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The integration of QFD Technique and Value Engineering and its Applying in a Healthcare Center

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Abstract

This paper deals with the integration of QFD and VE in the product planning process. QFD improves the service/product performance based on the customer's requirements, whereas VE focuses on the reduction of service/product costs without lowering its quality or performance. The integration of QFD and VE together leads to the reduction of costs and improvements of service/product or performance. In this paper first a conceptual model of integration of these two techniques is provided and then the implementation procedures are explained, and finally the results obtained from the implementation of it in a healthcare center are discussed.

Keywords
Product planning process , Value Engineering , QFD , integration of QFD & VE , Conceptual Model , Case study

1. Introduction
Nowadays that the competition between firms has increased substantially , the scientific study and planning of service/manufacturing systems has become inevitable. Senior executives of financial institutes are looking for dynamic organizations compatible with the customers' needs and wishes in a way that value overweighs the service/product costs. The success of financial institutes in a competitive market depends on the recognition and fulfillment of their customers' needs through which they can obtain their customers satisfaction, which itself may be the outcome of fair price , desired quality , good delivery , after sales service .. or a combination of several of these factors. While VE achieves this purpose by lowering the costs and increasing the value for the customers , QFD takes into account all the needs and requirements of the customers and attempts to fulfill them , which subsequently may lead to the increase in product/service satisfaction of the customers. The objective of this paper is to provide a Model for the integrating of both VE and QFD in order to optimize the product/service performance while considering the customers' needs and lowering costs and maintaining quality. In this paper first the QFD & VE are introduced and then the method of their integration is offered . The last section discusses the application of the Model in a healthcare center.

1.1 Value Engineering
Some of the various definitions of VE (value Analysis) are as follows:
Value Engineering is a technique for determining the manufacturing requirements of a product/service, it is concerned with its evaluation and finally the selection of less costly conditions[1]. VE is a process for achieving the optimal result in a way that quality , safety , reliability and convertibility of every monetary unit is improved[2]. Value Engineering is usually applied in the analysis and design of a service/product.[3]

Different methods for executing the VE have been used . These methods have a general format which contain the following five phases (figure 1).

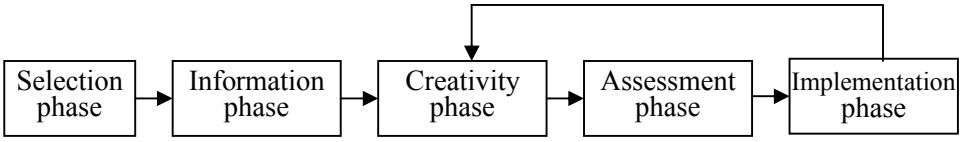

Figure 1: Five major phases of VE

1.2 QFD

According to GOAL/QPC (one of the major consultative centers of QFD in the U.S.A)Quality Function Deployment is a systematic process to identify and fulfill the spoken and unspoken requirements of customers in any of the stages of product development.(from design to final product). No doubt for achieving this goal the cooperation of different sectors including marketing and sale , engineering planning , manufacturing, after sales service and other departments is required . There have been different methods discussed in the QFD literature and because of the popularity of four-phase QFD among experts , as follows:

1. Product planning.
2. Product design.
3. Process planning
4. Production Planning

Figure 2 represents the Four-Phase QFD schematically. As it is shown in the figure , this process begins with the customers' requirements and ends with process control requirements The quality houses are the main factor in their connection to each other.

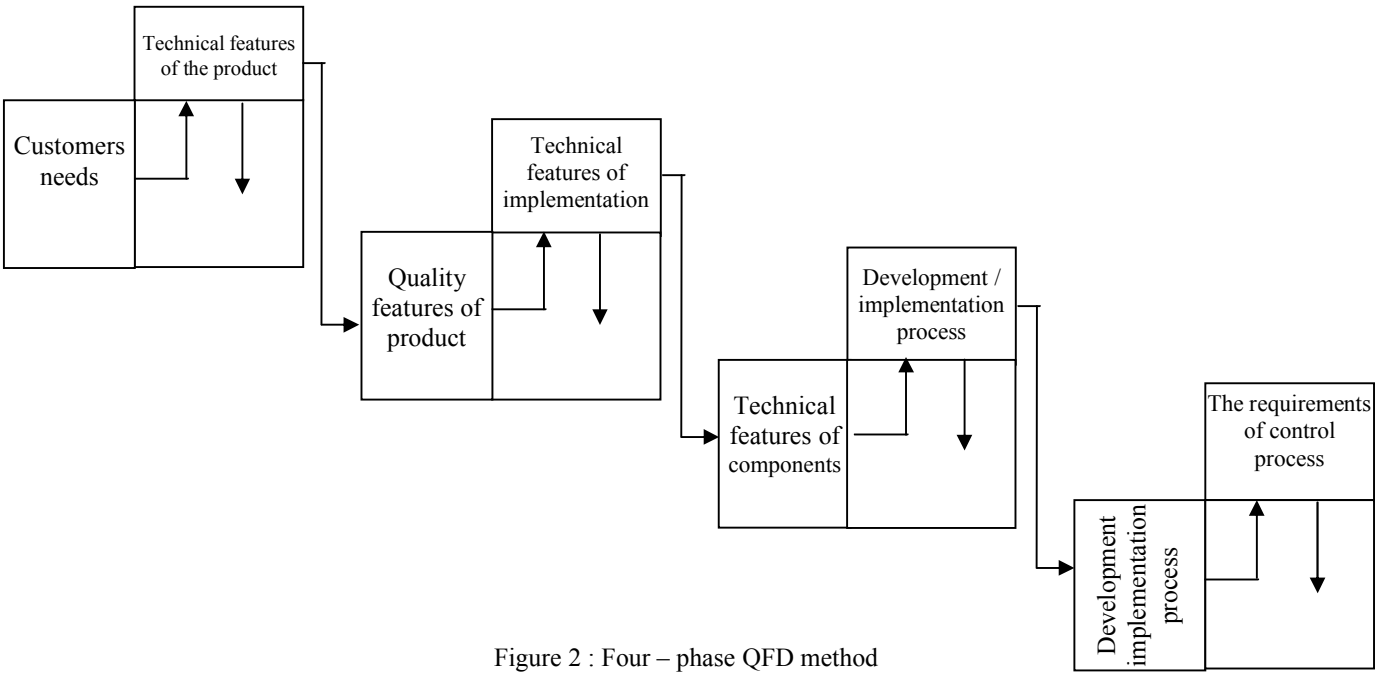

Figure 2 : Four – phase QFD method

1.3 The Integration of QFD & V.E

Value Engineering and QFD have different orientations . The main objective of V.E is the reduction of operational costs in the main and support process of an organization so that to lead to a reduction in the cost price .

V.E selects a solution which produces more value for the customer. Unlike the V.E , QFD focuses on the customers' needs and requirements and tries to bring about innovations in the product/service design in a way that more satisfaction is obtained . In other words this technique looks for changes which produce the greatest value according to the customers' needs. It is worthwhile to mention here that out of the many possible solution , (alternatives), QFD selects the one that is practical (compatible with the organizations' capability) and is economical (requires less investment/operational costs). Needless to say that considering these two criteria (cost reduction & value addition) in a decision- making process may lead to the selection of a better alternative which not only enjoys a higher value by the customers but also imposes less expenses on the organization ,a factor which contributes to the price stability / cheaper product/service cost prices . V.E is implemented during the planning phase , because 70% of the future costs depends on this stage (6) . The best time for the application of V.E in a project is during this stage (3) . Alain Leblanc , a member of American V.E Association and the senior manager of Canadian PW&C company , has demonstrated the relationship between QFD &V.E in this way .(figure3)

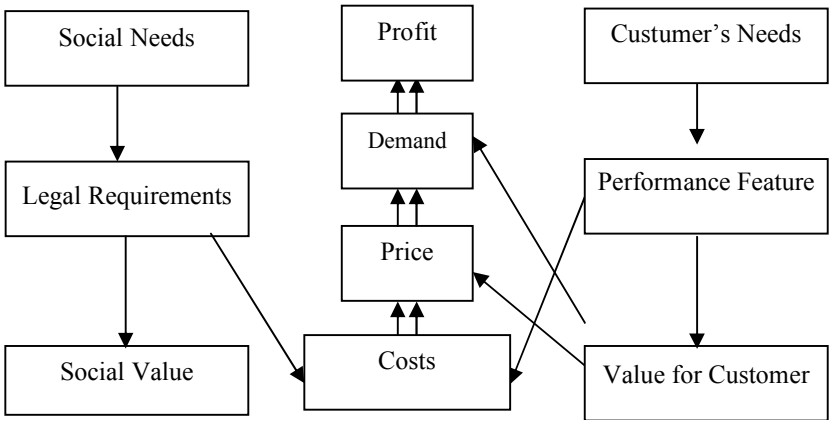

Figure 3 – relationship between QFD & V.E design by A.lebelan

In this diagram the relationship between the customers' needs and the product/service characteristics and their value for the customers has been demonstrated . According to Leblanc the customers' needs on one side and the societal/legal requirements on the other side determine the product/service features. These specifications not only determine the production cost , but also can be used to assess the value they generate for the customers .Based on this method the selling price of the product/service is set .

2. The Presentation of a Conceptual Model

As was mentioned in the beginning of this paper, QFD looks for an increased customers' satisfaction and consequently more sale in order to earn more profit. Whereas V.E aims at earning more profit through a reduction of costs without lowering the quality of product/service. The main purpose of incorporating the techniques of QFD & V.E in the design of product/service or production process is the selection of suitable alternatives which while lead to the increased value for the customers do not increase the product/service cost . In other words through improving the costs , customers' satisfaction is obtained .The conclusion of this is that the process of product/service planning based on QFD principles begins in this manner . i.e.

- The customers' needs and requirements are taken into account .
- Certain characteristics of the product/service related to these needs are determined .
- The solutions (alternatives) contributing to the materialization of these needs are identified .

Then using the V.E technique , those solutions (alternatives) which have a higher value index for the customers are chosen .The integrated conceptual Model of QFD &V.E has been offered in figure 4 .

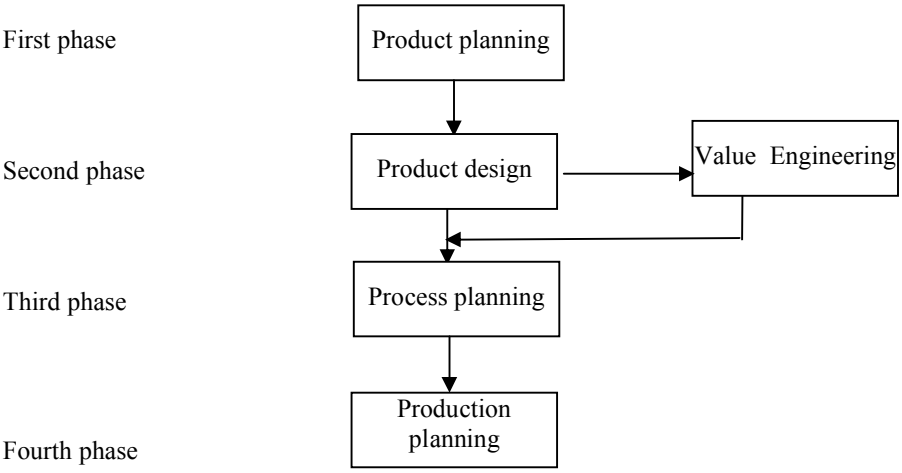

Figure 4: The Integrated conceptual model of QFD&V.E

The Description of Proposed Model

Figure 5 represents the role of V.E in the second phase of QFD. The input data from the second phase of QFD is entered into the second phase of V.E .The data include the quality characteristics of components and the subsystems of the product . Then the various alternatives in the sequence of data collection , innovation and assessment , are identified and evaluated, so that the best alternative(s) to be selected .The data collected as a result of V.E application are entered along the key product/service characteristics are inserted into the third phase of QFD (process planning) .[figure 5]

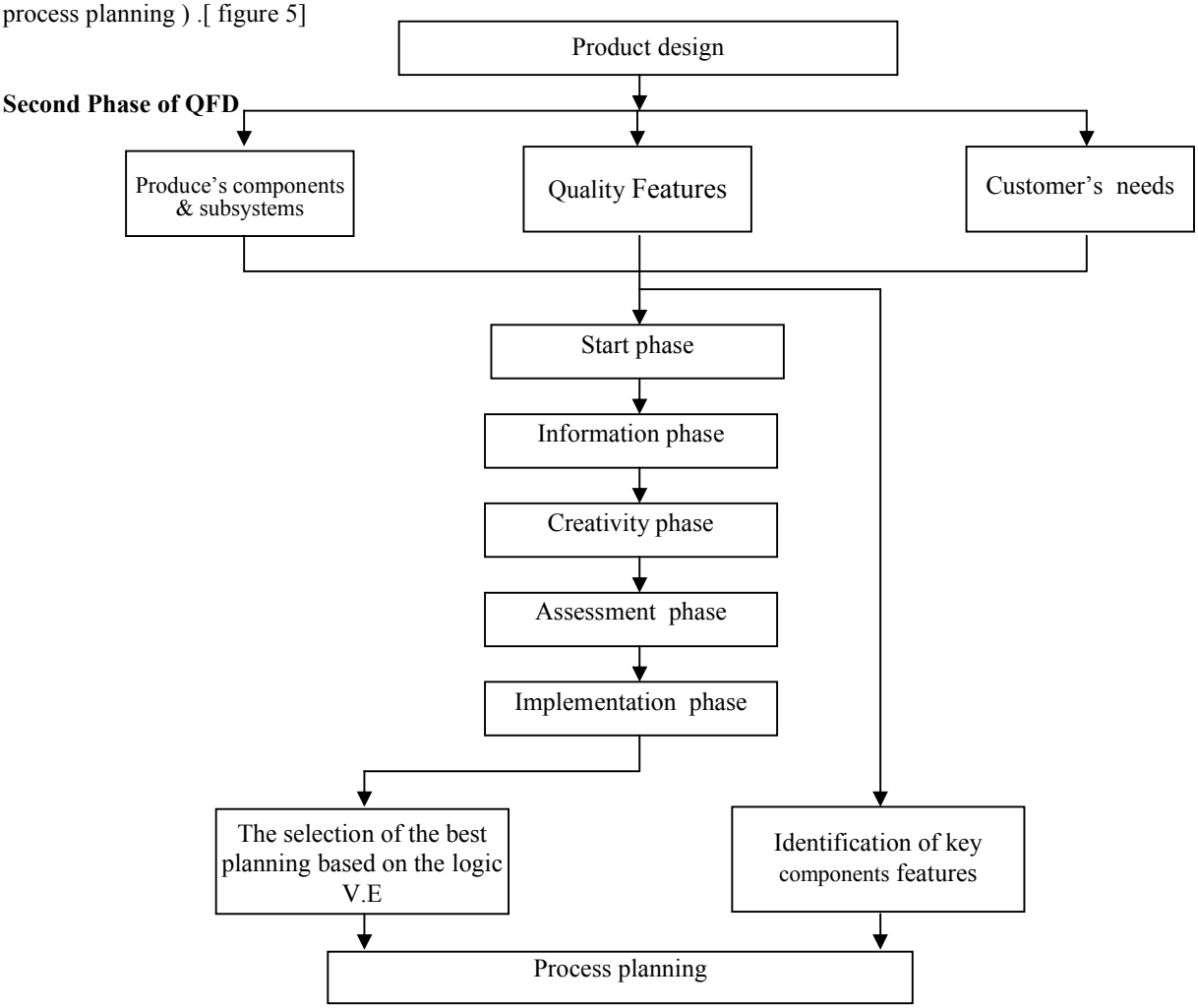

Figure 5- The method of integrating V.E stages in the second Phase of QFD

Since the first stage of V.E (source phase) has been implemented in the opening phase of QFD , it is omitted in the integration. Moreover because after the selection of best alternatives , We return to the third phase of QFD, so the fifth phase (implementation Phase) of V.E is also omitted .

In Figure 6 more details concerning the incorporation of both QFD & V.E has been shown .Based on these diagrams , first the customers and their requirements are identified. Then in a table their needs are reviewed and questions concerning **who , how , why , where , and what** are answered **.** By completing this table , the first Quality Matrix (house) is formed . In this matrix the relationship between the customers' needs and the factors affecting them (technical specifications of product/service) are analyzed . The collected data from the first matrix – i.e the technical features of product/service (the factors contributing to the materialization of customers' needs)and their values - are added to the second matrix (house of Quality) . In this matrix the relationship between the solutions and the technical characteristics of product/service is studied .The aim of this review is the assessment of solutions impact on the technical characteristics of product/service .In addition , the correlation between alternatives is also reviewed . After this stage , We arrive at the V.E process . The resulting output from the second quality house of QFD identifies the list of solutions and their values . As was mentioned , the value of every solution is determined according to its impact on the technical features of product/service .

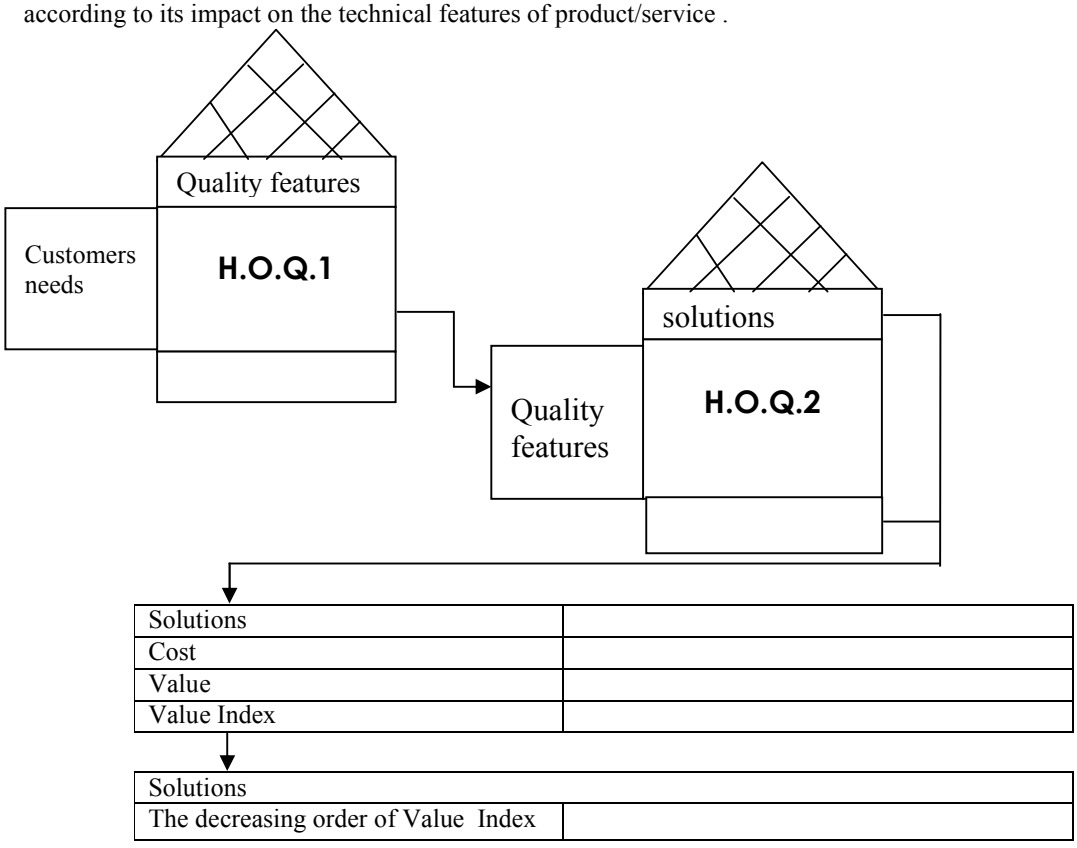

Figure 6 : Relation between H.O.Q and V.E

In this stage the cost of solutions is also estimated . By dividing the solutions value in its costs the value index is obtained . The order of solutions on this list represents their importance in fulfilling the customer's needs with minimum costs .

3. The implementation of the Model in a healthcare center

In this part the implementation of the Model in a healthcare center is explained .The referring healthcare center was the specialization ward of one of the Social Security hospitals which provided treatments for the outpatients. It had 256 beds and 6 operation rooms. The number of employees including the contracting companies amounted to 575 people. In the specialization ward of this hospital 1200 patients were treated daily. Outpatient service is the

provision of care and treatments to the patients without hospitalizing them. Reduction of waiting time, Closer examination by the physicians, appropriate public relation, welfare facilities and the complaints to manager needs were extracted by doing a survey with the patients. The significance of each of the above five needs were determined through an interview with the patients (visitors to the clinic) and then was inserted in table 1. As it is shown in the table the reduction of waiting time had the highest priority and then spending enough time for examination by the physicians, appropriate offering of information, accountability and finally improving the welfare facilities of the clinic were the subsequent priorities.

Next the factors important in the realization of customers requirements were identified. For this purpose the views of staff and managers of the clinic were considered. In fact, the influential factor was to translate the customers' needs into technical language .The factors identified were as follows.

1. Regular attendance of physicians
2. Reduction of Patients
3. Improving Informative system
4. Accountability and responsibility before the patients
5. Clear and unequivocal regulations
6. Motivating physicians
7. Establishment of welfare facilities

The relationship between the above 7 factors and the 5 major demands of customers has been demonstrated in Table 1. As it is apparent, each factor may be related to more than one need/requirement of the customers. For example, the regular attendance of physicians in the clinic not only contributes to the reduction of patients' waiting time and the reception of enough attention from physicians, but also increases the accountability and informative systems. In the last two cases, the regular attendance of physicians facilitates the process of information providing and reduces the number of patients' dissatisfaction. Since the effect of these factors on the customers' needs/requirements is not the same, so the effect of these factors has been shown using the (O = low) (Δ = medium) and ($\bullet$ = high)symbols . In order to convert the qualitative values into quantitative ones for each low , medium and high cases the following numbers 1, 2 , 3 were selected respectively. Then the sum of each factors' effects within the total set of requirements were calculated through the value addition of effects. As was expected the regular attendance of physician had the highest effect on customers' satisfaction. The decrease in the number of patients and unequivocal regulations were the next priorities (Table 1). In addition to the direct effect, a factor may affect the customers' requirements indirectly. That is there might be a cause and effect relationship between factors. As an example, the unequivocal regulations are effective in the regular attendance of the physicians and motivating them, because the indiscriminating rules for all individuals encourage the disciplined ones. Therefore unequivocal regulations not only directly increase the customers' satisfaction, but also indirectly - through its influence on other factors such as physicians attendance - play a role in the realization of customers' needs. After the analysis of the interactive effects of these 7 factors – which is not of our concern here – the final value of the factors was estimated by adding the direct & indirect effects (Table 1).

For improving the effective factors, a guideline (table 1) were proposed by the physicians, nurses, employees, patients and the members of the project team. Then the impact of alternatives on the effective factors was analyzed. The impact of alternatives on each other (indirect effects) was also examined. By considering the direct and indirect impacts, the relative value (significance) of solutions was calculated (Table 2).

Next the administrative costs were estimated by the senior management of the hospital and given back to the project team. Considering the value of solutions and their costs indexes, the value index was calculated. (Table3) Finally the solutions were tallied in a descending hierarchy of value index and handed over to hospital management (Table4).

Table1: Matrix of relation between patient's demands and effective factors on these demands

Effective factors / Patient's requirements	W	The regular attendance of physicians	Reduction of patients number	Improving the information system	Accountability before patients	Clear and unequivocal regulations
Reduction of waiting time	32	●	●	o	o	●
Careful examination	21	●	●	Δ	o	Δ
Appropriate notification	21	o	o	●	o	●
Accountability	16	Δ		Δ	●	o
Welfare facilities	10					
Value sum of effective factors (direct factors)	18		17	12	16	17
The value of effective factors (direct plus indirect factors)	17		15	15	14	23

● :w=5 o :w=3 Δ : W=1

Table 2 : The Effect of Effective factors over solutions

and financial status of physicians	Increasing working shifts	Increasing the physicians number	Screen physician	Personnel training	Extra chairs	Children play ground	Study room	Accountability	Controlling the outpatient cases	An active Public Relation department	Playing Movies in the W- Room	Working in holidays
●				◯	◯							◯
	●	●	●						●			● ◯
			◯	●								◯
				●				●		●		
●			Δ				◯	●		●		
●	●	●										●
					●	●	●				●	
17	11	11	5	12	1	1	1	18	4	1	1	8
16	17	11	5	13	1	1	1	12	2	5	3	13

Table 3: Value Index of solution

Solutions	Increasing the moral and financial status of physicians	Increasing working shifts	Increasing the physicians number	Screen physician	personnel training	Extra chairs	Children play ground	Study Room	Accountability	Controlling the outpatient cases	An active public Relation department	Play movies in the waiting Room	Working in holidays
Weight of solution	16	17	11	5	13	1	1	1	12	2	5	3	13
Effective weight	34	6	28	7	3	0	6	0	1	0	0	0	14
Value Index	0.47	2.83	0.29	0.71	4.33	∞	0.16	∞	12	∞	5	∞	0.92

4. Text Sections and Headings

Table 4 : List of Solutions in descends manner base value Index

Solution	**Value Index**	**Grade**
Extra chairs	∞	1
Study Room	∞	
Controlling the outpatient case	∞	1
Play movies in the w-room	∞	1
Accountability	12	2
An Active public Relation department	5	3
Personnel training	4.33	4
Increasing working shifts	2.83	5
Working in holidays	0.92	6

Screen physician	0.41	7
Increasing the moral and financial status of physicians	0.47	8
Increasing the physicians number	0.39	9
Children play ground	0.16	10

Summary and Conclusion

Value Engineering and QFD have different orientations. QFD is after more profit through more sales which is obtained by increasing the customers' satisfaction, whereas V.E focuses on profit increase through cost reductions without lowering product quality. The main objective of integrating QFD and V.E is the selection of better alternatives in product/service planning or product/service process which not only produces a higher value for the customer , but also does not increase the cost of product/service.

In this paper the integration of QFD and V.E was examined in the product planning process. For this aim a conceptual model was developed. The implementation stages were also explained .In fact the proposed Model was an integration of a Mini QFD & a Mini V.E ,in which the complete QFD process is not implemented rather its first two phases i.e product projection and product planning are carried and a list of solutions along with their value is obtained from two quality houses. The V.E process is not implemented completely either, rather the solutions and their relative values are entered from the second quality house into the second phase of V.E. The administrative (implementation)costs are estimated and then the ratio of cost to value is calculated and the best alternative based on this ratio is selected. The application of the Model in a service organization confirmed that first of all its implementation is easy to perform and secondly the managers found the results acceptable , in other words it was reliable.

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