

Strategic Points of Iranian Health Financial Reform Applying Shanonn's Entropy Model

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ABSTRACT

Background: This research intends to evaluate the most important strategic points after performing the first phase of financial reforms of Iranian health care system by classifying and ranking the most important weak points for policy makers and enabling them to remove or reduce these weaknesses for changing into strength points as well.

Methods: The present study was applied in three separated continuous qualitative, quantitative and mathematical phases applying thematic analysis for extracting the main weak points, Shanonn's Entropy and simple additive weighted (SAW) for ranking and classifying the most important mentioned weaknesses.

Results: There were 35 main weak points regarding the expert views. Applying Shanonn's Entropy, "Lack of information of master managers about any advantages of new financial reform" has selected as the most important option with the highest weight of 0.060 and categorized as the first rank using SAW, in contrast, "Non-justice distribution of equipment" had the lowest weigh of 0.001 and also the last rank (33rd).

Conclusion: Any efforts for removing these obstacles and reducing of mentioned limitations could be useful in providing required space for future phases of reforms and calculation of unit cost, operational budgeting and management of costs and productivity.

KEY WORDS: Iranian health financial reform, Shanonn's entropy, simple additive weighted

INTRODUCTION

Supply and Distribution Management of Financial resources is one of the most important challenges for policy makers in all health systems [1]. It is so much important even without a suitable infrastructure any increase in financial credits for effective benefits from financial resources of health system has no more effects in better usage of these resources [2].

For this purpose, Iranian Ministry of Health and Medical Education made the first step of the health financial management reform of country from 2005 under the title of Iranian health financial management reform after successful applying of Pilot plan of estimation the services costs and functional budgeting in 25 hospitals [3].

The first phase of these financial reforms in health system of country was applied in all universities of medical sciences in the form of accrual accounting instead of cash one. Whereas different studies and evidences have considered several benefits for accrual accounting including promotion in evaluation of reversible financial assets, facilitating the process of planning, decision making and management and achieving a better and more comprehensive picture of public sector performance [4].

But, at the same time cash accounting is used for registration of financial accidents in other Iranian governmental organizations. All receipts, paid and cash balanced items have been registered upon exchanging the amounts. As a result financial statements are based upon accrual accounting and show traditionally all resources of cash receipts and allocation of cash expenses. Then it is possible to compare them with budgeted amounts [5].

There are some public problems in cash accounting such as lack of suitable information about services costs, ignoring the depreciation costs for relevant periods and evaluation of any problems in purchasing plan of capital assets for government due to the lack of enough information about governed assets in different organizations [6] and also lack of compliance in incomes and created costs that may cause a violation from correct activities and incorrect reflection of incomes [7]. As the pioneer of financial reforms, Ministry of Health and Medical Education has used an accrual base for universities and faculties of medical sciences.

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Therefore according to the previous studies, it is possible to classify any applying of accrual accounting in governmental sector and into seven classifications as follows: More integrated description and any governmental programs costs, focusing on costs control and measuring the effects, any effects on pricing for end-users, benefiting from discussions and providing more responses for used resources and investment in public organizations, providing better responses for further effects of debit policies and measuring of financial effects on governmental policies for primary estimations [8].

According to the mentioned items, it is possible to claim that any changes from cash base into accrual one is the required infra-structure for applying of financial reforms in public sector of country including the Ministry of Health and Medical Education. It means that any changes from an accounting system with lower useful information into another system with more useful information [9]. As other studies emphasized accrual accounting implementation is an appropriate approach in order to enhance social accountability of public managers in the country, increasing transparency of financial reports, calculating the cost of service, operational budgeting, prioritizing activities and programs and also optimizing future decisions [4]. Entrance of specialists, Transparency of financial reports, Internal control, Presence of auditor, Recognition of costs, income and Financial independency of units are other accomplishments stated in another study after applying accrual accounting in Iranian public sector [10].

But there is already a gap indicating the weaknesses and challenges during and after accrual accounting setup through health care system as an Iranian main public sector, therefore this research intends to evaluate the most important weak points for performing of first phase of financial reforms of health System (establishment of accrual accounting instead of cash one) by classifying the most important weak points by the use of Shannon's Entropy method for weighing of criteria and simple additive weighting technique in order to classifying them and find a schematic of current weak points for policy makers and enabling them to remove or reduce these weaknesses for changing into strength points as well.

MATERIALS AND METHODS

The present study was applied in three separated and continuous phases on financial & budget managers of different Universities of Medical Sciences and also their educators of health financial management reform for classifying the most important weak points of the first phase of this reform (establishing accrual accounting) considering that weak points are those internal problems initiating from intra sector lacks or deficits as follows:

1- At first phase we collected all viewpoints and ideas of the experts with a qualitative method. The target population of this study includes all financial & budget managers occupied at Universities of Medical Sciences throughout the country accompanied with selected educators of health financial management reform of country that are responsible for training of basic principles of accrual accounting to the members of their sub-groups as well. According to the easy sampling method from among 80 financial & budget managers and 60 educators of health financial management reform who were experienced, interested and concerned people were invited to this research. It was tried to consider their variety of their servicing place according to the types of universities (First, second and third grades). Firstly we could compensate the weak points and deficits purposefully and according to the results of primary contents and holding different sessions for expert discussions about definitions, conceptual structure and two separate brain storming sessions for managers and educators. It was tried in mentioned conceptual structure to discuss different scopes including general principles of accrual accounting in governmental sector and resulted advantages accompanied with any experiences of other countries and any probable weak points resulted from implementation of this phase of reforms in Iranian Health System.

As a result about 15 persons of educators of health financial management reform attended in brain storming sessions with 10 persons of financial & budget managers of these universities and then in four expert panels as well. All mentioned people had a more than 7 years of experience and at least 3 years of occupation in financial units and/or budget of universities. Due to the academic records of mentioned people, they had at least a bachelor of science in one of the relevant fields of study in financial & accounting subjects.

At the beginning of group discussions it was tried to explain all goals of research clearly accompanied with explaining all key words and terms for providing a suitable condition for brain storming. Then it was tried to create minimum interfere by researchers for providing an open space for group discussion. As a result there was a suitable condition for maximum participation of all members. Simultaneously and upon providing different ideas by the participants, all concepts and key words were written down and registered by the research team. Then all participants had at least three chances for explaining their ideas accompanied with an open questionnaire including relevant questions. They were requested to answer the questions in accordance with their previous experiences resulted from presented discussions. All discussions and ideas of people have been recorded completely through the sessions and then two members of research team extracted the major verbal codes by re-evaluation of all made discussions accordingly. Furthermore, at the time of holding the sessions, one of the team members took a note about major items of the research. In next step, we could classify and coded all

mentioned concepts and inter-group discussions of researchers and also presented responds in the form of a questionnaire for finding any weak points in health financial management reform. The real meaning of important and key terms was different terms with more focus by the respondents and/or any repeated concepts through the session. Due to a close relation between the results of different discussions most concepts have been focused by more than one person in mentioned results. Therefore it seems that all received respondents are saturated with enough sample size. Lack of finding an important and new message at the end of sessions was the major criterion of saturation level in a way that it was felt that all participants had no new items for adding to research findings.

2- Shannon's Entropy method was applied in second phase for weighting of indexes. Shannon's Entropy is one of the extraction methods of criterion importance in any decision making process. In this method, we have more weight for different indexes with more changes [11].

Shannon's Entropy is an important concept in social sciences and physics and also information theory. Shannon's Entropy is a lack-of-insurance (uncertainty) criterion in information theory which is specified by distribution of probability as P_i . In other words, Shannon's entropy is a criterion for lack of confidence through a separated probable distribution. Such a non-confidence of distribution is more than any cases for sharper abundance distribution [12]. Following is the measuring method of such a non-confidence situation:

$$E_i = S(P_1, P_2, \dots) = -K \sum_{i=1}^n P_i \ln P_i \quad (i=1,2,\dots,m)$$

Where:

K is a fixed amount and since the above-mentioned relation is used in statistical calculations, it is named as probable distribution of entropy P_i . When P_i is equal for i & j , then it is assumed to be as $P_i = \frac{1}{n}$. P_{ij} could be applied in a decision making matrix for evaluation of different options with final decision making matrix as follows:

$$X_1, X_2, \dots, X_n$$

$$\begin{matrix} r_{11}, r_{12}, \dots, r_{1n} A_1 \\ r_{21}, r_{22}, \dots, r_{2n} A_2 \\ \cdot \\ \cdot \\ r_{m1}, r_{m2}, \dots, r_{mn} A_m \end{matrix} = D$$

The results of above-mentioned matrix is as follows for $(P_{ij})_j$

$$P_{ij} = \frac{r_{ij}}{\sum_{i=1}^m r_{ij}} \quad j=1, \dots, n \quad \forall ij$$

Then it is possible to calculate E_j entropy as follows:

$$K = \frac{1}{M}$$

Following we may calculate d_j amount or deviation degree which may specify relevant index (j) about the amount of useful information for decision maker. More close amounts of measured index show that there is not any difference among competent options for the specified index. Therefore its role would be reduced accordingly in any decision making process.

$$d_j = 1 - E_j, \quad \forall j$$

Then it is possible to calculate W_j amounts in which the best weight is as follows:

$$W_j = \frac{d_j}{\sum_{j=1}^n d_j}, \quad \forall j$$

In case decision maker has a special prior weight for index j (λ_j) then it is possible to calculate new weight (W_j) as follows [11]:

$$W_j = \frac{\lambda_j W_j}{\sum_{j=1}^n \lambda_j W_j}$$

3-After specifying the importance coefficient of each option according to the pre-specified method, by the use of Simple Additive Weighted model as the simplest methods of multiple-indexes decision making methods[13], we may consider the importance coefficient of each option by the use of weighted average in this step with maximum number of them as the optimized option. Therefore it is possible to find out the priority of weak points of health financial management reform.

Following formula is used for calculation of optimized option (A^*) [14]:

$$A^* = \left\{ A_i \mid \text{Max} \frac{\sum_{j=1}^n W_j r_{ij}}{W_j} \right\}$$

If $\sum W_j = 1$, then A^* is equal to:

$$A^* = \left\{ A_i \mid \text{Max} \sum_{j=1}^n W_j r_{ij} \right\}$$

RESULTS

The result of findings out of content analysis of the expert panels with financial & budget managers and educators of health financial management reform occupied in relevant universities under the coverage of Ministry of Health and Medical Education in the field of weak points of first phase in health financial management reform of country have resulted in thirty five weak points as mentioned in table 1.

Table 1- Weak points of health financial management reform resulted from viewpoint of experts in expert panels

Non-enough number of occupied specialists in financial field	Resistance of personnel against any changes
Low level of personnel satisfaction	Familiarity with daily life of personnel
Lack of experiences of new personnel	Weak criticism among people
Weak responses of personnel	Weak situation of best governance
Presence of an age gap among occupied forces	Lack of institutionalization of health new financial management reform
Lack of information of master managers about any advantages of health new financial management reform	Presence of opposite sub-cultures among managers
Weakness of middle managers in attraction the participation of personnel	Lack of notifying of organizational chart
Occurrence of great changes in level of master & middle managers	Non-suitable organizational structure in the financial field & budget of universities
Various duties & responsibilities of managers	Weak transparent relations among financial & budget managers at Universities of Medical Sciences
Weak evaluation tools of used functions by managers	Presence of administrative bureaucracy
Weak attitude of managers about resulted changes out of establishment a new system	Different problems in payment system for absorption & maintenance of special financial forces
Weakness of infra-structural systems	Time-wasting of the process for finding final product of health new financial management reform
Hardware problems	Lack of any feedback about any success of applying health new financial management reform & project outputs
Complexity of software	Lack of an annual functional & executive program
Weakness of system suitability	Any delay in performing the accrual system

In next step we could calculate the weight of options importance (weak points of health financial management reform) by the use of Shanonn's Entropy method. The results are mentioned in table 2. As it is obvious, higher weights belong to those options with more changes. As a result, this may cause a difference among options through different weights out of entropy.

As it is obvious total weights of options in this method is equal to 1. Therefore the highest weights are related to weak information of master managers about the advantages of health financial management reform (with highest weight), weak attitude of managers about resulted changes out of establishment of health financial management reform and weakness of middle managers in attraction of personnel. All three mentioned factors are included in weak points of management. On the other hand, the minimum weights are related to time wasting of finding the final product of health financial management reform, parallel works of cash & accrual systems and non-justice distribution of equipment (with minimum weight) which are included in weak operational and process points.

Table 2- The weight of options importance by the use of entropy method

Options	Weights
Lack of information of master managers about any advantages of new financial reform	0.060
Weak attitude of managers about resulted changes out of establishment a new financial reform	0.059
Weakness of middle managers in attraction the participation of personnel	0.057
Occurrence of great changes in level of master & middle managers	0.055
Various duties & responsibilities of managers	0.054
Weakness of infra-structure systems	0.052
Lack of notifying of organizational chart	0.048
Resistance of personnel against any changes	0.047
Lack of institutionalization of new financial reform Culture	0.046
Complexity of software	0.044
Low level of satisfaction of personnel	0.041
Lack of experience of new personnel	0.038
Lack of responding of personnel	0.035
Non-enough number of special occupied personnel in financial field	0.034
Presence of opposite sub-cultures among managers	0.033
Any delay in performing the accrual system	0.031
Lack of an annual functional & executive program	0.028

Various duties of process owners	0.027
Lack of an official process for writing any strategy	0.025
Presence of an age gap among occupied forces	0.023
Weak evaluation tools of used functions by managers	0.022
Hardware problems	0.020
Familiarity with daily life of personnel	0.019
Weak criticism among people	0.017
Weakness of system suitability	0.016
Weak transparent relations among financial & budget managers at Universities of Medical Sciences	0.013
Presence of administrative bureaucracy	0.011
Non-suitable organizational structure in the financial field & budget of universities	0.009
Lack of suitable budget for performing of new financial reform	0.009
Different problems in payment system for absorption & maintenance of special financial forces	0.008
Weak situation of best governance	0.007
Lack of any feedback about any success of applying new financial reform & project outputs	0.005
Time wasting process of finding final product of new financial reform	0.003
Parallel cash & accrual work system	0.003
Non-justice distribution of equipment	0.001

At third step, all participants were requested to recognize the most important indexes which were under the effect of 35 options (weak points). Then we could recognize three indexes of efficiency, transparency and control. Therefore in order to specify their importance coefficient we used again entropy method for which the relevant weights are mentioned in table three.

Table 3- Weights of different indexes by the use of entropy method

	Efficiency	Transparency	Control
Weight of indexes	0.319	0.356	0.325

Finally and after applying of obtained weights in different options and performing required calculations, we could find relevant classification of weak points in health financial reform as mentioned in table 4 below.

Table 4- Classification of weak points in health financial reform according to the obtained credits out of Simple Additive Weight (SAW)

Grade (Rank)	Weak points of Health New Financial Management Reform
1	Lack of information of master managers about any advantages of new financial reform
2	Weak attitude of managers about resulted changes out of establishment a new financial reform
3	Weakness of middle managers in attraction the participation of personnel
4	Occurrence of great changes in level of master & middle managers
5	Various duties & responsibilities of managers
6	Weakness of infra-structure systems
7	Lack of notifying of organizational chart
8	Resistance of personnel against any changes
9	Lack of institutionalization of new financial reform Culture
10	Complexity of software
11	Low level of satisfaction of personnel
12	Lack of experience of new personnel
13	Lack of responding of personnel
14	Non-enough number of special occupied personnel in financial field
15	Presence of opposite sub-cultures among managers
16	Any delay in performing the accrual system
17	Lack of an annual functional & executive program
18	Various duties of process owners
19	Lack of an official process for writing any strategy
20	Presence of an age gap among occupied forces
21	Weak evaluation tools of used functions by managers
22	Hardware problems
23	Familiarity with daily life of personnel
24	Weak criticism among people
25	Weakness of system suitability
26	Weak transparent relations among financial & budget managers at Universities of Medical Sciences
27	Presence of administrative bureaucracy
28	Non-suitable organizational structure in the financial field & budget of universities
29	Different problems in payment system for absorption & maintenance of special financial forces
30	Weak situation of best governance
31	Lack of any feedback about any success of applying new financial system & project outputs
32	Parallel cash & accrual work system
33	Non-justice distribution of equipment

DISCUSSION

Before applying of health financial reform in Iran, it seemed that cash accounting was not enough for programming goals and any decision making of management. It could not provide required field for responding of managers about their own functions. On the other hand and by the use of the said method it was impossible to control & evaluate any effects of department programs. This may cause a field for changing the case from cash into accounting condition [15]. But certainly what were inevitable were different limitations and weak points of different fields of management, personnel, information system, organizational culture, structure, process and functions in performing the first phase of health financial reform and due to the wide scope of its establishment. The real goal of this research is to recognize and classify all mentioned weak points and submission of guide lines and different proposals for changing them into strength points.

According to the findings of this research, all managerial limitations are the most important weak points for performing accrual accounting in affiliated units of Ministry of Health & Medical Education. Therefore any weak information of master managers about any advantages of establishment a financial reform, their weak attitude about resulted changes out of establishment of this reform, weakness of middle managers in absorption of personnel participation, occurrence of great changes in the level of master & middle managers and various duties and responsibilities of managers are the first five priorities (First to fifth grades) of weak points.

Therefore other studies show that there are different problems for introducing of accrual accounting in under-developed countries. It has been stated that any establishment of this system in mentioned countries needs a modified attitude of management and also evaluation system of management functions. Any lack of attention to this factor has made most managers to reject this method as well [16]. The other made researches have pointed out to knowledge level of managers about the role of suitable financial reporting and the basic importance of these reports and also recognition of managers about financial discussions and their analysis as an important innovative factor for acceptance of accrual accounting by managers [16-17].

Therefore regarding the importance of managers in successful establishment of this system and since all mentioned five weak points are major factors in performing the accrual accounting in Health System of country and are related to managerial factors, it is proposed to increase the public knowledge of master and middle managers about advantages of accrual accounting and benefit from group discussion sessions and other techniques for betterment of their attitude about these changes. Furthermore any benefit from other motivating factors and enrichment of communicative skills accompanied with providing an estimated fixed condition in managerial jobs and reducing non-necessary changes are the other factors for betterment of mentioned weak points and changing them into strength points as well.

In addition to all mentioned items, any weakness of infra-structure systems, lack of notifying the organizational chart, resistance of personnel against any changes, non-personalization of financial reform and complexity of software are included in the groups of those weak points with grades 6th up to 10th and at the top of the table. Meanwhile, the results of Todour & Motio researches show that performing of accrual accounting needs a development in IT system and betterment of executive methods with designing of legal structure and training of current personnel and employing of new personnel [7]. On the other hand any creation of responding culture has a great role in acceptance and applying of accrual accounting at governmental sector [8].

Therefore it seems that any benefit from different techniques for reasoning and preparing of personnel and any changes and acceptance of new system besides holding of applicable educational periods, benefiting from innovative and encouraging motivators and also any efforts for establishment of a suitable /integrated organizational culture for establishment such a system and removing any problems in Information System are other guidelines for removing any weak points and changing them into strength points as well.

Furthermore, since the Health Sector is the first performer section of accrual accounting among other public sectors of country, it seems that more benefits from experiences and information of special experts in accounting throughout the country has a special role besides applying of facilities of IT specialists for upgrading the accrual accounting information system.

From the viewpoint of distribution of accrual accounting culture and personalization of which, it seems that more cooperation in this field may be useful in development of this phase of health financial reform. For example any development of conferences, workshops and thinking sessions and exchange of experiences between Ministry of Health and Medical Education with other organizations and concerned parts including Population of Official Accountants of Iran, Ministry of Economy & Finance, Islamic Parliament, Applicable Assistance of the President, General Inspection Organization, Organization of Writing the accounting Standards could be considered as some executive guidelines for personalization of financial reform inside and outside of Health sector.

According to the results of this paper, it seems that there are some other weak points with lower importance in comparison with above-mentioned items, but they are also included in the group of weak points. Therefore they should attract some executors and custodians for finding a suitable solution. In a glance, it is possible to associate most of them to some pre-requisites for further motivation and better performance by the

personnel. Some of the mentioned weak points are the result of applied policies by the affiliated ministry which have been selected due to the required time and location. Therefore with regard to all results of this paper and those weak points, it is better to have suitable changes in all programs and executive functions right now in order to accelerate the process more than before.

Conclusion:

Finally and with regard to this reality that first phase of reforms in Health System of Iran has been applied completely in all sub-units of Ministry of Health and Medical Education. Needless to state that more attention to weak points for performing of accrual accounting is really important as the first phase of mentioned modifications. Any efforts for removing these obstacles and reducing of mentioned limitations could be useful in providing required space for future phases of reforms and calculation of unit cost, operational budgeting and management of cost and productivity.

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