates mechanisms: this feature has a fundamental importance, since the payment for services rendered can arise from different ways that, ultimately, can also be combined. Among the payment options comes the lump sum, where the service provider organization is fully responsible for the performance and quality defined in the contract in exchange for a total amount agreed to provide the agreed services. In the second option, the method used is the payment per unit cost, where the service provider organization is fully

responsible for the performance and quality, defined in the contract, in exchange for a set price per unit for the agreed services. Finally, there is another option that corresponds to a bonus system, where the service provider is fully responsible for the performance and quality defined in the contract in exchange for a lump sum, plus the agreed amount for services rendered after;

- Performance-based payments: this feature may, or may not, be included into the contract to develop, depending on the agreement between the parts. If successful, the payment option can be established in different models: payment according to the results obtained in the established facility management services agreement, incentive payments taking into account the results, not the services but the core business of arranging and paying on the results of saving, and in this case, where the mechanisms of facility management identify opportunities for savings, profits are added to the same facility management agreement.

These agreements are undoubtedly of great importance for the provision of services to an organization. Associated with these contracts and, as a tool to control the level of services provided, we have the tools of service level agreement

3.2 Service level agreement

Because organizations increasingly look for to a system of outsourcing is necessary to carry out effective monitoring of services. The contracting model for service level agreement is one of the possible tools and it is more used to exercise control. These contracts are associated with a specific service, and may have different service level agreements in the organization's facility management agreements.

For this type of agreement is to be carried out it is necessary to perform an arduous process of managing the service level, cyclical process that consists of several steps that are grouped into two phases. The first, which begins by defining the current state of the organization, setting goals, functionality, implementation, monitoring and evaluation of results. This phase aims to assess the current situation and prepare the service level agreement. The second phase aims at collecting and analyzing the results obtained

during implementation of the process defined in the agreement.

Lewis (1998) and Muller (1999), quoted by Gonçalves (2007), define the steps of the cycle management of service levels such as:

- Current status, during this step there is an assessment of the current state of the company, when they make a statement of the actual situation of the company, reviewing services developed to support the core business of the organization;
- Definition of objectives, the service provider should understand the strategic objectives of the organization and, use the strategy to fit services to the needs of the same, in other words, at the end of this stage the service provider should understand the mode of operation of the organization at various levels and adjust services;
- Operation, this step must define the parameters of the service, will be used in the calculation of performance indicators. In addition, the parts must make sure that the management tools are available so that you can, over time, collect and repost data on the parameters chosen;
- Implementation, this step corresponds to the process where appropriate parameters are discussed to reflect the state of service;
- Monitoring, after a period of time, usually fixed, the results obtained using the parameters should be collected and analyzed. This step should lead to the selection of indicators used in the contract;
- Evaluation of results, at this stage, culminating in the signing of the contract, the parties should consider the result obtained from monitoring and with the aid of the strategic plan, select the level of service that determine the different levels of performance;
- Report results, during the period of service reports are prepared based on the indicators selected in the first phase. These documents allow the provider and receiver to follow the progress of the entire system at regular time periods;
- Redefinition of objectives, this phase of the cycle is back to start the service level agreement, allowing the client and the provider to re-evaluate the requirements of its core business and may, if necessary, allow change in both the

services to be provided as the established service level agreement.

Although this is a very hard cycle, as can be seen in the previous description, if applied with wisdom and through a methodical process may be quite feasible to the organization, here you can include the management and maintenance of buildings.

One of the obstacles in the implementation of service level agreements in the area of construction relates to the difficulty of defining/selecting performance indicators to monitor and evaluate the buildings. Thus, the important role assigned to key performance indicators is necessary to study them.

3.3 Key performance indicators

Over time, those involved in the construction process felt the need to evaluate the performance of buildings and activities of management and maintenance. For this performance to be assessed it is necessary to create tools that indicate what can be improved simply and accurately. An example of these tools is designed by key performance indicators. These are nothing more than objects of evaluation tools whose main task is assisting the organization to assess progress towards the goals. It is, therefore, important to define specific performance indicators over the lifetime of the building. Each phase must have appropriate indicators for the state of the construction and the goals it has set itself.

Despite the existence of a large number of indicators, their use should be controlled so that they do not neglect its primary objectives, thus, providing inaccurate information to those responsible for this analysis.

The study of the performance of buildings is not new. There are so many standards organizations and same authors who felt the need to find tools to understand if the buildings have, or not, the desired performance. In this area of research there are different standards and published works, among which stand out:

- The ISO 6241 (ISO, 1984), compiled a list of performance requirements, following some quality criteria such as spatial quality, thermal, indoor air, acoustics, and visual integrity of the building. These criteria led to a list of requirements based on an assessment of users, the different subsystems that can be studied if

the income of the buildings is to be analyzed. Among the requirements are stability, fire safety, safe use, sealing, hygrothermal comfort, clean air, acoustic comfort, visual comfort, tactile comfort, antropodynamic comfort, hygiene, adaptation of spaces for specific uses, durability and economy. The requirements are applied to the following subsystems: structure, surrounding, external divisions, internal divisions and services, which include systems for water supply, air conditioning and other facilities (Leite, 1997);

- Another normative association that seeks to define a checklist to determine the performance of buildings is the American Society for Testing Materials who launching the STP 901 (ASTM, 1986). This publication is a set of verification checklist for the planning and construction of the building, as it reaches for a total performance it is necessary to ensure the suitability of the immediate built environment to future occupations and functions. As is the case with ISO 6241 (1984), this publication checklist separates into two main areas. The first concerns the integrity of the building itself when it comes to your eye protection, mechanical and physical properties against the aggressions of the surrounding environment. The second, gives importance to occupiers of buildings and the comfort they may need at various levels, such as thermal comfort, acoustic, visual, air quality and comfort space. The latter criteria should be tailored to its occupants and their physiological, psychological, sociological and economic values.

- Authors like Hartkopf et al (1993) have defined a list of qualities of performance for buildings. This list is quite similar to that presented by STP 901 (ASTM, 1986) and defines requirements that relate to the spatial quality, thermal, air, acoustic and visual integrity of the building;

- For office buildings and, due to its specificity, it's necessary to analyze certain requirements. Thus, during the use phase and, for this particular use, we can name ASTM E1700 (2005) who gives information about several functional aspects of buildings. This standard has the ability to introduce a feature of evaluation that, in studying the performance of buildings is relatively different from the others already presented. ASTM E1700 (2005) combines two different rating scales that indicate the performance related component of the building that is on evaluation. The indicative

value of the state of performance is achieved by combining a subjective numerical scale that takes into account the requirements of the users of the building (Facility Management Requirement Scale), with another scale, also numeric, which takes into account technical requirements and maintenance of the buildings itself (Facility Rating Scale). The scales match the description on a standard to a numeric value between one and nine. Because it has two different scales and they may also be related, this standard can be used for assessments and comparisons between different buildings, components, or systems belonging to buildings, among which we may highlight the following: comparing the adaptability of different buildings, or systems to the same maintenance strategy, evaluation of the variation of the goals or requirements estimated for the maintenance and the results obtained; estimate the adaptability of certain maintenance actions, existing in a building, to other uses than the current; among other applications;

- In addition to the ASTM E1700 (2005) also Del Carlo (1994), quoted by Leite (1997) indicated that some requirements may be established for the case of buildings with concerns for flexibility, security, conditions environmental, energy use, recycling, and also reduction of fixed costs which are fundamental to create environments with high user satisfaction and hence higher productivity.

Because the application of service level agreement to management contracts and building maintenance awarded by several organizations is increasingly common, there must be a careful study of the indicators, so that its application is possible. The use of indicators during the management and maintenance must undergo constant adjustments, since the demands of managers and users are increasing over time.

Consequently, reference standards and several Works of several authors in this area of research, such as:

- Igal Shohet (2006), professor and researcher at the department of civil and environmental engineering from the technological institute of Israel, has developed indicators with the intention of improving the management and maintenance in health care facilities. His research led to the creation of a set of eleven performance indicators grouped into four distinct

categories, namely: characterization parameters (3); indicators of organizational performance (4); building performance indicators (1); maintenance efficiency indicators (3). Despite the importance of all categories, the latter two are most relevant to the technical management, providing information on the performance of the building, calculated mainly on the state of conservation and the weighting of the importance given to each of the systems, and maintenance efficiency indicators, studied through a set of three indicators including calculation factors as the local cost of ownership and number of users, among others;

- Sónia Raposo (2011), researcher at the Laboratório Nacional de Engenharia Civil, completed recently a PhD proof which analyzed several indicators of performance for maintenance actions in public buildings. The methodology consists of applying a set of seventeen performance indicators, divided into economic performance indicators(10), technical performance indicators (5) and organizational performance indicators (2) in five schools from the first cycle of basic education of Lisbon. This research aims to understand the efficiency of maintenance actions performed in these parks are built.

- Due to the increasing interest and importance of this area of research, it became necessary to develop, EN 15341 (CEN, 2005), which present and describe performance indicators for maintenance actions. This European standard defines a set of seventy one indicators divided into three groups. Thus it is possible to cover different aspects of maintenance, including the economic (24), technical (21) and organizational (26) ones.

4 DESCRIPTION AND APPLICATION OF CASE STUDIES

4.1 Initial considerations

After presenting a statement of terms relating to the management and maintenance of buildings, specifying, when possible to Office buildings, as well as tools related to the area of facility management. The main purpose of this paper is to examine the application of service level agreement management system to building maintenance. Parallel to this objective we tried, also, to look into the key performance indicators used by stakeholders to evaluate all the

processes that are part of the building's management and maintenance.

4.2 Research methodology

As a research methodology and means of obtaining results, we opted for the application of a survey and conducting interviews. This was applied to several organizations that are related to the management and maintenance of office buildings, services and/or administrative.

As a method of obtaining information from both sides, services receptors and providers, two surveys were, one to each player mentioned.

The survey used is divided into two main parts. The first has as its main objective the characterization of actors, building stock and strategies adopted by the organization. Although the characterization part is not able to respond to questions related to the main purpose of this paper, contributes to understand some of the responses obtained in the next phase of the investigation. The second, also subdivided, aims to understand the usefulness, or not, the tools of facility management have addressed these theses in the building's management and maintenance.

Thus, the investigation into receiving services organizations intended in the first part, to make a characterization of the respondent, the building stock of the organization, the adopted strategic options for the activities of building's management and maintenance. In the second part, which is subdivided, each respondent should answer bearing in mind its human resources options that perform the actions of management and maintenance of building stock. More specifically if these actions are carried out by employees belonging to the organization, if they use an outsourcing solution, or even an intermediate solution. This branch aims to understand the different choices made by organizations, whose management and maintenance activities are carried wholly or partly by the organization itself, and those whose actions are performed entirely or partly by organizations outside contractors.

Similarly, the survey to provider services organizations also has a first part which is to characterize the actors, actions and strategies used in building's management and maintenance, and, questions about the

knowledge and application of tools of facility management. After the last question of the characterization phase, the questionnaire is subdivided, and each respondent should answer to the corresponding part, namely, if he uses, or not, service level agreements as model of contracting for the actions of management and maintenance.

4.3 Characterization of case studies

As case studies were selected recipient organizations and service providers whose works are related to office buildings.

Thus, the service receiving organizations interviewed were:

- Vodafone Portugal, comunicações pessoais, S.A;
- TAP Serviços;
- Nokia Siemens Networks Portugal;
- Ernst & Young Portugal;
- EDP Valor – Gestão integrada de serviços, S.A. – which were applied two surveys to different departments.

The type building or building stoke of the service receiving organizations, is composed, in general, of a building with Great development in height and plant with mostly administrative functions and workspaces. Some organizations have, also, commercial and materials storage spaces.

By the service providers were asked two organizations which provide full service, work facility management logic. These organizations were:

- Ferrosfer – Ferroviária Serviços;
- ISS Facility Services Portugal.

4.4 Presentation and discussion of results

At this point the results obtained from the survey to the mentioned organizations are presented and analyzed.

The application of the survey to service receiving organizations can highlight the following conclusions:

- When assessing the main source of maintenance items, respondents mentioned the support systems for the regular operation of the building, such as: electrical, heating, ventilation and air conditioning, security and cleaning;

- All organizations use a system of outsourcing activities to develop the management and maintenance. As justification for this option was presented the fact that they do not have the necessary know-how, strategic decision aimed at reducing costs, the passage of "risk" for the mere supplier or strategic choice;

- All respondents are familiar with the area of facility management, indicating that the main advantages of this new area are: the optimization of the use of systems and, consequently, increasing their useful life, ensuring the operability of the building maintenance activities; improving the management of contracts and the relationship between clients and service providers; implementation of strict management of the services required; centralization of control systems, increasing his effectiveness;

- Respondents indicated using service level agreement, as the concept of control of the services received by organizations. Among the advantages of applying this model of engagement we include: definition of services needed in quality and quantity; the definition of responsibility; ability to parameterize beacon concepts and indicators; ability to optimize the performance of different systems by comparing the results obtained and those who are contractually required to the supplier;

- Of the types ok key performance indicators found in EN 15341 (CEN, 2005) service receptors preferentially use the technical ones. This conclusion is confirmed by the choice made by respondents when asked to sort a set of indicators present in the standard cited above, on a scale of one to ten.

For service providers, it is possible to make the following analysis:

- Service providers organizations of buildings management and maintenance develop the following services: contract management, energy and waste management; study of the necessary technical actions required by the customer;

- Among the advantages that the facility management can introduce in building's management and maintenance, the interviewed indicate the cost reduction and the ability to adapt strategies and resources to the needs of the customer;

- As to the use of service level agreement, the response was again consensus statement,

however, it indicated that this model is no longer used due to lack of responsiveness from the customers whose size of the organization and/or its housing stock is not high;

- As for the advantages mentioned for the use of this contracting model, it is possible to mention the ease and flexibility in the management of organizational resources and greater transparency in service delivery. On the other hand, the disadvantages are difficulties in defining the key performance indicators to be used to quantify, objectively, some criteria in service provision;
- As for the different preferred indicators, opinions differ among the organizational and technical ones. From the indicators used by service organizations in its activities, the highlights are as follows: total response time to breakdown, percentage of preventive maintenance tasks completed, the frequency of preventive actions, response times for curative interventions, downtime, number of valid work orders resolved and number of work orders by intervention area.

5 FINAL CONCLUSIONS

The management and maintenance of building stock is one of the main challenges for organizations. Therefore, it is necessary to provide workspaces features to ensure a smooth and increased productivity.

For the activities of buildings management and maintenance to run efficiently, it is necessary to meet economic, technical and organizational aspects. Of all the processes that make up the buildings management activities, the most important is maintenance. This should be the target of a process of reflection so that the strategy chosen can meet all the needs of the organization.

Facility management, as an area of research associated to the buildings management, uses several tools that allow performing management actions and monitoring of services. Additionally, advantages and drawbacks of service level agreements and key performance indicators were analyzed.

The application of these tools to the construction area is increasingly necessary, because the organizations turn to outsourcing systems to develop management actions and maintenance

buildings. This system of outsourcing needs to have control systems.

The use of tools of facility management has, in the opinion of respondents, the ability to increase service efficiency, still offering, to the providing service organizations, the freedom of resource management.

To sum up, the application of tools of facility management lead to an important advantages to the technical maintenance services for office buildings.

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