Organizational Cost-effectiveness in Petroleum Sector: A study on exploration & production companies working in Pakistan

*Ghulam Baqir **Dr. Naveed Akhtar

*PhD Scholar and Chief Human Resource Information System, OGDCL, Islamabad
**Director QEC, National University of Modern Languages, Islamabad

Abstract

Cost effectiveness reflects the cost of an intervention in relation to outcome. The present study has measured and evaluated the quality programmes/ projects with reference to their effectiveness in terms of cost and quality in exploration & production companies (petroleum sector) of Pakistan. The population of study consists of professionals working in the selected exploration & production companies by distributing 250 questionnaires, out of which 183 valid responses were included for further processing and analysis of the study. Multiple regression technique was used to test the hypotheses. The results of study reflect that all chosen characteristics significantly contribute toward achievement of organizational cost-effectiveness. Those companies who applied quality programmes in their processes have the periphery of minimum cost and maximum outcome of their products and are more cost effective organizations. The study also signifies the impact of quality programmes/projects having support of strategic/operational level for the achievement of dependent variable (cost-effectiveness) and requires the attention of executives to adapt and implement the latest technologies by providing the training opportunities to all professionals from time to time. The study also strengthens the concept of Cost Effectiveness Analysis in the E&P projects where the managers can improve their processes to minimize the cost and save the time.

Keywords: cost effectiveness, quality programmes/ projects, top management commitment, training & development, quality culture

Introduction

In the growing business for today, cost is the important part of a product which constitutes an opportunity for organizations to have competitive advantage in the market place. The cost and its outcomes to a programme can be measured by the evaluation process. The cost-effective organization is that organization which has maximum outcomes with minimum cost / input and achieves its desired goals. Muennig & Bounthavong, (2016) and Levin (2001) describe that "Cost effectiveness

analysis (CEA) is a tool for evaluation and comparing the cost with reference to its outcome while this may be from the two or more course of actions". The cost-effective organization will have the programmes which are successful when these are validated and evaluated otherwise may be described as failed and thus organizations cannot achieve its defined objectives. In order to improve production of the hydrocarbons, the upstream companies are required the high technology tools to explore those areas which have better prospects of these products. The unique nature of E&P business always requires high quality and support of the trained manpower / professionals in this field (Bickel, 2008).

The developing countries like Pakistan have scarce resources and their national E & P companies try to invest only in those areas where there are more chances to success for a discovery of oil / gas. The E&P companies have also another problem of technology which is being changed, upgraded by the giants day by day and it is very costly when purchase. Dilshad & Iqbal (2010) expedites that the history in Pakistan for quality management is not very old and there are a number of organizations which have not adopted total quality management philosophy because of its high cost. Nawar (2006) has also elaborated that quality culture is not considered / discussed at the time of planning phase and this later on becomes the reason for failure of any programme/project.

The importance of this study is also accepted as it proves that those exploration & production companies which apply these philosophies in their strategic decisions are more cost effective organizations with reference to quality, productivity and efficiency. The local E&P companies are also having retention problem of employees because multinational companies hire this workforce on high rates. Thus the managers can utilize their limited budgets in an effective manner when they choose those projects which are supported by top management commitment, quality culture, teamwork and technological advancement. The purpose of the study is to explore such quality projects/programmes which are cost effective. In their models Keri et.al,(2012) have reflected the impact of technology, cost and applied the analytical tool (CEA) but not measured the perception of end users that these programmes/projects are cost-effective or otherwise. In order to cover these gaps and explore these venues, the researcher has worked on how to help decision makers for making better strategic decisions with limited resources, and to encourage programme managers for using very efficient & effective QPs so that they can achieve objectives at lower cost and superior outcome.

Problem Statement

The cost effectiveness of a programme is based on its success or failure. When a program is declared successful by the program manager, it is required to be evaluated and validated. In the process to explore & produce oil, gas and other natural resources, the companies have to invest a large amount of resources with high risk. In order to minimize the risk and lowering cost with maximum output is the key for the company to survive in this business. The problem of limited resources being faced by developing countries like Pakistan put the national exploration & production companies to invest in those areas where prospects of natural resources are high. They have another problem of technological advancement and this is too costly when acquired. Similarly retention of trained manpower is very important for an E&P company to survive. These problems provided a path to the researcher to conduct this study which has been designed to measure and evaluate the quality programs/projects with reference to their effectiveness in terms of cost, time and quality in upstream petroleum sector. In this regard the total cost of the programmes/projects and the perception of the employees regarding effectiveness/outcomes has been collected through questionnaire having major questions as under:

Research Questions

1) How far quality programmes are cost effective?
2) How QPs contribute towards organizational cost effectiveness?
3) It is felt that top management always plan well before initiation of the programmes to make them cost effective.
4) Due to non-prevalence of quality culture in the organization, the programmes remained ineffective.
5) The organization uses technology in each function to improve quality.
6) Management encourages employees to get relevant training for career development.

Objective of the Study

Literature revealed that cost effectiveness of the quality programmes has been described by various authors mostly relying on secondary data but no such empirical research work had been conducted in Pakistan. The objective of the study was to explore and test empirically to know the cause & effect of independent variables on dependent variable (organizational cost effectiveness). The main objective of the study was as under:

- To help decision makers for making better strategic decisions in response to changing competitive environment.
- To help an organization for moving quickly side by side the learning curve for acquiring and implementing the cost-effective quality programmes.

Literature Review

Top Management Commitment

The support of top management plays a vital role in the success of any project to be accomplished within the given time period (Colwell & Joshi, 2013; Goetsch & Davis, 2014). Due to lack of commitment from top management, the quality programmes/projects cannot achieve desire success (Schein, 1991). Walsh *et al*., (2002) also recognizes that desired objectives could not be achieved due to improper planning, poor implementation and unsuccessful evaluation of the programme/project even then if a large number of resources are allocated for it. He argues that TQM interventions failure rate has exceeded 75% due to lack of top management commitment. Van-Rooyen (1999) has stated that primarily TQM is failed due to lack of sustainable support from top management and also found more than 60% TQM ineffective or have no effect in the institutions. Sallis (2014) and Pelikan (2006) has reported the failure of TQM in a study of Irish Healthcare and also explained that the same aspect has also been reported in the various studies. Nadeem (2006) has stated that commitment of the top management plays an important role in implementation of the quality programmes in the organizations. Top management commitment is independent variable for measuring the impact on organizational cost effectiveness.

H1: *Top management commitment is helpful for the success of a total quality management programme which ultimately leads to achieve the cost effectiveness.*

Quality Culture

In order to achieve the strategic goals, the culture plays an important role on the employees to work in this direction. Normally employees do not accept the change as they become the part of that culture where output is not determined and thus the QPs are not implemented in true sense and leads toward failure of the project. Juran (1964) elaborated that without giving the full attention and developing of clear understanding on three key aspects of quality (i) quality cost (ii) climate of the organization (iii) requirement of the customers, the proportion of success to

achieve the desired objectives is reduced. The evaluation process must include all those factors which are more beneficial and provide guidance for achievement of the goals as well as improvement of the performance either relating to the internal operations, financial obligations or customers of the organization.

This concept has also been endorsed by the Nawar (2006) that top management do not take into consideration of quality culture at planning phase of the project and thus quality initiatives are failed because of this ignorance. Marsha (2004) say that "Although many believe that prevention and early intervention programs are cost-effective, evidence of their financial costs and benefits is limited". The quality culture plays a vital role for the achievement of desired objectives (Goetsch & Davis, 2014).

H2: *Quality culture supports the total quality management programmes at strategic level in order to achievement of the cost effectiveness by the organization.*

Training & Development

Training & development plays a vital role in the performance of an employee which leads toward achievement of goals. Exploration & Production Companies are compulsory required to set the budgetary provisions for training of their professionals under the PCA (Petroleum Concession Agreement) obligations which will reduce the risk and cost of business. Akhtar (2010) elaborates that "Learning in the organizations can take either through structured training and development program or by creating certain components which enhance the different capabilities of the organization. The aim is to improve the effectiveness of the organization. Learning can affect different organizational resources and leverage them to create certain capabilities and competencies which improve organizational effectiveness" (p.302). Dean (1991) has expedited that in order to enhance the education on fast track basis, some countries planned for training to improve the quality of education but in vain due to insufficient budget and unproductive quality training programmes.

H3: *Effective training & development increases employees' professional capabilities which makes quality programmes successful and achieve cost effectiveness.*

Technology

The internationally increasing demand of the energy by the big giants like China, India as well as domestic consumption have put the pressure on E&P companies to explore and produce the resources with

minimum cost and maximum output. For all this to capture by an E&P company, it must go in line with the technological change and updating of its programmes which are more cost-effective. This day by day technological change in each field companies have to put their business in line with these changes otherwise they may not be able to compete in the market.

Imran (2010) elaborated in a study regarding analysis for the use of Multi Services Unit in the field of E&P business, where it has been explained that "the oil & gas industry is constantly developing methods and technologies which would minimize the operating cost and time. The Multi Services Unit (MSU) is one of the technologies that were developed to optimize oilfield operations by delivering both slick line and cased-hole wire line services in a single unit". The author has also elaborated that the continuous need of E&P business for new techniques and latest technologies which are the always sources for the improvement of operational quality and increases efficiency with time saving and minimizing cost. So it can be said that the survival in high business risk requires the implementation of advance technological programs in E&P companies.

H4: *Technology with advanced features supports the quality programmes in achieving organizational cost effectiveness.*

Cost Efficiency

Cost includes direct and indirect cost of material, labor and factory overheads. The cost of the project will be fixed and variable in each organization. For successful and cost-effective programmes/projects; the time and cost have the significant values for the company which is measured by its efficiency. Boardman (2001) describes that cost is the expended resources for the intervention which are usually in the shape of currency or monetary terms like dollar, pound, yen etc; whereas the measure of effects depends on the intervention which has been considered or selected.

Shahrukh (2011) elaborated that TQM and sustainable development are interdependent. Built in quality is a prerequisite and key factor in today's cut throat competitive business climate. There are many other factors which contribute to cost of quality. For Example an E&P Company procured the chemicals for its drilling operations. There were no specifications of chemicals spelled out like purity etc prior to the tendering. The company bought the chemical from lowest bidder without any test of the sample. The cost of chemical was $300 per ton with 16% purity.

Another bidder quoted for $900 per ton with 95% purity. During the drilling operation, the bought chemical was used 6 times more to get the desired result, which was expected with 95% pure chemical. Thus resulting the cost of chemical as $1800 per ton, which was twice the cost void of a bidder with 95% purity. This was not a cost effective decision and resulted in loss to the company as well.

H5*: Cost efficient/effective (minimum cost with maximum outcome) organizations achieve their strategic goals and stay in business.*

Conceptual Framework

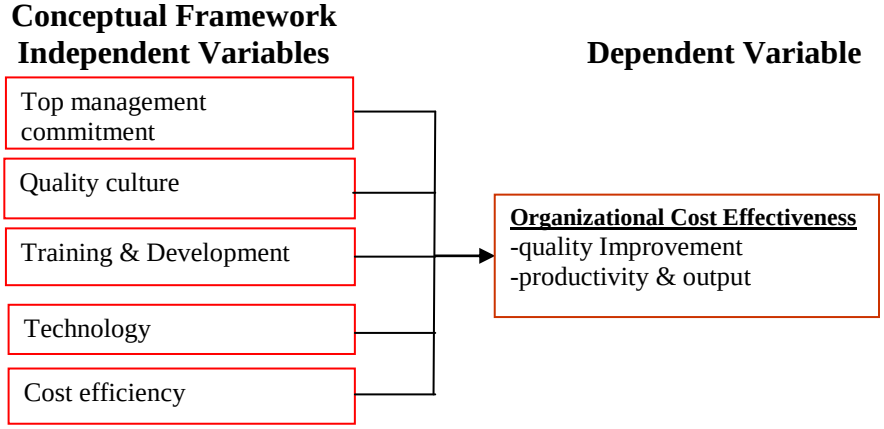

Figure: *1 Proposed Conceptual Framework*

Methodology

Research Design

This is one-industry research design with the aim to determine the high cost and risk associated to the E&P business. Therefore, professionals like Geologists, Geophysicists, Drillers and Engineers were selected for the study. Data was collected to measure their perception and observation concerning cost-effectiveness of the organization having impact of management commitment, quality culture, training & development, technology and cost efficiency in the area of exploration, and drilling activities. A scale was adapted to measure the perception on these variables. In the first phase the problem statement was properly defined and then proposed model of cost effectiveness in E&P business was framed out with the assistance of the previous literature and conducted studies. The dimensions of dependent and independent variables were defined and operationalized to achieve the objective of measurement and purpose of the study. Similarly the relationships among the variables were also examined and hypotheses were defined so that proposed model can be supported. To analyze the demographic aspect, personal information gathered through

instrument was also processed alongwith other data in SPSS tool which resulted and the details are given in the next section. As the nature of study is causal and requires determining the influential components of cost effectiveness which was carried by applying the regression analysis.

Population and Sample

In order to build and test the hypothesis, the chosen environment is the exploration and production companies working in Pakistan. The population of the study includes professionals (geologists/ geophysicists/ drillers/ Engineers) working in these exploration and production companies i.e. OGDCL, PPL, POL, MPCL, OMV and MOL. Estimated population consisting of professionals was about 300 in the selected exploration & production companies and by calculating through Slovene's formula the required sample size comes to 171.

Sample Characteristics

The analysis was carried out to know the biographical characteristics of 183 respondents who were the professionals of E&P Companies. Most of the respondents are master degree holders so the level of education with post graduates qualification employees are 103 with highest response of 56% of the total while 19% are BE/BSC(Engg). Post qualification experience professional is a valuable asset for the company in E&P business. In the study respondents were arranged into seven groups with reference to the work experience and frequency distribution reflects that 35% of total respondents have 06 to 10 years of experience and 30% respondents were having 0-5 years of experience. Rests of the respondents have more than 10 years experience in this field.

Scale used in the study with reliability analysis

The independent variable 'top management commitment' has the influence of authors like Schein (1991), Wilkinson *et al.,* (1996), Redman et al., (1996), Wash et al., (2002), M.Pelikan (2006), Nadeem (2006). Quality Culture' was adapted from the instrument developed by Akhtar (2010), while other variables have the influence of authors like Scheuermann *et al*., (1997), Kailash (2003), Rana (2006), Deepak (2006), Zia (2006), Mohannad (2009). Questionnaire was based on Likert Scale of 5-point with Strongly agree=5, Moderately agree=4, Neither agree/Nor disagree =3, Moderately disagree =2, Strongly disagree = 1

Table 1: *Constructs/Scales - Internal Reliability*

Reliability	Cronbach's alpha	items
Top Management Commitment	0.789	3
Quality Culture	0.774	8
Training & Development	0.775	4
Technology	0.781	4
Efficiency & Economy	0.697	4
Quality Improvement	0.701	4
Productivity & Output	0.823	5

Results and Discussion

Before conducting the regression analysis the multicollinearity tests were run and the result values of the variables were in the acceptable range and there were no multicollinearity found and data was normal for Correlation and Regression analysis.

Correlation analysis

Table 2: *Correlation analysis*

Variables	1	2	3	4	5
1. Management Commitment	1				
2. Training & Development	.505**	1			
3. Quality Culture	.582**	.559**	1		
4. Technology	.520**	.561**	.453**	1	
5. Cost effectiveness	.514**	.406**	.477**	.543**	1

**. Correlation is significant at the 0.01 level (2-tailed).

The results as indicated the correlation analysis among the different variables under study. The table shows that management commitment is having significant relationship with cost effectiveness (r=.514**), Training & Development (r= .406**), Quality Culture (r=.477**) and technology with cost effectiveness having (r= .543**). All the independent variables are having positive significant relationship with dependent variable and according to the values showing in the correlation table, assuming that no multi-collinearity was found between the variables.

Regression Analysis

Table 3: *Regression analysis*

Predictor	**Cost Effectiveness**		
	B	**R^2**	**ΔR^2**
Step 1			
Mgt Commitment	.422***	.264	.264***
Training & Development	.223***	.165	.165***
Quality Culture	.539***	.227	.227***
Technology	.376***	.295	.295***

*** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$

H1: *Top management commitment is helpful for the success of a quality management programme which ultimately leads to achieve the cost effectiveness.*

Results of the regression analysis shows that Top Management Commitment has strong and positive relationship with Cost effectiveness having Beta value as .422 with significant level of P<= 0.001. According to the results, which are supporting the hypothesis that Top management commitment is helpful for the success of a quality management programme which ultimately leads to achieve the cost effectiveness. Thus the hypothesis is accepted.

H2: *Quality culture supports the quality management programme at strategic level in order to achievement of the cost effectiveness by the organization.*

The table also shows the relationship between Quality Culture and Cost effectiveness. The results shows that β = .539 at 0.001 significance level. This relationship is reported to be significantly related. Thus the hypothesis stated above is accepted.

H3: *Effective training & development increases employees' professional capabilities which makes quality programmes successful and achieve cost effectiveness.*

The above table is showing the relationship between effective training & development and Cost effectiveness and according to the beta value i.e. β = .223 at 0.001 significance level, it is confirmed that the proposed hypothesis is accepted.

H4: *Technology with advanced features supports the quality programmes/projects in achieving organizational cost effectiveness.*

The regression table is showing the positive and significant values for the relationship of technology advancement and cost effectiveness i.e. β = 0.376 at significance level 0.001. So the hypothesis stated as "Technology with advanced features supports the quality programmes in achieving organizational cost effectiveness" has been accepted.

H5*:* *Cost efficient/effective (minimum cost with maximum outcome) organizations achieve their strategic goals and stay in business.*

In the given below table, it can be said that public sector company has high drilling cost per meter when compared with private sector company.

Table 4: *Comparison summary for cost-effectiveness (Cost Efficiency)*

Operator	Public Sector Company		Private Sector Company	
Concession Area	Nosha area comprises of Attock, Mianwali, Kohat, Karak Districts & North Wazirstan Agency in KPK Province		Tapal area comprises of Bannu, Hangu, Kohat, Karak, North Wazirstan, Dara Adam Khel in KPK Province	
Well Name	Nosha-2	Nosha-3	Tapal East-1	Tapal East-2
Spud Date	3-Sep-10	30-Mar-11	30-Aug-10	5-Jul-11
Days Consumed	457	516	296	337
Depth (Meter)	4341	5250	4900	5216
CEA (Cost per meter drilled)= Cost/Output (Depth)	*4,423*	*4,810*	*3,929*	*4,580*

Source: *Annual Report 2011-12 (Block/Well names have been changed due to data confidentiality)*

According to E&P professionals, that in drilling of wells there are many factors which the companies always determine to minimize cost and time but sometimes these factors are un-controllable due to one or the other reason. Formation of the platform, land cultivation ratio, rocks, hills etc are also some factors which lead toward delay in completion of the projects. All these are the assumptions but the work carried professionally with commitment, team work, and advance technology may be the scientific way to control cost and save time.

Conclusion

In the business today, cost is valued as important part of any product which constitutes and provides an opportunity to the organizations to work and have competitive advantage in the market place. The results of study show that theoretically assumed dimensions of the independent variables (top management commitment. quality culture, training & development, and technology) are significantly contributing to achieve the cost-effectiveness (DV). Thus all the developed hypotheses H1 to H5 are significant at $p < 0.001$ and accepted. The Values of adjusted R^2 are characterized with a significant relationship between the independent variables and dependent variable. It reflects that two variables (QC) and (T&D) are very important and the management has to increase the budget provisions for the development of quality culture and training of the employees with latest tools & techniques for achieving the organizational

cost effectiveness by implementing quality projects/programmes in the business.

From the data analysis of independent variable 'cost efficiency' it has been noted that some companies have least cost-effective projects/programmes when compared with other E&P companies working in the same area/region. The study has measured the cost efficiency (monetary values) by applying the CEA in true sense. The overall empirical findings revealed that the study concept exist in the E&P companies working in Pakistan and management can internalize the components of a cost-effective organization by implementing the quality programmes/projects.

Implications for managers at strategic & operational level

The aim of this study was to know the cost effectiveness of quality programmes/projects in E&P Companies and make sure that organizations have achieved the desired objectives in this regard. The main premise was supported and revealed that programmes/projects are positively associated with the cost-effectiveness. Each independent variable is positively correlated with dependent variable having different share of contribution. Upon conducting of detailed analysis it was known that programmes/ projects implemented with support at top management level, technological change and trained workforce leads toward achievement of organizational cost-effectiveness. The quality culture in any organization provides the platform to work in efficient as well as effective manner. Therefore managers should make a financial commitment for evaluation to implement and improving the processes by utilizing "Feigenbaum's cost of quality techniques", "Demings' approach to TQM", Six Sigma and other standards etc.

Training & development (TD) is the dire need of today that employees should be trained on the quality programs/projects to make them cost-effective otherwise these programs will be failed and the companies may lose their business. As per requirement of the PCA (Petroleum Concession Agreement), E&P companies are bound to allocate the budget for training and development of the employees but in some cases it has been noticed that it is not being fully utilized by the companies during the specified period. Therefore, E&P managers should focus on self motivation of the employees with effective training programmes which will lead to the personal growth of the worker and facilitate with optimal measures to link and fully align these personal goals with organizational objectives. All such HRD interventions intended at training activities with a vision to focus on

cost-effective organization with successful quality programs can be more innovative, adaptive and valuable for the achievements of desired objectives and success in high risky business like E&P with satisfaction of all stakeholders.

Recommendations

After revealing the results through analysis, the study recommends that management should encourage the employees for new ideas which will lead towards culture change. The culture is the core component for the implementation of the quality programmes at strategic/operational level for the effectiveness with minimum cost and maximum output. Moreover, technology in the new era has proved to be the change leader in each field by dominating all other factors. Latest tools and technologies are very important in the business of exploration & production which lead to minimize the cost. A well executed cost-effectiveness analysis points up the importance of obtaining realistic estimates of program costs and of valid determinations of program outcomes in the real world. During the study it was observed that managers in exploration & production companies mostly use the tool of CBA (Cost Benefit Analysis) and they rarely use the CEA (Cost Effectiveness Analysis) while investing in the quality programmes/projects. It is strongly recommended for E&P Managers to use the CEA as well to arrive at a better solution.

Future Research Areas

For future directions it is recommended that existing model can be re-defined by adding more predictors to fine tune the research area. This will further strengthen the concept and organizations will be benefited. Moreover, concept of cost effectiveness itself has firm outcomes which can be called the manifestation of a cost effective organization having quality programmes/projects implemented with the objective to minimize the cost and save time. It is therefore, suggested to examine the other outcomes which are not tested / covered in this study either in same industry or otherwise.

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