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An Assessment of Using Capital Budgeting and Risk Management in the Libyan Oil Sector

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الملخص:

ركزت هذه الدراسة على تقويم استخدام الميزانيات الرأسمالية كأحد الأدوات الهامة للتخطيط والرقابة على المشروعات النفطية. واظهرت النتائج أن معظم الشركات التي شملتها الدراسة أي ما نسبته 90% منها لديها سياسة واضحة لتميز بين النفقات الإدارية والرأسمالية، وإن 81% لديها نظم معلومات والعنصر البشري الكفء المطلوب لتوفير البيانات والمعلومات اللازمة للإعداد هذه الميزانيات. كذلك وضحت نتائج الدارسة أن ما نسبته 90% من عينة الدراسة تستخدم طريقة صافي القيمة الحالية و74 % تستخدم طريقة معدل العائد الداخلي و45% منها يستخدم طريقة فترة الاسترداد عند تقويم المشروعات الاستثمارية. أما فيما يتعلق بعنصر المخاطرة فقد بينت النتائج أن الشركات النفطية الليبية تأخذ بعنصر المخاطرة عن طريق تعديل معدل خصم التدفقات النقدية بينما يوجد قصور في استخدام بعض الطرق الأكثر تطورا لتحليل مخاطر المشروعات الاستثمارية مثل تحليل الحساسية والمحاكاة. بالإضافة إلى ذلك توصلت الدراسة إلى وجود علاقة ذات دلالة إحصائية بين استخدام طرق خصم التدفقات النقدية وطرق تحليل المخاطرة وبين درجة تأهيل وخبرة الأشخاص القائمين على إعداد الموازنات الرأسمالية والذي يعد مؤشر هام للإدارة هذا القطاع.

الكلمات المفتاحية: تقنيات الميزانيات الرأسمالية، تحليل المخاطر، صافي القيمة الحالية (NPV) معدل العائد الداخلي (IRR)، فترة الاسترداد (PP)، الشركات النفطية الليبية.

Abstract

This study has the objective of assessing the significance of capital budgeting as a tool for planning and controlling oil projects in Libya. The initial results indicate that as much as **90%** of the surveyed Libyan oil companies have a clear policy to distinguish between current and capital expenditures, and **81%** have sufficient information for capital budgeting. The survey results also indicate that most companies have a proper accounting system with sufficient human capital. As much as **90%** of companies use Net Present Value, **74%** use Internal Rate of Return, and **45%** use Payback Period as criteria for evaluating investment proposals. As for the risk, companies were found to be taking into account the risk factor by applying an adjusted discount rate. However, they lack in using advanced models for risk analysis such as sensitive analysis and simulation which are of value in determining the feasibility of projects and risk analysis. Also, the study demonstrated the existence of a significant relationship between applying quantitative methods like the cash flow discount methods (DCF) and risk analysis tools with persons' qualification level and their experience which is an important indicator that should be given more attention from the administration in this sector.

Keywords: capital budgeting techniques, risk analysis, net present value, internal rate of return, payback period, Libyan oil companies.

1. INTRODUCTION

The relationship between return and risk is one of the most important elements that investors face with securities, managing investment portfolios, and preparing the capital budgeting (Sadorsky, 2001, p 18). The preparation and implementation of investment expenditures involves a sacrifice of certain cash flows at present in order to generate uncertain returns in the future. This is so because of the relatively long time span that elapses between cash outflows and expected economic returns. The capital expenditure decision is characterized by large amounts involved, higher risk, and higher uncertainty (Cooper et al., 1992, p21). For example, this is especially more valid for the oil industry which is a traditional case of uncertainty in the decision-making process; it provides the best environment for the investigation of corporations' behavior towards risk and the effects on their performances (Suslick et al., 2009, p32).

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The process of discovery of oil faces high risk globally, where the proportion of success in getting oil is only 10% and a cost of about 15 million per well (Suslick and Schiozer, 2004, p 4; Larches, 1997). Due to this fact, it is not surprising that oil companies seek to implement the best ways possible to manage financial risk. These characteristics make it necessary to have good planning and control through the implementation of some quantitative techniques for capital budgeting.

Investment decisions greatly affect the present and the prospect of the firm and the welfare of society as a whole. This is why making a good investment decision is important. Proper investment decisions will add to firms' value, especially in developing countries including Libya where most of its income comes from oil. In addition, Libya's territory (90% of which is a desert) has the largest oil reserves in Africa with reserves of 47.1 billion barrels in 2012 and represents 4% of the global crude oil reserves in 2014. This means Libya has one of the largest oil reserves in the world. Consequently, Libya's economy is highly dependent on oil production which accounts for 94 % of government revenues and more than 90% of the

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total exports for the last 37 years (Ali and Harvie, 2013, p 275; Mahmud& Russell, 1998; Oil& Gas, 2014, p 121).

The objective of this paper is to assess the use of capital budgeting in Libya. As an approach, a survey was employed to reveal the use of capital budgeting in Libyan oil companies. This study derives its importance from the following points: **first**ly, this study is a first attempt to assess capital budgeting as a planning and controlling tool in the Libyan oil and gas sector, so it seeks to help to find out the strengths and weaknesses of using capital budgeting in oil companies. **Second**ly, the oil and gas sector is the most important sector that contributes to economic development in Libya, and, this study is expected to contribute to the studies on the oil and gas sector. **Third**ly, due to the decline in oil production because of political events in Libya from **1.6** million barrels per day to **0.35** million per day (**78-%**) and a sharp drop in oil prices (Mohareb& Chmaytelli, 2015), more attention is required to capital budgeting as a planning and control tool for capital expenditures and risk analysis for this important economic sector.

2. LITERATURE REVIEW: EXPERIENCES IN CAPITAL BUDGETING AND RISK MANAGEMENT: -

Due to its importance, capital budgeting has been examined by many empirical studies where surveys and descriptive statistics were used such as Klammer (1973); Cozzolino (1977); Schall et al. (1978); Hertz (1979); Eck (1979); Pike (1980); Wehrung (1989); Peltz (1992); Walls et al. (1995); Graham and Harvey (2001). These studies focused on the assessment of capital budget as a planning and controlling tool for capital expenditures and risk analysis in the USA, UK, Canada, and other countries. For instance, the empirical study by Brounen (2004) on 313 companies in the UK, Netherlands, France and Germany, reported a remarkable approval of the payback period (PB) method by European companies, as high as 69.2%, 64.7%, 50% and 50.9% of the respondents in UK, Netherlands, Germany and France respectively. The same study also indicates that the PB method was found to have greater popularity among private companies than public companies. Due to the risk of investment spending, administrations would prefer to retrieve investment costs as soon as possible.

In another study, questionnaires were sent to organizations to see whether they used sophisticated capital budgeting practices or not in order to determine the impact of uncertainty about the extent of development capital budgeting practices (Verbeeten, 2006). The response rate was almost 26.9%. The same study found that companies used many tools and procedures (such as Monte Carlo simulation, decision-tree analysis, etc.) at the same time to assess investment projects' risk. This is in line with the strategy of using many tools to focus the decision maker's attention on different important parts of the investment decision. Moreover, the study suggested that a high level of experience in the capital budget provides the ability and willingness to adopt new capital budgeting applications.

Meier and Tarhan (2007) preliminary results from surveys are as follows: (i) during the last period companies show an increased willingness to use the methods of discounted cash flow, and (ii) companies often use the weighted average cost of capital (WACC) as the discount rate to assess their investment projects. By comparing with previous surveys, they found evidence that there is increasing use of these methods over time. These results also suggest that there is an increasing complexity of capital budget methods due to the conditions of risk and uncertainty.

In another study by Lam et al. (2007), a questionnaire was sent to a sample of 157 with a response rate of 31%, finds that for investment project risk analysis, several methods have been used, including shortening the payback period (80.4%), raising the required rate of return (78.3%), sensitivity analysis (69.6%) and (58.7%) simulations model and others. This emphasizes the importance of using several tools to analyze risk when preparing the capital budget.

Bennouna et al. (2010) sent a questionnaire to the 88 largest Canadian companies in order to understand the current methods applied to assess the capital budget. They found that most of the Canadian firms use risk analysis methods with the main ones being sensitivity analysis 92.8 % scenario analysis 85.3 % and risk-adjusted discount rate 76.8 %. This study shows a considerable increase in using sensitivity analysis and risk-adjusted discount rate as important tools for risk analysis.

In the survey of 290 companies from Latin America by Maquieira et al. in 2012, it was found that these companies are similar to the United States companies. Both of them used the NPV, the IRR, the PB and the profitability index (PI) as criteria for evaluating investments. For small and medium businesses, the use of these tools is commensurate with the stability of the markets and specific investment opportunities. Also, according to the study's sample, these companies prefer to use sensitivity analysis and simulation for investment risk analysis.

In addition to this, capital budgeting and risk analysis in the oil industry also received early attention from institutions such as the U.S. Geological Survey, Institut Français du Pétrole, etc. Their goal was to provide a strategy that limits exposure to risk and uncertainty in exploration and prospecting processes in oil projects (Suslick and Schiozer, 2004, p 6). In a study in 2001 entitled "Assessment of Potential Oil and Gas Exploration Investments: Management Perspective", questionnaires were sent to 221 decision-makers in 864 oil companies in the United States. The survey results indicate that several ways such as the NPV, IRR, (NPV/investment cost) ratio, and variance of NPV are used. Also, sensitivity analysis, adjustment discount rate, and decision tree analysis are the most commonly used methods for risk assessment in this industry (Razak, 2001,p 30).

Emhjellen et al., (2002) in their article "Investment Cost Estimates and Investment Decisions", explained how to use the simulation method to prove misusing the likelihood ratio of 50/50 (average) for capital expenditures for evaluating investment oil projects, when the probability distributions of costs are non-identical to avoid errors in the evaluation of investment oil projects which lead to wrong decisions by accepting negative NPVs projects.

French and Gabriele (2005) explained that the most important problem facing the administration for the development of oil projects is including risk and uncertainty in decision-making. They suggested two ways. The first is by modifying a discount rate of cash flows or increasing it. This implies that unconfirmed future cash flows will be less than their value. As a result, the NPV for the project will decrease and thus will increase the required quality and profitability for a project to be acceptable. The second is by modifying future fluctuating cash flows, identifying statistical trends for these variables and then calculating an expected NPV of the project.

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Asrilhant et al. (2006), conducted a survey study about using analytical tools for strategic project management of the oil and gas sector in the UK. The survey results of Asrilhant et al. (2006) indicate that the administration of this sector uses several tools to assess risks of exploration and development projects including sensitivity analysis, simulation models and decision-tree analysis in the UK. The survey study finds that companies are familiar with using the NPV, IRR, and PB.

Brealey et al., (2006) criticized sensitive analysis since it does not take into account the correlation between different variables. For example, an increase in the sale price of oil may lead to an increase in activities of the project and consequently increase operating costs. For this reason, a decision maker must calculate and find out a correlation coefficient between these future variables which is the most difficult part of project evaluation. They suggested another way which is Monte Carlo simulation which is a sophisticated and formal method to evaluate investment alternatives and the basis for decision-making in oil and gas companies.

We conclude from the previous studies that advanced capital budgeting practices are more valuable in cases of high uncertainty as in the case of the oil industry. In this context, several authors suggested that diverse methods and tools of capital budgeting can complement each other and provide additional information about solving evaluation problems of investment projects that are under examination (Verbeeten, 2006, p112). This requires using more risk analysis tools whereas most of the previous studies emphasize the importance of planning investment expenditure using quantitative methods that take risk.

3. DATA & METHODOLOGY: -

3.1. Data: -

In this study, **a survey approach**, which is used in most of the published empirical research, was adopted in order to collect primary data to make an assessment for capital budgeting and risk management in the Libyan oil sector. Before the field survey, a pilot study was done where questionnaires were distributed to different Libyan oil companies for testing and improvement. Questionnaires which consist of two types of questions (closed and open-closed) were designed for compatibility with the study purposes and search hypotheses. They focused on demographic characteristics, capital budget and risk analysis techniques. To achieve this goal, we developed **51** questions in two languages (English & Arabic) as follows:

The study's population consisted of all Libyan oil companies that are owned by the Libyan National Oil Company (NOC). They are 11 companies . The sample covers all these companies. The Libyan oil sector companies have been chosen as a sample of the study because of their importance to the national economy of Libya. Moreover, the magnitude of the capital invested in the oil sector is high and with high risk relative to other Libyan sectors. The 40 questionnaires were distributed to staff at all Libyan oil companies who have knowledge about capital budgeting and risk analysis techniques, and 31 have been retrieved. This implies a response rate of **77.5%** which is a satisfactory proportion for research purposes.

Table (1): Questionnaire:

No.	Classification	No. of questions
1	General information about participants in the study	4
2	General information about companies in the study	3
3	Information about the capital budgeting system	34
4	Information about methods of risk analysis	10
	Total	**51**

Table (2): Population & Sample:

Classification	No.
Number of population companies	11
Number of sample companies	11
Number of distributed questionnaires for testing & improvement (a pilot study)	6
Number of distributed questionnaires	40
Number of returned questionnaires	31
Response rate	**77.50%**

3.2. Hypotheses of the study: - The objective of the study is to make an assessment of the use of capital budgeting and risk analysis in Libyan oil companies by testing the following main hypotheses:

H01. *"Libyan oil companies have elements of preparation and using of capital budgets as a tool for planning and control of investment expenditure"*

H02. *"Libyan oil companies take into account risk elements by using some quantitative methods and models of risk analysis"*

H03. *"There is no difference in the application of quantitative methods (the DCF and risk analysis) in terms of scientific habilitation"*

H04. *"There is no difference in the application of quantitative methods (the DCF and risk analysis) in terms of experience"*

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To test the previous four main hypotheses, the study derives eleven further sub-hypotheses as follows:

H01.*"Libyan oil companies have a clear policy to distinguish between current and capital expenditures."*

H02 *"Information systems provide clear, timely and reliable data and information that are necessary to prepare capital budgets."*

H03. *"Libyan oil companies have qualified human elements needed to apply methods and models of quantitative risk analysis"*

H04.*"Libyan oil companies have an interest in the application and development of capital budgeting system through an incentives system to encourage preparers and users."*

H05.*"Libyan oil companies have necessary computer systems for application of some risk analysis models, and there is no difficulty to benefit from their outputs"*

H06.*"Libyan oil companies used risk analysis methods when capital budget is prepared."*

H07.*"Libyan oil companies used risk analysis models when capital budget is prepared."*

H08*. "There is no difference in the application of the DCF in terms of scientific habilitation"*

H09*. "There is no difference in the application of the risk analysis methods in terms of scientific habilitation"*

H10. *"There is no difference in the application of the DCF in terms of experience"*

H11. *"There is no difference in the application of the risk analysis methods in terms of experience"*

3.3. Statistical Method & Data Analysis: -

In this aspect, descriptive statistics have been used in collecting, organizing and presenting data obtained from the questionnaire. In addition, statistical inference also has been used to test hypotheses at different significant levels **(.01, .05, and .10**) as shown below:

Part I: - This part is devoted to descriptive statistics through the presentation of tables, graphs and calculations of statistical measures and ratios which describe the characteristics of the study sample as follows: -

Table (3) the characteristics of participants and oil companies under study

	Frequency	**Percentage**
(1) Academic qualification:		
Bachelor's	16	51
Master	8	26
Ph.D.	3	10
Others	4	13
Total	**31**	**100**
(2) Specialization:		
Accounting	15	48
Business Administration	10	32
Economy	4	13
Finance	2	7
Others	_	_
Total	**31**	**100**
(3) Occupation:		
Chairman of the Board of Directors	--	---
Financial Manager	9	29
Head of the Budgets Department	10	32
Head of the Accounting Department	8	26
Others	4	13
Total	**31**	**100**
(4) The type of activity of the company:		
Exploration & Production	21	68
Marketing & Sales	3	10
Service	7	22
Total	**31**	**100**

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Survey results show that 51% of participants have bachelor's, 26% master's and 10% PhDs. This implies that 87% of all have a degree and above qualification. It is also interesting to see that the specialization of most of the qualified personnel is accounting. Given the fact that capital budgeting requires more finance, this finding can be evaluated as a deficiency. Occupation with distribution is close to even among financial managers (29%), heads of budgets department (32%), and heads of accounting departments (26%). Moreover, we can note that most of the study's population at (68%) is exploration. This reflects the production nature of oil companies under study where they are searching for a natural resource that is depleted at any time. This naturally requires more research and drilling oil wells to compensate for extracted quantities from this resource and a consequent increase in investment spending in this sector from the rest of other economic sectors.

Table (4) Other measures of central tendency & dispersion:

	Mean	Median	Mode	Standard deviation
(5)- Experiences:	13.84	9.91	19.33	9.29
(6) Age of the Company:	28.68	22.11	17.304	5.943
(7) Proportion of fixed assets to total assets:	76.58%	85.52%	84.333%	20.16%

We can note that most of the participants' experience exceeds 13 years. These results show that the majority of respondents have the necessary qualifications and experience to answer the questionnaire. This is a good indicator to understand the problem of the study, which boosts confidence in answers. Also, the average age of Libyan oil companies is more than 25 years which is in line with the results of the study by Thuyet et al. (2007) on oil companies in Vietnam. As a result of the longevity of economic unity in action, it is necessary that they were and are still assessing the large investment projects by systems that provided the necessary information to enable them to plan and control these projects. Add to that, their proportion of fixed assets to total assets is more than 75% which indicates high investment in fixed assets, so they are characterized by their needs for large funds. As a result, due to the nature of the oil industry which includes increasing risk, risk factors must be taken into account when preparing capital budgets in this sector.

Capital budgeting used by the Libyan oil companies and risk analysis: -

Analysis of collected preliminary data by descriptive statistics that describe properties of capital budgeting system in the target oil companies by the study is displayed in table and charts as follows: -

Table (5) fundamentals of implementing capital budgets

Classification		Percentage
1. Capital budgeting system: -		
	-The administration applies a capital budgeting system	**100**
	-Investment alternatives are identified before preparing capital budgeting	**100**
	-Company has more than three capital budgets	**52**
	-Fixed productive assets are replaced every 15 years	**84**
	-Evaluation methods are changed in the previous period	**16**
	-There is a relationship between the size of investment and the evaluation methods	**74**
	-Size of annual capital budgeting is more than 15$ million	**68**
	-The administration monitors the actual implementation and analysis deviation	**87**
	-Weighted average cost of capital is used to calculate the discount rate	**90**
	-Capital budgets are prepared by Budget Departments	**74**

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2. information system: -		
	-The available data and information are easy and clear to understand	**71**
	-The available data and information are reliable	**68**
	-Necessary data and information for preparing the capital budget are in a timely manner	**65**
	-The current systems provide sufficient data and information for predicting investment and operating costs	**81**
	-The current systems provide sufficient data and information for predicting a project's economic life	**90**
	-Sufficient data and information for using quantitative methods such as time series analysis are available	**52**
3. Management attention for capital budgeting: -		
	-There is a clear policy to distinguish between current expenditure and investment expenditure	**100**
	-The administrations are interested in applying quantitative methods	**77**
	-The administrations use computer outputs for decision-making	**68**
	-The administrations have an incentives system to develop capital budgeting	**77**
	-Quantitative methods such as time series analysis is used to predict future revenues	**52**
	-They make a feasibility study based on new data from previous data	**65**
4. Qualified human resource:		
	-They have universities qualifications	**94**
	-Their experience is more than ten years	**68**
	-They have training courses in the field of capital budgeting & risk analysis	**74**
	-Training courses are sufficient	**83**
	-They use quantitative methods to develop capital budgeting	**65**

From viewing and analyzing the previous data, it is clear to us that most of the Libyan oil companies under study used a capital budgeting system as a tool for planning and control of capital expenditure through the presence of scientifically and practically qualified persons, existence of information system that provides necessary data and information, management attention to apply and develop this system by having a specialized department for preparation, sufficient training courses and incentives system. Additionally, we observe the magnitude of investment spending in this important sector as a result of that and the need for good planning in this industry.

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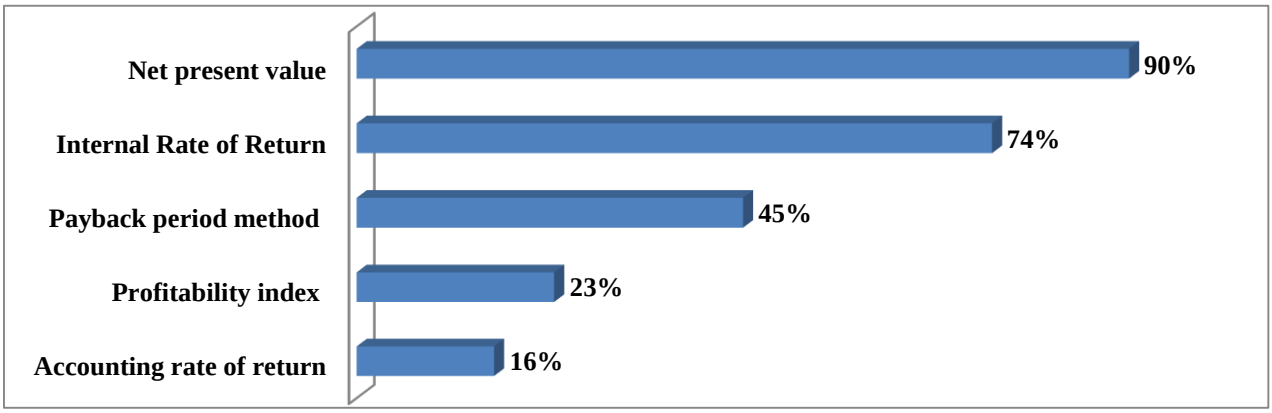


Figure.1. illustrates the used investment appraisal methods.

These companies focus more on cash flow discount methods (DCF) than other traditional methods, where **90%** of these companies used the NPV, **74%** of them used the IRR, and **45%** used the PB to evaluate investment proposals. This is a good indicator because of using more than one way jointly at the same time in order to benefit from these methods' advantages.

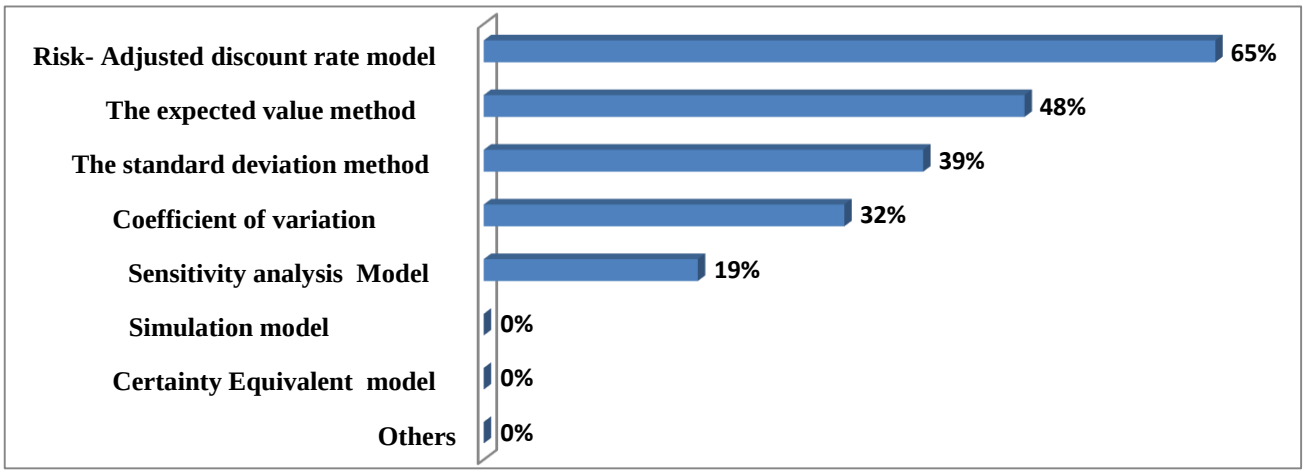


Figure.2. illustrates the used risk analysis methods.

As for the risk, companies are found to be taking into account the risk factor by applying some methods like adjusted discount rate (65%), the expected value (48%) and coefficient of variation (32%). However, the study finds that they lack in using advanced models for risk analysis such as sensitive analysis and simulation which are important in this field. This is consistent with the results of some previous studies like Schall et al. (1978), Boyle and Schenk (1985), Cooper et al. (1992), Doughert and Sarker (1993), Graham et al. (2001), Elumilade et al. (2006) and Brunzell et al. (2013) which concluded that companies focus more on discount of future cash flows methods and adjusted a discount rate by the risk premium.

Part II: -

This section is devoted to testing hypotheses using inferential statistics. Consider a binomial random variable x, where n is the number of trials performed and p is the probability of success on each trial. The population of all sample proportions approximately has a normal distribution if the sample size (n) is large, and n is large if both np and $n(1-p) \geq 5$, then x is approximately normally distributed with mean $\mu = np$ and standard deviation $\sigma = \sqrt{}$ npq where $q=(1-p)$. Also, according to the Central Limit Theorem, the sample is large if its size is at least **30**, and the sampling distribution will be normal distribution (Bowerman et al., 2014; McClava et al., 1998). The first seven sub- hypotheses which are related to the two first main hypotheses and a statistical test can be formulated mathematically as follows:

1. *H0: P = 0.70*
2. *H1: P < 0.70*
3. *Statistical test:* $Z = \frac{\hat{P}-P}{\sqrt{P(1-P)/n}} \sim \quad Z\,\alpha$

The proportion of **70%** is good to accept a null hypothesis from the perspective of the researcher because it represents more than two-thirds of the study sample ratios. It can display and summarize statistical hypotheses testing in the following table: -

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Table (6) statistical tests

NO. sub-hypothesis	The calculated value of Z	C. V. of Z (α =.01) *	C. V. of Z (α =.05) *	C. V. of Z (α =.10) *	Statistical Decision
1	3.6450	-2.33	-1.645	-1.28	Fails to reject the null hypothesis
2	-0.6075	-2.33	-1.645	- 1.28	Fails to reject the null hypothesis
3	0.4860	-2.33	-1.645	-1.28	Fails to reject the null hypothesis
4	0.8504	-2.33	-1.645	-1.28	Fails to reject the null hypothesis
5	-0.2429	-2.33	-1.645	-1.28	Fails to reject the null hypothesis
6	-0.2429	-2.33	-1.645	-1.28	Fails to reject the null hypothesis
7	-6.1960**	-2.33			Reject the null hypothesis

***Critical Value of Z test, ** significant at (α =.01)**

Through the previous hypotheses test, we can accept the first main hypothesis. As for the second hypothesis, it has been accepted. The sixth hypothesis related to the use of risk methods as the adjusted discounted rate of future cash flows, and rejected the seventh hypothesis related to the use of risk analysis models. These describe the concentration of Libyan oil companies under study in some styles more than advanced models such as simulation and others.

As for the last four sub-hypotheses which are related to the third and fourth main hypotheses, they can be formulated mathematically as follows: -

1. ***H0: P1 = P2***
2. ***H1: P1 > P2***
3. ***Statistical test:*** $Z = \frac{P1-P2}{\sqrt{Pq\left(\frac{1}{N1}+\frac{1}{N2}\right)}} \sim \quad Z\,\alpha$

Where:

P1: is a ratio of application of quantitative methods for persons who are qualified or have more experience.

P2: is a ratio of the application of quantitative methods for persons who are less qualified or have less experience.

It can display and summarize data analysis and statistical hypotheses testing in the following two tables:-

Table (7) effect of scientific and practical training on capital budgets

	Freq.	Freq. of use the DCF*	% of use the DCF	Freq. of use R.A. tools**	% of use R.A tools
Academic qualification: -					
High qualified ***	11	10	91%	9	82%
Low & medium qualified****	20	13	65%	11	55%
Total	31	23	74%	20	65%
Experience: -					
> = 10 years	14	12	86%	12	86%
< 10 years	17	11	65%	8	47%
Total	**31**	**23**	**74%**	**20**	**65%**

(NPV, IRR) **(Risk analysis methods) *** (PhD. & Master) * (Bachelor's & high diploma)**

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Table (8) statistical tests

NO. sub-hypothesis	The calculated value of Z	C. V. of Z (α =.01)*	C. V. of Z (α =.05)*	C. V. of Z (α =.1)*	Statistical Decision
8	1.672**	2.33	1.645		Reject the null hypothesis
9	1.55***	2.33	1.645	1.28	Reject the null hypothesis
10	1.353***	2.33	1.645	1.28	Reject the null hypothesis
11	2.29**	2.33	1.645		Reject the null hypothesis

***Critical Value of Z test, **significant at (α =.05), *** significant at (α =.10)**

Through the previous hypotheses test, they are rejected at different significant levels (**α =.05** and **.10)** which means there is a significant relationship between applying quantitative methods like the DCF and risk analysis tools with the relevant persons' qualification level and their experience in Libyan oil companies.

4. THE STUDY RESULTS: -

It can be concluded from the previous analysis that all the surveyed Libyan oil companies have a clear policy to distinguish between current and capital expenditures. Also, most of them used capital budgets as a planning and control tool for capital expenditures, and they analyzed actual deviations from the capital budgeting numbers. Add to that, their information systems provided required data and information for the capital budget preparation, and this data is characterized by clarity, reliability and timeliness. Most Libyan oil companies have a human element who is qualified academically and practically to apply the capital budget system and quantitative methods to analyze risks. Moreover, they have an incentive system to engage people who prepare capital budgets, which reflects management's attention to the application and development of the budget system by using appropriate quantity methods.

In addition, all of them have necessary computer systems for the application of some models of risk analysis such as simulation models, and companies' management did not face any difficulties in taking advantage of computer systems outputs. These companies focus more on cash flow discount methods (DCF) than other traditional methods, where **90%** of these companies used the NPV, **74%** of them used the IRR, and **45%** used the PB to evaluate investment proposals. This is a good indicator because of using more than one way jointly at the same time in order to benefit from these methods' advantages. Also, more than half of these companies have more than three capital budgets that are more than fifteen million dollars this reflects the nature of the oil industry that requires more research on decreasing natural resources by further research and exploration processes and more huge investment costs.

In addition to that, the Libyan oil companies take into account risk elements when they prepared their capital budgeting by applying some methods such as adjusted discounted rate of future cash flows. Most of them do not use some advanced models for risk analysis such as the simulation model, which is one of the most important methods. Moreover, it became clear to us that there is a significant relationship between applying quantitative methods like the DCF and risk analysis tools with the relevant persons' qualification level and their experience in Libyan oil companies.

We also find that they are consistent with the results of other previous studies which focused on evaluating capital budgeting in the Arabic and African countries that almost have similar economic circumstances to Libya; for example, the study by EL- Sady et al. (2011) on **167** listed companies in the Kuwait Stock Exchange (KSE) and **344** non-listed companies from different industries, the Mavoyi and Poll study (2012) which dealt with **20** mining companies from the Johannesburg Securities Exchange (JSE) in South Africa as a sample and the Kofi and Doku study (2013) which covered eight companies from various economy sectors that are registered in the Ghana Stock Exchange (GSE). All previous studies used questionnaires as a means to assemble primary data from targeted companies. Descriptive statistics were also used to analyze and describe collected data through ratios, tables and charts. They found that most companies focus on discount cash flows methods (NPV, IRR) and the PB respectively to evaluate investment alternatives.

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