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Original Research

Factors Affecting the Cost of Maintenance of Residential Buildings in Afghanistan

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Abstract

The residential building (apartments) often needs to be repaired and maintained after a certain period to be fully operational. And this care involves a lot of money. Past research has shown that the maintenance costs repairs are relatively high due to poor maintenance performance. Therefore, the purpose of this research is to identify the factors that increase these costs. In this research, a quantitative method is used to obtain accurate information. First of all, critical factors are identified using a review of past literature, then 60 questionnaires were distributed to construction managers, supervisors, municipal engineers, and maintenance managers. questionnaires have been filled and collected using Likert scale system to evaluate and classify the factors. The findings show that the most important factors that have more influence on housing maintenance cost were found which consist of low quality of material, building age, lack of tenancy care, and building function, which causes an increment in maintenance cost in housing. In the end, some measures are proposed to minimize the housing maintenance cost like participation of tenants and residents in maintenance and using good construction material.

Keyword: Residential Building, cost of maintenance, factors, Afghanistan.

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1. Literature review

Maintenance is all technical and managerial operations that ensure the functionality of all elements of a building in its standard form. To carry out effective maintenance activities, it is necessary to have a proper maintenance plan and an efficient monitoring system. Maintenance management is a joint operation involving technical, social, legal, and financial issues that control and manage the standard operating conditions of the building. It is worth noting that the majority of people do not know the importance and value of maintenance and management of buildings. effectiveness of the maintenance and repair system for owners who rent their property is significant and increases their income (Lee et al, 2001). maintenance is one of the other functions such as productivity, quality, safety, and environmental repairs (Emma et al, 2009). For example, the best quality and safety performance in residential buildings (apartments) is to expect 24-hour electricity, water, sewerage, and fire services. The range of maintenance activities cost, including building development from 25% in 1950 to 50% in 1990 has increased. Statistics from the Malaysian Bureau of Statistics and Commerce show that maintenance of residential buildings accounts for 50 percent of the total cost of maintenance for all other buildings (educational, commercial, residential, and offices) (Groote et al, 1995). Maintenance of the residential building is a major part of the country's economy and is increasing year by year as the number of existing buildings has increased and the operation of buildings is ongoing 24 hours a day. It is also a necessary command to maintain its original state Allows it to be used properly and effectively. Other very important factors make it necessary to take care of the necessary repairs, some of these factors include the following (Chanter et al, 2007).

- To maintain the value of capital
- Maintaining buildings with acceptable conditions and standard criteria
- Provide an acceptable and pleasant view of the building
- Generate revenue for the building owner and
- Preservation of historical and engineering values of buildings

The costs of maintenance for residential buildings include all costs that the building can be used in the best way. The purpose of building maintenance management is to maintain buildings with the best standard conditions and the highest level of use with the lowest required price on an ongoing basis. found that in certain cases the cost of maintaining a building is higher than building a new one, and provided the following reasons (Chanter et al, 2007).

- In most cases, maintenance is performed on a small scale, which is uneconomical
- Demolition and other preparatory work before repair and relocation needs cost
- Maintenance should be done in a confined space
- The cost of cleaning and rearranging areas is very high
- Maintenance will stop production or cause inactivity

Defined the life cycle cost for owning and using each type of property as the costs invested in it throughout the life of the property. To know the lowest price of utility costs in the long term of owning, Life cycle cost analysis is a good tool in choosing the most economical expenditure of equipment or projects among other options (Lee et al 2001). The options can be different companies, for example, the installation of elevators for homes can be selected after a series of studies from companies such as Panasonic, Toshiba, Mitabashi, etc. so, the life cycle cost analysis is an economic approach tactic which determines the overall consumption including the procurement and operation over its lifetime (Barringer 2003). The ratio between maintenance costs and the main costs of the building is essential for the life cycle costs. This ratio includes the capital cost, management, maintenance, and operation cost of the building (Wu et al 2007). The costs of commissioning, maintenance, and demolition are always higher than the costs invested in building. these costs increase from two to twenty times. Therefore, it is very important to estimate this ratio accurately according to the building life cycle cost. To minimize the costs of maintenance for residential buildings, it is necessary to identify the factors that affect these costs. By identifying these factors, we will have significant information about the total costs of maintenance for residential buildings. The results give building managers a good opportunity to allocate the appropriate budget to these expenditures. Therefore, the main purpose of this article is to identify the factors that have a greater impact on the cost of maintenance and preservation of residential buildings (Barringer 2003).

2. Identifying Factors that affect the cost of maintenance

Maintenance costs are one of the main components of a building cost. The cost of maintenance and care includes one to three to one to two of the total cost of a building, which also depends on the type of building, such as apartments, houses with yards or villas, etc. There is a lot of discussions these days about the ever-increasing cost of maintenance. To reduce the cost of maintenance, construction and maintenance managers must adopt measures and strategies by reducing the number of maintenance activities (Rydell et al 1970). Several factors affect the costs of maintenance. These factors are generally divided into five groups. Building features, tenants, maintenance factors, political and other factors are shown in figure 1 (El-haram 2002).

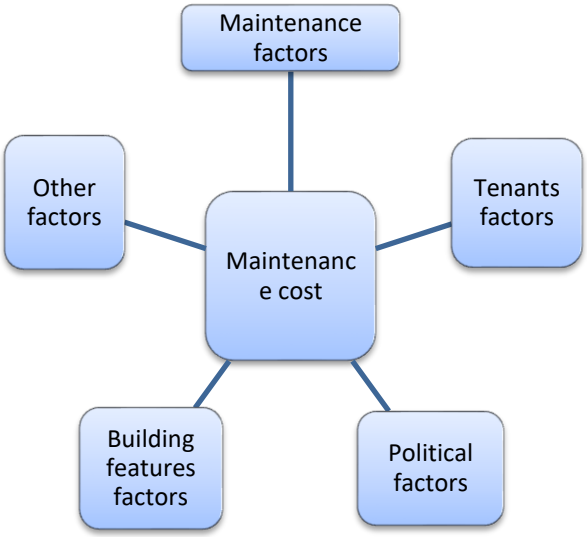


Figure 1: Major factors affecting the maintenance cost of residential buildings

3. Building Features

Building characteristics are one of the major factors that affect the maintenance costs of residential buildings, including building lifetime, building function, building area, type of structure, building surface, type of service, building materials, and other factors. Each building has special features that require a different amount of maintenance costs. For example, the features of a simple apartment and an equipped apartment are from the point of view of convenience and various service facilities. The lifetime of a building has a special dependency on maintenance costs, that is, the longer the life of the building, the higher the costs, such as painting, roof tile replacement, corrosion of water and sewerage systems, and other cases that provide sustainability for the building. The height, size, and area of the building also affect the cost of maintenance. height of the building due to the provision of supplies and equipment such as preparing scaffold for painting and cleaning the windows, etc. increases the costs (Sonthya 2006). The type of structure is the factor that affects maintenance spending. Due to the huge investments in basic infrastructure in recent years, the number of demolitions in buildings has increased significantly. Therefore, buildings need a large amount of money for maintenance management, repair, renovation, and replacement elements (skinner 1982). The strength of buildings should be taken to protect human lives and maintenance should be taken periodically. Especially in steel structures, the problem of corrosion of steel is very vital and must be prevented to ensure the safety of the building one hundred percent. Therefore, we can say that maintenance costs depend on the type of building and vary according to the type of structure (Neves et al 2004). The building service

system is essential for the welfare, safety, and health of residents, which includes ventilation, heating, electricity, water, sewerage, communication networks, etc. Moving these systems inside buildings also affects maintenance costs. The building service system is a key component that must be taken under consideration for maintenance so that the building can meet the needs of its occupants (John and Clement, 2005, Lam et al 2001). The choice of building materials in the initial stage of design is very important and has a significant impact on maintenance costs. A lot of money is spent on repairing and replacement of building components, and the main reason is the wrong choice of materials in the design stage. Incompatibility, poor quality of building materials, and lack of proper maintenance plan cause a lot of damage to building elements (Shabha 2003).

4. Tenants

The cost of maintenance of residential buildings is always influenced by the tenant or occupant of the building depending on various factors. These factors include the level of expectations of the occupier, the use of service facilities, the misuse of the building by the contractor, the delay in reporting defects, and so on. Twenty-five percent of total maintenance costs are incurred by the tenant (Elharam 2002). Occupying or resident involvement in maintenance management is a strategy adopted by the landlord to create a balance between high maintenance costs and the tenant's legal expectation level (Olubodun 2001). High rent expectations and standard living conditions increase maintenance costs. In Hankank, according to statistics from the Department of Housing Maintenance, its expenditures increased from Hankank's $ 432 million to Hankank's $ 1.7 billion in 1988. Proper use of property and places plays a major role in the maintenance of buildings. Therefore, by enacting laws and providing procedures, these costs will be reduced. Otherwise, improper use of places and service systems will increase costs and will be proportional to the amount of damage. Delays in submitting reports and untimely actions of demolition or repairs of places increase the amount and volume of repairs and increase maintenance costs (Yeb 2001). Lack of access to places for protection and maintenance by responsible persons directly increased the cost of the project, the majority of residents do not allow caregivers to enter their houses due to the privacy of their family and cultural issues. For example, the presence of a crack in the exterior wall of the upper houses needs to be repaired, but the residents are not allowed to use their area to repair it, so repairing it from the outside requires scaffolding, which increases the cost of repairing the wall. The type of repairing system is also one of the major factors that have a significant impact on the cost of maintenance (Lee et al 2001). Explained that generally these factors are divided into two groups. The first is technical factors that include poor quality of materials and elements or the use of second-hand or unavailability of materials or elements, lack of technical personnel, and poor quality of work. the second is management factors that depend on financial constraints and provided financial resources. The damage can be increased until providing the budget, or sometimes the budget is not enough to cover all the repairs. Lack of timely maintenance, for example, when the elevator

breaks down, maybe it can be repaired with less amount money, but if care is not taken, it may stop working after a short period, which causes more costs. Lack of budget management and team selection and maintenance management is one of the important issues that directly affect the cost (Elharam 2002).

5. Political Factors

Political factors are also among the major factors that in some cases affect the cost of building maintenance. Especially in cases where there are changes in government policy. These factors include new policies, safety regulations, hygiene, and poor management. New safety and hygiene regulations can increase costs considerably in some cases. This means that in addition to the fact that the buildings must be properly ready for operation and following the living standards of the residents, the maintenance staff must act in such a way as to satisfy the residents' wishes and desires according to the new health standards (Elharam and Harner 2002). Stated that These criteria include proper ventilation system, heating, and cooling system, adequate lighting, and sanitation. In existing buildings in case of new facilities or technology, which is in line with the wishes of its residents. The project owner is forced to spend a large amount of money to maintain the building to make the building acceptable and to generate revenue (Thompson 1994).

6. Other Factors

In addition to the above factors, some other factors affect the cost of maintenance and repair of residential buildings. The third user is one of the factors that affect costs (Tuin 2003). According to Tuin, this factor is one of the main causes of expenditure in high-rise residential buildings. Said although security guards have been hired to protect the buildings, this problem still exists. The reason for these defects or damages is the negligence and lack of interest of third parties in building maintenance. Lack of professional training for workers and staff is a very important factor and causes the low quality of work and their performance, which results in more staff errors and increased number of defects, which in turn leads to additional costs so that we can build a building with a good standard for operation (Pascual et al 2008).

7. Method of research

In this research, a quantities method has been used following the literature review. A similar study conducted which is a very suitable method in the form of a questionnaire that was able to collect all the information was proposed. The questionnaire should be prepared like that, on the one hand, it is simple and short and on the other hand, it does not take more time to collect more respondents and comprehensive data (Gillham 2000, Elharam et al 2002). In this research, the same method has been used (Ali 2009). The questionnaire in this research was filled in by professionals and especially by engineers in the Department of Supervision and maintenance of the Ministry of Urban Development, who have taken care of and managed more than ten projects that invested in tens of millions of Afghanis, and Some questionnaires were filled with well-experienced university professors and engineers. According to Gillham 2000, writes that among the distributed questionnaires, 30% of them can provide satisfaction and reliable results.

In this study, 60 questionnaires were distributed to the above-mentioned individuals, out of the 60 questionnaires, 24 of them responded. the details are presented in table 1. Which covers 40% of the distributed questionnaires. Respondents were asked to rate these questionnaire items on a Likert scale a universally accepted method used in similar research. In this questionnaire, the influential factors that have increased the costs of maintenance and repair of residential buildings have been classified. This ranking starts from the beginning that has the least impact (1) and ends to (5) that have the biggest impact. After distributing this questionnaire and receiving answers from the respondents, it was analyzed and evaluated based on the Important Index, which was used in similar research (Elharam and Honer 2002), and the result of the evaluation is presented in Table 2.

$$important\ index=(5n_5+4n_4+3n_3+2n_2+1n_1)/(5(n_1+n_2+n_3+n_4+n_5))*100$$

whereas, n_1, n_2, n_3, n_4, n_5 are impact index. n_1 has the least impact and n_5 shows the most impact.

Table 1: Category of respondent

Duty	Number of respondents
Maintenance Engineer	18
Construction faculty professors	9
Others (owners and tenants)	8

8. Result analysis and discussion

Factor ranking was done using questionnaires in which the factor score starts from 1 which has the least impact and ends to 5 which has the most impact. Our main goal in this research is to analyze the questionnaires and identify the most important factors which have affected the cost of maintenance and replacement of elements in residential buildings.

Table 2: Results of analysis and ranking of factors that increase the cost of maintenance and preservation of residential buildings

No	Factors	n1	n2	n3	n4	n5	Important index	Ranking
1	Material quality	1	1	2	4	16	0.875	1
2	Building age	1	1	4	8	10	0.80833	2
3	Lack of tenants attention	0	2	6	5	11	0.80833	3
4	Type of service	0	1	3	15	5	0.8	4
5	Lack of timely maintenance	0	1	7	7	9	0.8	5
6	Building rate of use	0	3	3	10	8	0.79167	6
7	Security (explosion)	1	2	4	7	10	0.79167	7
8	Delay and lack of timely inspection	2	0	4	10	8	0.78333	8
9	Repairing and material quality	1	1	5	9	8	0.78333	9
10	Installation quality	0	4	4	7	9	0.775	10
11	Un skill worker	2	2	2	7	9	0.77273	11
12	Type of building	1	3	3	9	8	0.76667	12
13	Mismanagement of maintenance	0	3	7	5	9	0.76667	13
14	Mismanagement of budget of maintenance	0	2	6	11	5	0.75833	14
15	Unfamiliarity with as built drawing	1	2	4	11	4	0.73636	15
16	Lack of commissioning training	2	2	3	12	5	0.73333	16
17	Budget deficiency	0	5	4	12	3	0.70833	17
18	lack routine maintenance	0	2	11	6	4	0.70435	18
19	Resident culture	2	4	3	11	4	0.69167	19
20	Tenant expectations	2	2	9	6	4	0.66957	20
21	Building location	2	5	5	8	4	0.65833	21
22	Access to building	0	8	5	7	4	0.65833	22
23	New material and technology	1	2	10	11	0	0.65833	23
24	Damages by third party	1	3	10	8	2	0.65833	24
25	Building size	2	5	8	5	4	0.63333	25
26	Establish new laws	2	4	9	6	3	0.63333	26

27	Building height	1	6	10	6	1	0.6	27
28	Building facade	1	13	5	3	2	0.53333	28

As it is clear from the findings, quality of building material, age of the building, tenant negligence, building service, and lack of timely maintenance are ranked from first to fifth respectively. Tenant negligence seems to be an important factor. use of the residential building, which, unfortunately, most of them today are used for public offices or services or private domestic and foreign companies, lack of timely maintenance are an important factor (Azlan shah et al 2010). Expenditures will never be huge unless the deficiencies are rectified immediately. The various factors in this paper are factors that cause an increase in maintenance costs of a residential building in other countries as well but are not ranked in the top five in this research, which associated with differences that depend on the conditions and facilities and the standard of living of their people. for example, In Malaysia, the most important factor is the high level of tenant expectations, Follow by the building façade, location, and security of the building and other factors.

9. Conclusion

As mentioned earlier, 28 items were identified in the questionnaires to survey the participants, using the literature review and similar articles. after analyzing and evaluating them, the top five ranking factors, which are the poor quality of building materials, building age, tenant negligence, type of service, and lack of timely maintenance have the greatest impact on residential building maintenance costs. The following are proposed approaches reducing these costs:

- Active participation of tenants or residents in the maintenance of residential buildings
- Introduce and present instructions for using buildings and equipment to residents, including the necessary training and how to use it
- Effective and productive management of building care (preparing the right policy for the maintenance of residential buildings)
- Fairly allocate an annual budget for maintenance
- Prompt maintenance before deficiencies become more widespread
- Adopt a maintenance system (before defects occur)
- Hiring a few numbers of skilled workers with accepted standards

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Appendix

Evaluation of factors affecting the cost of preservation and maintenance of residential buildings

How you evaluate based on your experience the below factors affecting the preservation and maintenance cost of residential buildings?

Name		**Duty**				
Name of Project	**Organization**	**Owner**				
پروژه موقعیت:						
No	**Factors**	**Score**				
		Least (1) to More (5)				
		1	**2**	**3**	**4**	**5**
Building Features						
1	building age					
2	building height					
3	building size					
4	Type of structure					
5	Type of service					
6	Material quality					
7	building location					
8	building façade					
Tenants						
1	Tenant expectation					
2	building rate of use					
3	lack of tenants attention					
4	Delay and lack of timley inspection					
5	Lack of comssioning training					
6	Resident culture					
7	Access to building					
Maintenance						
1	Installation quality					
2	Unskill worker					
3	Mismanagement of maintenance					
4	Budget deficiency					
5	Lack of timely inspection					
6	Mismanagement of budget of maintencance					
7	New material and technolgoy					
8	lack routin maintenece					
Political and other factor in your opinion						
1	Establish new laws					
2	Repaing and material quality					
3	Damages by third party					
4	Security (explosion)					
5	Unfamiliarity with asbuilt drawing					
6						
7						
8						
9						
10						

Thank You Very Much

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