

**IDENTIFICATION AND PRIORITIZATION OF FACTORS  
INFLUENCING COSTS OF INSTALLATION SUPPLY AND  
STRATEGIES FOR REDUCING COSTS IN RAZI  
HOSPITAL OF QAZVIN**

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**Abstract**

Present paper introduces a meaningful approach to identification and prioritization of factors influencing costs of installation supply and strategies for reduction of costs in hospitals. With this purpose, using expert opinions including officials and suppliers of logistics unit of hospitals, five factors leading to increased costs of installationsupply (A1 to A5) and five ranking criteria (C1 to C5) were extracted and using the first questionnairegoods and services purchased by logistic unit were identified and sorted and the extent of expert agreements were indicated. Then through the second question of the same questionnaire factors influencing increase in costs of installation supply and the extent of expert agreements were inferred. In second questionnaire at first pair-wise comparisons were conducted between factors mentioned by consulted experts, then pair-wise comparison were conducted between ranking criteria and at last decision matrix ( group matrix of factors against criteria) was determined by experts and at last after problem solving using AHP, VIKOR and TOPSIS and integrating the obtained solutions via Copeland method the factors were prioritized and the third questionnaire was distributed to experts and the result was a set of strategies for reduction of costs including time and cost saving and also reducing waiting time of the units requesting for goods and services (requesting units).

**Keywords:** cost management, multi-criteria decision making, hierarchical analysis, multi-criteria optimization and compromise solution, similarity to ideal solution, supply officer, revolving fund.

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## Introduction

With respect to current costs of hospitals and heavy costs of installation unit and also those of periodical maintenance of equipment and machines, it is necessary to address this unit and its supply officers in a particular way. Thus it should be tried to remove or reduce the problems with respect to this aspect. Installation unit strongly needs to purchase various goods and services in industrial and construction field in order to meet needs of different units of hospital. Diversity of required goods and services is in such a large scale that at least one supply officer should address the related activities so that all needs in this field are met. In this respect some factors lead to special problems and increased costs of supply and it is necessary to identify and prioritize these factors so that actions can be taken with the aim of reducing above mentioned costs and also save in time of requesting unit.

Logistics unit of hospitals receive requests for purchasing goods and services confirmed by related experts and then price it and send it to accounting unit. These requests are sent back to logistics unit after securing credit and related signatures. The first problem is lack of some suppliers and contractors at province level and it is inevitable to travel to big cities e.g. Tehran in order to meet these needs and factor of lack of some suppliers and contractors at province level (A1) leads to increased costs and waste of time for obtaining goods and services. The second problem is lack of appropriate supplier at province level in order to provide goods and services within a short time and according to this lack of competent suppliers from various guilds (A2) leads to loss of time and emergence of different problems. Third problem in relation to providing goods and services is that installation unit does not provide accurate technical specifications for goods requests and in this way factor of lack of specialized knowledge in some personnel members of installation unit (A3) leads to waste in time for acquiring goods and services. Fourth problem is lack of driver in hospital logistics unit (A4) which leads to waste in time of supply officer because he should personally address issues related to driving and maintenance of received car and with regard to this fact lack of driver in logistics unit leads to increased cost and waste in time and final problem of logistics unit is related to shortage of supply officers in installation unit (A5) which leads to waste in time.

## Research background and literature review

in general it should be said that according to conducted research, strategies for reducing costs of installation supply are not already addressed in Iran. Also there are no studies on prioritizing

wastes and strategies for addressing them through MCDM (multi-criteria decision making) techniques.

Cost management consists of a set of actions taken by management to satisfy customers together with control and reduction of costs (cost price) in a continuous way (8). Cost management system is a system for planning and control which follows these purposes: identifying and eliminating all cost items adding no value, identifying and evaluating new activities which can improve future performance of organization.

Currently many people and institutions that are in close relationship with customers and seek to earn more profit are convinced that reduction of costs and providing services is in a direct relationship with more profitability. Today concept of market is not restricted to a particular region and is a global concept. Strong competition at international level most often forces manufacturing and service institutions including firms, banks, hospitals, etc. to offer their products to the market with excellent quality and the least cost price. In addition new requirements such as WTO agreement can be a plausible reason for using cost management methods (10).

Supply officer is an officer appointed by the organization among qualified staff members and is responsible to take required actions to purchase goods and services according to commands from authorized officials under the requirements of rules and regulations (6).

Revolving fund consists of cash provided from accounting revolving fund reserve to units or officers eligible to receive it according to rules and executive bylaws after approval by minister or director of the related entity and/or their representatives in order to meet some required costs (6).

Having defined the terms, here because of high volume of materials in this field only significant ones are briefly mentioned. With respect to purchase, planned purchases, emergency or ad hoc purchases, centralized purchase and decentralized purchase can be mentioned (6). In classifying transactions based on transaction price, three groups can be identified i.e. small transactions (less than 55000000 Rials), medium transactions ( between 55000000 up to ten times of this amount) and big transactions ( more than ten times of that for small transactions) (1). With respect to tender two types of limited and optional one can be mentioned (6). In relation to purchase purposes, the following items should be considered by installation unit in their purchases; continuous supplying of materials, parts and services required for organizational

operation, continuous quality improvement of purchased parts and materials and finding competitive manufacturing firms in the market, purchasing standard items available in market and required services at the least possible price and achieving purchase goals with the least possible executive costs (7). Also among the most important purchase principles appropriate quality, appropriate quantity, appropriate price, appropriate resources and appropriate time (7). And finally an efficient installation unit with a qualified, insightful, righteous and committed manager with an accurate and wise management in a business organization consists of the followings: understanding and playing the role of a servant, paying attention to organization benefit and interest, correct management (9).

### Research method

Present research was a case-field one. Present research is used when researcher seeks to investigate about a particular case or field (4).

Research experts consisted of eight members of officials and supply officers of installation unit of hospital with at least 15 years experience in their current posts and a Master's degree in management and accounting.

AHP (Analytical Hierarchy Process) is among MADM methods employed for decision making and selection among various alternatives according to criteria determined by decision maker (DM). In other words decision making is called hierarchical when it divides criteria to sub-criteria and conducts a pair wise comparison between alternatives and between criteria (2). Process stages are in a way that at first step hierarchical tree is drawn in which goals, criteria and alternatives are shown. In second step pair wise comparison matrix is formed in which each level is compared to its related elements in the immediate higher level in a pairwise way. In third step weights of elements which have been compared relative to their higher level are indicated. In fourth step, final weight of each alternative is obtained by summing product of weight of each criterion and score of the intended alternative. In fifth step inconsistency rate is calculated to control for consistency of decision (5).

Multi-criteria optimization and compromise solution or VIKOR (Visekriteijumska optimizacija kompromisno resenje) is a method based on compromise planning of multi-criteria decision problems and addresses problems with inconsistent and conflicting criteria. In the case that DM is not able to identify and express preferences for a problem in the beginning of the process, this method can be an effective tool for decision making. This method progresses in several steps the

first one is that decision matrix is formed based on criteria, alternatives and evaluation of all alternatives with respect to criteria. In the second step multi-dimensional criteria are converted to undimensional and normalized decision matrix is formed. In the third step, according to importance of various criteria in decision making, weight vectors of criteria are determined. In fourth step, best and worst values are selected among values available for each criterion. In fifth step utility and regret measures (S and R) are calculated. In the sixth step, VIKOR index (Q) is calculated and in the seventh step alternatives are ranked in increasing order based on values of S, R and Q and finally the alternative with the lowest rank in all three above mentioned orders is selected as the best alternative (5).

TOPSIS (Technique for order preference by similarity to ideal solution) is a method in which alternatives are ranked based on similarity to ideal and the more the alternative is closer to ideal solution the higher rank it will have. Method steps is in such a way that in first step decision matrix is formed based on number of criteria, number of alternatives and evaluation of all alternatives based on various criteria. In second step criteria with various dimensions are converted to undimensional criteria and normalized decision matrix is formed. In third step according to importance of various criteria indecision making, weight vector of criteria is specified and in forth step weighted normalized decision making is determined by multiplying normalized decision matrix into weight vector. In fifth step best and worst values for each criterion among all alternatives respectively form ideal and anti-ideal solutions. In sixth step distance from ideal and anti-ideal solutions is calculated and in seventh step similarity index is calculated which is a value between 0 and 1 and the more similar the intended alternative to ideal solution, the closer to 1 its similarity index would be (5).

In present research after collecting data from questionnaires, at first factors influencing costs of installation supply (A1 to A2) are compared in a pair-wise way and using group AHP method, weight and priority of factors are determined. Then ranking criteria (C1 to C5) are compared in a pair-wise manner and the mentioned factors are prioritized using two methods of VIKOR and TOPSIS. Finally priorities obtained from these three methods are integrated by Copeland method and the final priority of factors influencing facility supply costs is determined.

### **Data analysis**

This part of study is done to reply main questions of research.

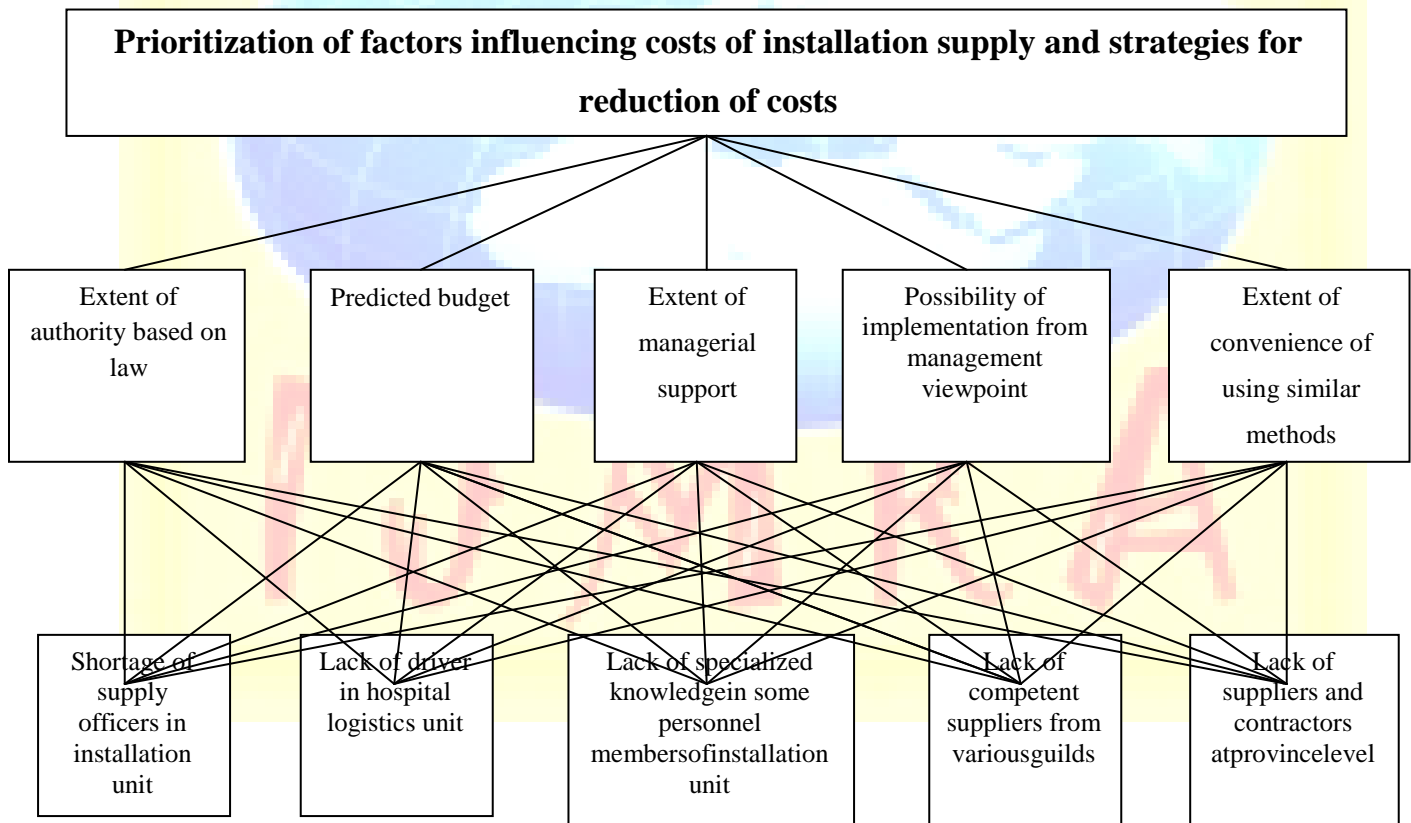


**Q1:** what are the factors leading to increased costs of installation supply in Razi hospital of Qazvin?

According to results from study, factors effective in increased costs of installation supply are as the following: lack of some suppliers and contractors at province level (A1), lack of competent suppliers from various guilds (A2), lack of specialized knowledge in some personnel members of installation unit (A3), lack of driver in hospital logistics unit (A4), shortage of supply officers in installation unit (A5).

**Q2:** what is the prioritization of these factors?

According to obtained results, factors influencing installation supply costs are pair-wisely compared, then group AHP is used to obtain priority of factors as this order: A5>A3>A1>A2>A4. Hierarchical tree in this method is same as the following:





	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$
$A_1$	2.9447	3.1897	3.3257	4.1733	3.4652
$A_2$	2.9007	3.3565	3.8908	4.6077	4.0143
$A_3$	3.1258	3.6505	3.3625	4.6638	4.8149
$A_4$	6.2449	5.7651	5.8935	6.9633	6.4472
$A_5$	2.1552	1.9520	1.9520	1.5746	1.5746

Finally using Copeland method, priorities obtained from three methods are combined in final form as this:  $A_5 > A_3 > A_1 > A_2 > A_4$ . It is inferred that  $A_5$ =shortage of supply officers in installation unit is the first priority,  $A_1$ = lack of some suppliers and contractors at province level is the second priority,  $A_2$ = lack of competent suppliers from various guilds is the third priority,  $A_3$ =lack of specialized knowledge in some personnel members of installation unit is the forth priority and  $A_4$ = lack of driver in hospital logistics unit is the fifth priority.

**Q3:** what are the strategies for reducing costs?

According to extracted results, strategies for reducing costs are indicated as follows based on expert opinions, extent of time and cost saving and also average wait time of requesting unit:

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Strategy description	Order of cost reduction related to factors:	Amount of expected reduction in each purchase unit (each average purchase unit is one purchase item per 7h working day with value of 5 million Rials).		
		Mean saved time\h	Mean saving in supply costs\Rials	Mean reduction of waiting time for requesting unit/working day
Using surplus transportation personnel of other units in morning shift for post of logistics driver	A1-A2-A4-A5	1.56	48333	1.67
Holding training classes for installation unit personnel and raising their technical knowledge level	A1-A3-A5	0.92	134167	2.17
Creation of supply officer post and filling this post with surplus of other units	A1-A2-A4-A5	1.92	112500	4.5
Interaction with other hospitals and organizations	A1-A2-A4-A5	2.50	150000	2



<b>at the same level in order to exploiting from their experience and information</b>				
<b>Exploiting from taxi agencies, freight agencies, etc. in order to reduce volume.</b>	A1-A2-A4-A5	1.21	82142	1.29
<b>Aggregation of requests by installation warehouse.</b>	A4-A5	1.83	175000	5
<b>Maintenance of machinery and plants installed in hospital especially in powerhouse</b>	A3-A4-A5	2.5	20000	4
<b>Internet, telephone and virtual purchase</b>	A1-A2-A4-A5	1.13	188750	2.25
<b>Prepare the grounds for holding monthly meetings between management\director and installation representative in order to solve problems</b>	A3-A4-A5	1	20000	5
<b>Elimination of bureaucracy as much as possible without compromising the law</b>	A5	1	500000	2

### Results and findings

Organization is a member of society. The society itself is involved in extraordinary change and revolution which in turn are due to changes in technology and science. Presence of these fast changes in society shows that an efficient management can not be achieved with relying merely on individual experience. Obviously these organizations should find new solutions associated with innovations, creativity and production of goods and services in order to survive in today's competitive environment. Improvement of methods for conducting works using software and office equipment enhances quality and quantity of works. Identifying and prioritizing factors leading to increased costs of installation supply is one among various methods for reducing costs of hospitals and also achieving other goals including increased transparency, reduced fatigue of workforce, enhancing work expertise of employees, saving time, managing reformation of work methods, enhanced profitability and many other benefits for hospitals.

The most important factor according to prioritization is shortage of supply officers in installation unit. This shortage leads to slow processing of requests for purchasing goods and

services directed to installation unit and in this way many problems are created for organization. Among strategies suggested for removing this factor is using internet, telephone and generally virtual purchase and this also alleviate problem of lacking driver in installation unit, lack of some required suppliers and contractors at province level and lack of competent suppliers in various guilds at province level. Also strategies of bureaucracy elimination as much as possible without compromising law and aggregation of purchase requests for installation goods and issuance of a single comprehensive request (at least for 6 month) according to warehouse space and present budget can help in alleviation of this factor.

The second important factor according to prioritization is lack of some suppliers and contractors at province level. This factor is an extra-organizational problem and organization can do little thing to eliminate it. It should adapt with existing conditions and alleviate imposed costs of this factor by taking appropriate measures. The best strategy according to expert opinions is to interact with hospitals and organizations at the same level in order to use their experience and information in identifying contractors and suppliers. Also the third factor according to prioritization is lack of competent suppliers in various guilds at province level and with respect to this factor the strategies similar to those mentioned for the previous factor can be exploited. Also the most credible suppliers and contractors at province level should be identified and exploited so that purchase can be done in a better way.

The forth factor based on priority is lack of specialization in some personnel members of installation unit and according to experts in order to eliminate this factor some training classes should be hold for staff of installation unit and raise their technical knowledge. Also it is very important to service and maintain machinery and plants installed in hospital and especially power house of installation unit.

Finally the fifth factor based on priority order is lack of drivers in installation unit and surplus transportation staff from other units can be employed as installation unit as driver in morning shift. In order to alleviate this problem also appropriate coordination can be achieved with suppliers so that they ship their goods through freight agencies and urban services such as taxi agencies also can be used.

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