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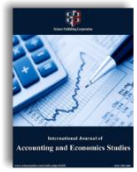

Cost-Benefit Analysis Using Quantum Computing in The Cultural Sector: An Applied Research in Iraq National Library and Archives

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Abstract

Importance is highlighted through an analysis of costs and benefits resulting from the use of quantum computing in the Culture Sector, as quantum computing provides quick solutions for archiving (books, documents, theses- university dissertations- some rare, valuable- historical books....etc.)which are needed by all scholars, researchers, or authors, in all scientific and practical specializations.
The Problem It is summarized in an increase in the number of (books - research - studies - publications - valuable books - articles - periodicals... etc.,) which leads to more devices, storage capacities, devices, computers... etc., which means an increase in costs in various aspects and in turn works to increase the burden. On cultural institutions, in addition to a lack of systems that highlight analyses and cost benefits
Aim : Providing a tool to analyze costs and benefits of using quantum computing in the cultural sector, which leads to oversight and control of costs
Hypothesis: Use of quantum computing works to achieve and analyze benefits and returns resulting from rationalizing costs.
Results Cost-benefit analysis per unit under Quantum computing represent (1,251: 1,251) respectively for actual and standard, its mean cost-benefit is (68%:56%) respectively for actual and standard.

Keywords: *Costs-Benefits Analysis; Quantum Computing; Culture Sector; Iraq National Library and Archives (NL&A).*

1. Introduction

The cultural sector includes a wide range of activities and industries that are related to arts and culture. This sector includes many fields such as literature, plastic arts, cinema, music, design, theatre, traditional crafts, cultural heritage, and others and Culture is the body of knowledge acquired over time. In this sense, multiculturalism values peaceful coexistence and mutual respect creates acceptance between different cultures inhabiting the same planet. Sometimes, the word "culture" is also used to describe specific practices within a subgroup of society, a subculture, or a counterculture. Culture is considered one of the important and necessary sectors for the growth and progress of nations, and it is the basic tool for building and developing societies. The Culture and Educational and academic institutions work to manage and develop digital platforms through modern technologies and quick solutions to archive (books, dissertations, scientific and academic research) for university students, researchers, and authors in all specializations at low costs commensurate with the services provided by these institutions. (Akindehinde, A.O., Folajimi, A., & Olutokunbo, A.O., 2022) Because cost accounting is constantly evolving to keep pace with all sciences, it requires an analysis of the costs and benefits of using some of the modern and completely new tools that are used in the education sector, which is quantum computing as one of the methods used for the education industry in Iraq; Cost accounting, through cost management tools, analyses the cost and benefit provided by educational institutions, and for the continuation and survival of any institution or facility, it must develop digital platforms through the use of computing technologies, which is any goal-oriented activity that requires computers, or benefit from them, Or manufactured, for example; Design, develop and build hardware and software systems; Processing, structuring and managing different types of information; Make computer systems behave intelligently; Creating and using means of communication and others. (Asadi, 2021) Here, the questions arise as follows:

- How do we analyse the costs of quantum computing?
- How can we know the benefits of using quantum computing?

2. Literature Review

2.1. Cost-Benefit Analysis (CBA)

Cost-benefit analysis is considered one of the most important accounting methods used and is very useful when evaluating projects or when evaluating any stage of the project, including the stage of conducting studies. (Muhammad, 2022) There is no doubt that every activity has a cost and results in a return. There is no cost without a return, and there is no return without a cost. The two are two sides of the same coin. The method of cost-benefit analysis is not new. This method appeared in practical application writings from about 1844, when the Frenchman Jules René used it in studying bridge and road projects in France. At the beginning of the twentieth century, the Englishman Pigou wrote about it, dealing with the costs of social returns, so it was a new development in the method, and in the 1930s, since this century, it has been practically used in the United States of America to justify government spending at this time, when the well-known economic setback was widespread. (Koopmans & Niek Mouter, 2020). The application of the cost-benefit analysis method began to spread after the end of World War II, and it was used in the design of armament systems in America and then in projects of the American Ministry of Defence. Starting in 1961, and after that, its use expanded in the fields of special services such as health and education, and this method continues to develop scientifically and spread in application until now. One of the most important signs of this is its increasing reliance on quantitative methods and computer technology. One of the most famous studies in which this method was used was the study on the Victoria Railway line in London in the 1960s of this century. Cost-benefit analysis is defined as a systematic approach to estimating the expected impact of a policy and is an analytical tool used to estimate the costs and returns of a policy in monetary terms. (El-Zeini, Khattab, al-Maliki, & Gohar, 2018). Cost-benefit analysis (CBA) is also considered one of the important guidelines that help administrative accountants achieve the highest value when solving problems or recording, as managers are constantly faced with decisions to allocate and distribute resources, such as purchasing new ready-made programs or hiring a new employee, and the cost-benefit approach must be used when making these decisions. Resources must be used if it is expected to achieve the company's objectives in a better way, considering the expected costs of those resources; the expected benefits from spending must exceed the expected costs. It may not be easy to determine the expected benefits and costs quantitatively. However, this approach is considered useful for making resource allocation and distribution decisions. (Alnoor Bhimani, Charles T. Horngren, Srikant M. Datar, & Madhav V. Rajan, 2023).and A (CBA) is a systematic process of (measuring- quantifying- comparing) expected societal benefits - total costs of a project (Brian Annis, 2023).

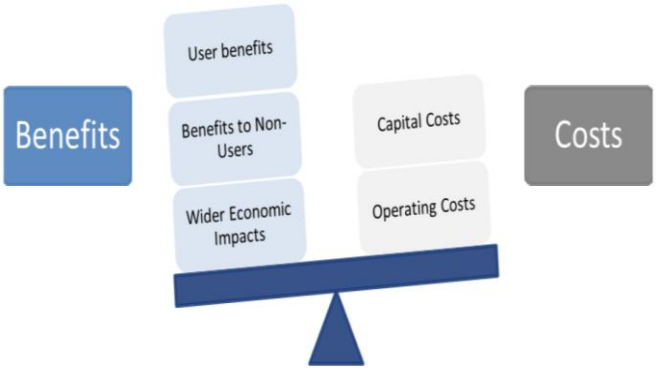

Fig.1: Illustrations Cost-Benefit Analysis (CBA).

Source: (Brian Annis, 2023).

2.2. Quantum computing (QC)

Quantum Computers appear to have a major impact on the world of business. Algorithms have evolved since (QC) was proposed in the 1980s. The most famous quantum algorithms are Shor's integer factorization algorithm and Grover's database search algorithm. Quantum algorithms have significantly outperformed classical computer algorithms and can be used to break encryption systems, for example, ECC, AES, and RSA. This is used globally on the Internet. Quantum computing has advanced to a high level of Interest in the software community: What is meant here are the problems that... It is difficult to solve compared to classical methods (software and Devices). Quantum computers are used for commercial purposes, Such as (IBM Q System One), and to access the volume, vendors such as (IBM, Amazon, or Microsoft Rigetti) provide via the cloud. There are some quantum features, including entanglement, that are supported by implementing quantum algorithms using the quantum software package. (Frank Leymann, Johanna Barzen, & Michael Falkenthal, 2020). Quantum cloud computing is several service that users can access. It is used to solve complex problems that require powerful computing. Quantum cloud computing provides different services in terms of structure and performance in a different way, even if we conduct a test to evaluate the performance of cloud quantum computing services and make a comparison between them. Using two different methods, like visual programming and Qiskit. We will see that the number of qubits per backend and the snapshots per run will greatly affect the execution time. Quantum computing is faster based on the specifications provided by quantum computers.

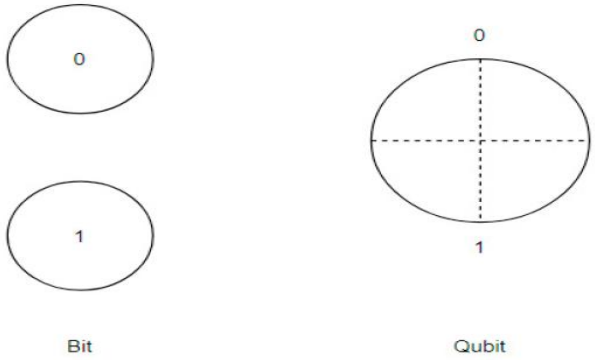

Fig. 2: Illustrates a Bit and a Qubit.

Source: (Haryono Soeparnoa & Anzaludin Samsinga Perbangsab, 2021)

2.3. Classical Computing Systems and Quantum Computing Systems

Traditional archiving systems are the administrative and technical systems that institutions use to preserve original documents in their physical form, organizing them chronologically or thematically. They are as follows: (Rama Rao, Krishnaiah, & Srinivas, 2025).

- Manual Indexing: is the process of manually recording metadata for each document within a traditional database.
- Traditional Databases: are systems that rely on tables and relationships to store document data.
- Document Management Systems: Software for managing the preservation, search, and availability of digital documents, often limited to linear search capabilities.
- Traditional backup: Copying data to external drives or local servers without a cloud infrastructure or intelligent retrieval.
- Traditional Security Systems: Rely on passwords and manual access rights, without advanced encryption or digital key management.
- Scanning: Using imaging devices to convert paper documents into high-resolution digital images (SHAFIQUE & ARSLAN MUNIR, 2024).

Quantum computing could radically change how data is managed and archived, especially in systems that deal with very large amounts of information (such as national digital archives or archiving medical and scientific data). A comparison between traditional systems and quantum systems in terms of their impact on archiving processes, in particular (Martin, 2024). As for digitization, it is the process of converting physical content (paper or analog)—such as documents, books, images, audio recordings, or films—into a digital format that can be stored, processed, and retrieved using computer systems. (Ahmad, Altamimi, & Aqib, 2024). It is also the technical process by which information or documents are converted from their original form (paper, photographic, or audio) into a digital format using computing devices and technologies, to facilitate their electronic preservation, management, and retrieval within digital archiving systems. The following table provides a comprehensive comparison between traditional computing and quantum computing in archiving processes. (Rallis, et al., 2025).

Table 1: A Comprehensive Comparison between Traditional Computing and Quantum Computing in Archiving Processes

Field	Traditional Computing	Quantum Computing
Basic Unit Type	Bit = 0 or 1	Qubit = 0 and 1 simultaneously (quantum superposition)
Processing Mechanism	Linear and sequential	Parallel thanks to quantum superposition and entanglement
Data Storage	Disk-based and array-based, high capacity, but limited Data compression	More efficient compression via quantum algorithms that study patterns in a vast probabilistic space
Indexing	Traditional indexing using B-trees or hash tables	Intelligent indexing based on quantum relationships and fast probabilistic searching
Search and Retrieval	Linear or binary search algorithms, the cost increases with data size	Quantum Grover algorithm enables radically faster searching (√N instead of N)
Security and Encryption	Relies on RSA/AES, potentially breakable in the future by quantum computing	Completely secure quantum encryption using Quantum Key Distribution (QKD)
Data Integrity	Relies on traditional hashing and cyclic validation	Non-reproducible quantum measurements ensure instant tamper detection
Post-Archiving Analysis	Linear processing and traditional statistics, time-limited	Parallel quantum analysis of big data with high speed and accuracy
Learning from Archived Data	Relies on classical neural networks	Quantum ML allows for faster and deeper handling of complex patterns
Energy Efficiency	High power consumption with scaling of storage and processing	Lower processing time thanks to faster computation speed, but current quantum devices require high cooling
Operating Costs	Low cost and commercially available	It is still expensive to operate, but it significantly reduces computation time, thus lowering overall energy consumption in the future.
Readiness for Implementation	Ready for widespread use	Still in the experimental stage (Early Adoption)
Stability and Reliability	Very high and proven	Requires precise environmental control (temperature, vibrations, radiation)

Source: Prepared by researchers based on some literature.

The following figure provides a comprehensive comparison between traditional computing and quantum computing.

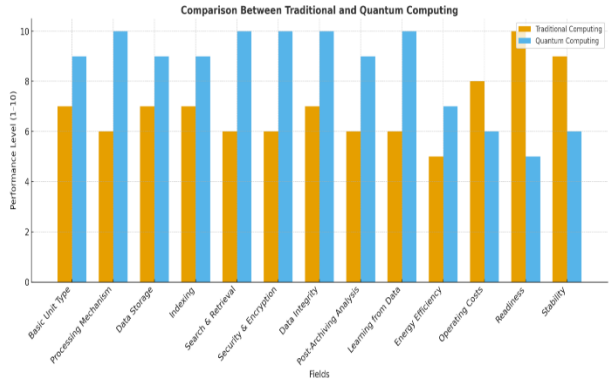

Fig. 3: Illustrates the Comparison between Classical Computing Systems and Quantum Computing Systems.

Source: Prepared by the researchers based on the previous table and some literature.

3. Research Methodology

3.1. Data Collection Methods

The researchers adopted a descriptive-inferential approach, drawing on a range of sources and studies published in scientific journals, books related to the research topic, and online articles and reports. For the practical aspect, they employed a descriptive-analytical approach to analyse the actual data, relying on the financial statements of the Iraqi National Library & Archives (NL&A). (The research sample) and personal interviews with employees. They also used an inductive approach to conduct a cost-benefit analysis, which served as the basis for calculating activity costs and subsequently determining cost savings through a comprehensive comparison between quantum computing applications and traditional systems.

3.2. Research Model

In this paper, two variables were used, the first being the Independent variable, which is as follows: Quantum Computing (QC). Second is the Dependent variable, as follows: Cost-Benefit Analysis (CBA)

3.3. Method of Data Analysis

To analyse study data, the Excel program was used to analyse data and arrive at the cost of services provided by the Iraqi National Library and Archives

3.4. Descriptive Analysis

The National Library and Archives (NL&A) adopts a noble mission represented in preserving the abundant heritage of books and documents that chronicle the events of Iraq as a state, history, and civilization over the years. It is one of the oldest formations that was established during the founding period of the modern Iraqi state at the beginning of 1920. A library was established called the Peace Library. In 1940, this library was linked to the Ministry of Education and was then called the Public Library. In 1961, a law was issued to transform it into the National Library. In 1963, it was attached to the University of Baghdad. In 1968, it was attached to the Council of Ministers. In 1969, it was linked to the Ministry of Culture and Information. In 1987, it was given the name National Library and Archives. This house is the main repository of information for the Iraqi state, including books, documents, research, theses, rare manuscripts, and other rare documents and documents.

Table 2: The Cost of 14 Activities Under the Activity Base Cost System (ABC) for Year 2023

[1]Name of Account under the government accounting system	Stationary	Publications
[2]Number of accounts under the government accounting system	21311	21312
[3]Total cost for year 2023 D/Q	11,839,800	625,950
Cost Driver	Working hours	Working hours
-	595,200	595,200
[4]Over had Rats	19.9	1.1
[5]Cost Object	-	-
Legal Deposit	381,929	20,192
Supply	381,929	20,192
Indexing & Classification	381,929	20,192
Secondment	572,894	30,288
Bibliography	572,894	30,288
Exchange & Dedication	763,858	40,384
Periodicals	763,858	40,384
Microfilm	763,858	40,384

[1]) This (NL&A) uses the government accounting system in preparing its data; it does not have a costing system.
[2]) Custom numbering according to the government accounting system
[3]) It represents the total cost Iraq dinar.
[4]) It represents Total cost for year 2023 Divided on cost driver
[5]) It represents the miner activities.

Technical Preparation	763,858	40,384
Documentary Library	763,858	40,384
Document Cabinets	1,145,787	60,576
Restoration & Maintenance of Documents	1,145,787	60,576
Information Technology	1,145,787	60,576
[6]Financial, administrative, legal, and security services	2,291,574	121,152
Total cost of the year 2023 D/Q	11,839,800	625,950

Activity-Based Cost System ABC						
		Direct cost				Utilities
Materials Control	Materials & Supplies	Other Supplies	Labours	Travel Expenses	Media	Subscribe to Newspapers
21381	21382	21396	112	21211	2142	21243
355,000	500,000	6,789,250	2,659,538,714	360,000	40,000	360,000
Number of Control	Number of Supplies	Number of Supplies	Number of Labourers	Number of Travels	Number of Labourers	Number of labourers
336	2,688	2,688	310	168.0	310	310
1056.5	186.0	2525.8	8579157.1	2142.9	129.0	1161.3
25,357	35,714	484,946	85,791,571	25,714	1,290	11,613
25,357	35,714	484,946	85,791,571	25,714	1,290	11,613
25,357	35,714	484,946	85,791,571	25,714	1,290	11,613
25,357	35,714	484,946	128,687,357	25,714	1,935	17,419
25,357	35,714	484,946	128,687,357	25,714	1,935	17,419
25,357	35,714	484,946	171,583,143	25,714	2,581	23,226
25,357	35,714	484,946	171,583,143	25,714	2,581	23,226
25,357	35,714	484,946	171,583,143	25,714	2,581	23,226
25,357	35,714	484,946	171,583,143	25,714	2,581	23,226
25,357	35,714	484,946	171,583,143	25,714	2,581	23,226
25,357	35,714	484,946	257,374,714	25,714	3,871	34,839
25,357	35,714	484,946	257,374,714	25,714	3,871	34,839
25,357	35,714	484,946	257,374,714	25,714	3,871	34,839
25,357	35,714	484,946	514,749,429	25,714	7,742	69,677
355,000	500,000	6,789,250	2,659,538,714	360,000	40,000	360,000

Transport Device Rent	Public Relations	Celebrations	Stamps	Telephone Calls Expenses
21265	21271	21272	21281	21291
36,102,666	374,000	30,000	366,000	2,482,847
Number of Rent	Number of Labourers	Number of Celebrations	Number of Stamps	Numbers of Callings
3,360	310	168	4,800	5,376
10744.8	1206.5	178.6	76.3	461.8
2,578,762	12,065	2,143	-	177,346
2,578,762	12,065	2,143	36,600	177,346
2,578,762	12,065	2,143	36,600	177,346
2,578,762	18,097	2,143	36,600	177,346
2,578,762	18,097	2,143	36,600	177,346
2,578,762	24,129	2,143	36,600	177,346
2,578,762	24,129	2,143	36,600	177,346
2,578,762	24,129	2,143	36,600	177,346
2,578,762	24,129	2,143	-	177,346
2,578,762	24,129	2,143	36,600	177,346
2,578,762	36,194	2,143	-	177,346
2,578,762	36,194	2,143	-	177,346
2,578,762	36,194	2,143	36,600	177,346
2,578,762	72,387	2,143	36,600	177,346
36,102,666	374,000	30,000	366,000	2,482,847

Information Network Services	Legal advice	Printing	Participate in Training courses	Clean the Building
21295	212104	21251	21261	21291
10,150,000	262,000	1,500,000	785,000	23,939,750
Working hours	Number of Causes	Number of Printing	Number of Training	Space
595,200	14	28,800	20	4,000
17.1	18714.3	52.1	39250.0	5984.9
327,419	-	100,000	-	1,615,933
327,419	-	100,000	-	1,615,933
327,419	-	100,000	-	1,615,933
491,129	-	100,000	-	1,615,933
491,129	-	100,000	-	1,615,933
654,839	-	100,000	-	1,615,933
654,839	-	100,000	-	1,615,933
654,839	-	100,000	-	1,615,933
654,839	-	100,000	-	1,615,933
654,839	-	100,000	-	1,615,933
982,258	-	100,000	-	1,615,933
982,258	-	100,000	-	1,615,933
982,258	-	100,000	-	1,615,933
1,964,516	262,000	200,000	785,000	2,932,619
10,150,000	262,000	1,500,000	785,000	23,939,750

[6]) It represents administrative and legal expenses related to (NL&A) & others

Banking Services Fees	Water Installations Maintenance	Electric Installations Maintenance	Cars Maintenance
21212	21421	21422	21431
97,300	260,500	3,393,500	3,105,500
Number of Services	Number of Maintenance	Number of Maintenance	Number of Maintenance
216	12	14,400	168
450.5	21708.3	235.7	18485.1
-	-	226,233	-
10,811	-	226,233	-
-	-	226,233	221,821
-	-	226,233	221,821
-	-	226,233	221,821
-	-	226,233	221,821
-	-	226,233	221,821
-	-	226,233	221,821
-	-	226,233	221,821
10,811	-	226,233	221,821
-	-	226,233	221,821
-	-	226,233	221,821
21,622	-	226,233	221,821
54,056	260,500	452,467	665,464
97,300	260,500	3,393,500	3,105,500

Car Works Maintenance	Furniture Maintenance	Building Maintenance	Maintenance of Machines	Books Maintenance
21433	2145	2146	2147	214411
7,279,000	1,422,000	3,624,000	10,807,500	330,000
Number of Maintenance	Number of Maintenance	Number of Maintenance	Number of Maintenance	Number of Maintenance
168	7,440	5	45,360	13,920
43327.4	191.1	724800.0	238.3	23.7
519,929	91,742	-	743,373	22,759
519,929	91,742	-	743,373	22,759
-	91,742	-	743,373	22,759
-	91,742	-	743,373	22,759
-	91,742	-	743,373	22,759
-	91,742	-	743,373	22,759
519,929	91,742	-	743,373	22,759
519,929	91,742	-	743,373	22,759
519,929	91,742	-	743,373	22,759
519,929	91,742	-	743,373	22,759
519,929	91,742	-	743,373	22,759
-	91,742	-	743,373	22,759
-	91,742	-	743,373	22,759
3,639,500	229,355	3,624,000	1,143,651	34,138
7,279,000	1,422,000	3,624,000	10,807,500	330,000

Maintenance of documents	Other Expenditure	Depreciations	Total cost	Name of Account under the government accounting system
214413	2164	52	-	Number of accounts under the government accounting system
1,343,750	24,414,360	7,863,000	2,820,341,387	Total amount for the year 2023 in D/Q
Number of Maintenance	workings hours	Machine working hours	-	Cost Driver
13,920	595,200	662,400	-	
96.5	41.0	11.9	-	Over had Rats
92,672	787,560	569,783	94,646,046	Cost Object
92,672	787,560	569,783	94,693,457	Legal Deposit
92,672	787,560	569,783	94,384,539	Supply
92,672	1,181,340	569,783	138,051,359	Indexing & classification
92,672	1,181,340	569,783	138,051,359	Secondment
92,672	1,575,120	569,783	181,718,179	Bibliography
92,672	1,575,120	569,783	182,238,107	Exchange & dedication
92,672	1,575,120	569,783	182,238,107	Periodicals
0	1,575,120	569,783	182,108,835	Microfilm
0	1,575,120	569,783	182,156,246	Technical preparation
92,672	2,362,680	569,783	269,535,147	Documentary Library
92,672	2,362,680	569,783	269,015,218	Document cabinets
347,522	2,362,680	569,783	269,328,289	Restoration and maintenance of documents
69,504	4,725,360	455,826	542,176,500	Information Technology
1,343,750	24,414,360	7,863,000	2,820,341,387	Financial, administrative, legal, and security services

Note. Author's own Computations, depending on data of Iraqi National Library & Archives (NL&A) 2023.

Table 3: Total Cost, Actual & Standard Number of Services for Activities

Cost Object	[7]Activities	[8]Total cost	[9]Actual Number of Services	[10]Standard Number of Services	[11]Difference	[12]Difference Ratio
Legal deposit	Granting Legal Deposit Numbers	94,646,046	8,395	10,350	-1,955	-19%
Supply	Stamp & Register legal Books	94,693,457	9,779	10,900	-1,121	-10%
Indexing & classification	Index &Categorize Incoming Books	94,384,539	10,296	8,000	2,296	29%
Secondment	Number of Loaned Books	138,051,359	70,535	125,000	-54,465	-44%
Bibliography	Indexing & Classifying Theses	138,051,359	5,200	5,200	0	0%
Exchange & dedication	Stamp & Record incoming books and periodicals	181,718,179	2,950	16,000	-13,050	-82%
Periodicals	Registration of Iraqi deposit patrols	182,238,107	2,777	1,150	1,627	141%
Microfilm	Photocopying documents	182,238,107	210,935	279,360	-68,425	-24%
Technical Preparation	Recording files	182,108,835	6,611	7,500	-889	-12%
Documentary Library	Sort, categorize, and stamp the Maps & images	182,156,246	4,952	2,900	2,052	71%
Document Cabinets	Recording files	269,535,147	4,888	18,000	-13,112	-73%
Restoration & maintenance of documents	Sterilization, Cleaning, Maintenance, & restoration of files	269,015,218	5,721	6,750	-1,029	-15%
Information Technology	Convert Arabic and English books to other languages and publish them on the international server	269,328,289	19,297	10,000	9,297	93%
Financial, administrative, legal, and Security services	Financial, administrative, legal, and security services	542,176,500	362,336	501,110	-138,774	-28%
Total cost of the year 2023 D/Q	-	2,820,341,387	724,672	1,002,220	-277,548	-28%

Note. Author's own Computations, depending on company data of Iraqi National Library & Archives (NL&A) 2023.

4. Results and Discussion

4.1. Descriptive data analysis and findings

From Table 3, we notice variance in the number of times a service is provided by the Iraqi National Library & Archives (NL&A), which led to an increase in costs. The following table will show the costs that achieve the current benefits and the limitations of the current traditional systems at the Iraqi National Library & Archives (NL&A)

Table 4: Current Advantages and Limitations of Traditional Systems at Iraqi National Library & Archives (NL&A)

Advantages	Limitations
Technical stability and ease of operation	Slow search and retrieval
Requires no advanced skills to operate the system	Weak digital security and encryption
	Limited automated data analysis capabilities.
Suitable for immutable documents (fixed historical documents belonging to the Library)	High consumption of physical space and human resources.
	Lack of scalability to keep pace with the rapid growth of digital data.

Note. Author's own Computations, depending on company data of Iraqi National Library & Archives (NL&A) 2023.

And now we will review the activities that add value and Non-value activities.

[7]) Represent the internal processes for (NL&A).
[8]) From Table1.
[9]) From House data for year 2023.
[10]) From House data for year 2023.
[11]) Represent The difference Between Actual Number of Services & Standard Number of Services.
[12]) Represent the Standard Number of Services divided on actual Number of Services.

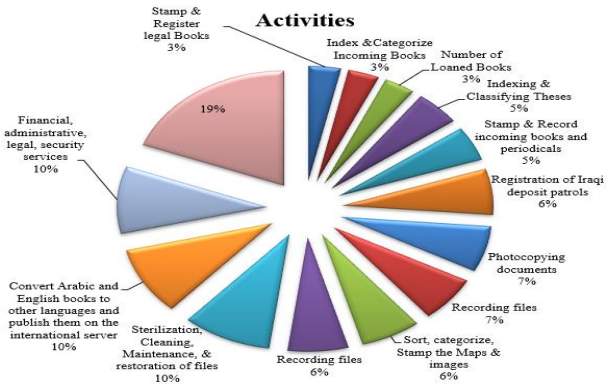

Fig. 3: Illustration Value-Add and Non-Add Activities & Cost Ratios.

Source: Author's own Computations, depending on data of Iraqi National Library & Archives (NL&A) 2023.

Through the shown figure under the Activity Based Cost system, we note there are unnecessary activities that inflate costs, and if we use quantum, the Iraqi National Library & Archives (NL&A) in Conjunction with the Activity Based Management (ABM) as follows:

Table 4: The Activities That Add Value and Non-Value Under Applied Quantum Computing Systems

Cost Object	Activities	Add Value Activi-ties	Non-Value Activities
Legal Deposit	Granting Legal Deposit Numbers	✓	✓
Supply	Stamp & Register legal Books		
Indexing & Classification	Index &Categorize Incoming Books		✓
Secondment	Number of Loaned Books		✓
Bibliography	Indexing & Classifying Theses		✓
Exchange & dedication	Stamp & Record incoming books and periodicals		✓
Periodicals	Registration of Iraqi deposit patrols		✓
Microfilm	Photocopying documents		✓
Technical Preparation	Recording files		✓
Documentary Library	Sort, categorize, and stamp the Maps & images.	✓	
Document Cabinets	Recording files		✓
Restoration & maintenance of documents	Sterilization, Cleaning, Maintenance, & restoration of files		✓
Information Technology	Convert Arabic and English books to other languages and publish them on the international server.	✓	
Financial, administrative, legal, and Secu-rity services	Financial, administrative, legal, and security services	✓	

Note. Author's own Computations, depending on data of Iraqi National Library & Archives (NL&A) 2023.

Through the table above, we notice excluded or curtailed unnecessary activities that do not add value in return there are important and necessary activities that add value, so I advise (NL&A) to pay attention to them. We will now exclude the Cost of non-value-adding activities through the use of the quantum computing system, the following:

Table 5: Total Cost of Activities Under Quantum Computing & Traditional System in D/Q

Cost Object	Activities	Total Cost	[13] Cost under the Quan-tum Computing System	Cost Under Traditional System	Differ-ence
Legal deposit	Granting Legal Deposit Numbers	94,646,046	94,646,046	94,646,046	0
Supply	Stamp & Register legal Books	94,693,457	0	94,693,457	-94,693,457
Indexing & classification	Index &Categorize Incoming Books	94,384,539	0	94,384,539	-94,384,539
Secondment	Number of Loaned Books	138,051,359	0	138,051,359	-138,051,359
Bibliography	Indexing & Classifying Theses	138,051,359	0	138,051,359	-138,051,359
Exchange & dedication	Stamp & Record incoming books and periodicals	181,718,179	0	181,718,179	-181,718,179
Periodicals	Registration of Iraqi deposit patrols	182,23	0	182,238,107	-

[13]) Under Quantum computing system exclude non-value-adding activities.

		8,107			182,238,107
Microfilm	Photocopying documents	182,238,107	0	182,238,107	-182,238,107
Technical Preparation	Recording files	182,108,835	0	182,108,835	-182,108,835
Documentary Library	Sort, categorize, and stamp the Maps & images	182,156,246	[14] 91,078,123	182,156,246	0
Document Cabinets	Recording files	269,535,147	0	269,535,147	-269,535,147
Restoration & maintenance of documents	Sterilization, Cleaning, Maintenance, & restoration of files	269,015,218	0	269,015,218	-269,015,218
Information Technology	Convert Arabic and English books to other languages and publish them on the international server	269,328,289	[15] 89,776,096	269,328,289	0
Financial, administrative, legal, and Security services	Financial, administrative, legal, and security services	542,176,500	542,176,500	542,176,500	0
Total Cost of the year 2023 D/Q	-	2,820,341,387	817,676,765	2,820,341,388	-2,002,664,623

Note. Author's own Computations, depending on data of the Iraqi National Library & Archives, 2023.

Through the table above, we notice that the total cost under Quantum computing is 817, 676, 765. And the difference between traditional systems was (-2,002,664,623), and through.

Table 6: Cost–Benefit Analysis for Activities Under the Quantum Computing System in D/Q

Activities	Total cost Traditional System	Total Cost Under Quantum Computing System	Number of Services Under the Traditional System		Number of Services Under Quantum Computing System		[16]Cost per unit Under Traditional System D/Q		[17]Cost per unit Under Quantum Computing System D/Q		[18]Rationalization Cost Under Quantum Computing System		[19]Rationalization Cost Ratio	
	Cost Analysis	Benefit Analysis	Cost Analysis		Benefit Analysis		Cost Analysis		Benefit Analysis		Benefit Analysis		Benefit Analysis	
			Actual	Standard	Actual	Standard	Actual	Standard	Actual	Standard	Actual	Standard	Actual	Standard
Granting Legal Deposit Numbers	94,646,046	94,646,046	8,395	10,350	100,000	100,000	11,274	9,145	946	946	10,328	8,199	92%	90%
Stamp & Register legal Books	94,693,457	0	9,779	10,900	0	0	9,683	8,687	0	0	9,683	8,687	100%	100%
Index &Categorize Incoming Books	94,384,539	0	10,296	8,000	0	0	9,167	11,798	0	0	9,167	11,798	100%	100%
Number of Loaned Books	138,051,359	0	70,535	125,000	0	0	1,957	1,104	0	0	1,957	1,104	100%	100%
Indexing & Classifying Theses	138,051,359	0	5,200	5,200	0	0	26,548	26,548	0	0	26,548	26,548	100%	100%
Stamp &	181,718,17	0	2,950	16,000	0	0	61,59	11,357	0	0	61,59	11,357	100%	100%

[14]) Reduced by 50% based on the opinions of the technicians.
[15]) Reduced by divide on 3 activity based on the opinions of the technicians.
[16]) Represent total cost under traditional system / number of service under traditional system.
[17])Represent total cost under Quantum computing system / number of service under Quantum computing system.
[18]) Represent cost per unit under traditional system Subtraction cost per unit under cloud computing system.
[19]) Represent rationalization cost under Quantum computing system Divide cost per unit under traditional system.

Record incoming books and periodicals	9						9				9			
Registration of Iraqi deposit patrols	182,238,107	0	2,777	1,150	0	0	65,624	158,468	0	0	65,624	158,468	100%	100%
Photocopying documents	182,238,107	0	210,935	279,360	0	0	864	652	0	0	864	652	100%	100%
Recording files	182,108,835	0	6,611	7,500	0	0	27,546	24,281	0	0	27,546	24,281	100%	100%
Sort, categorize, and stamp the Maps & images	182,156,246	91,078,123	4,952	2,900	300,000	300,000	36,784	62,812	304	304	36,480	62,508	99%	100%
Recording files	269,535,147	0	4,888	18,000	0	0	55,142	14,974	0	0	55,142	14,974	100%	100%
Sterilization, Cleaning, Maintenance, & restoration of files	269,015,218	0	5,721	6,750	0	0	47,022	39,854	0	0	47,022	39,854	100%	100%
Convert Arabic and English books to other languages and publish them on the international server	269,328,289	89,776,096	19,297	10,000	10,000	10,000	13,957	26,933	0	0	13,957	26,933	100%	100%
Financial, administrative, legal, and security services	542,176,500	542,176,500	362,336	501,110	6000,000,000	6000,000,000	1,496	1,082	0.904	0.904	1,495	1,081	100%	100%
Total Cost Benefits for the year 2023	**2,820,341,387**	**817,676,765**	**724,672**	**1,002,220**	**600,410,000**	**600,410,000**	**3,892**	**2,814**	**1,251**	**1,251**	**2,641**	**1,563**	**68%**	**56%**

Note. Author's own Computations, depending on data of the Iraqi National Library & Archives house, 2023.

From the table above, the cost per unit under Quantum computing represents (1,251: 1,251) respectively for actual and standard, it's means the cost-benefit is (68%:56%) respectively for actual and standard.

Based on all of the above, we conclude that linking traditional systems with the transition to quantum computing for the National Library and Archives, as the institution responsible for Iraq's historical memory, is crucial, given the significant challenges it faces in managing its vast collection of documents. The transition to a digital library powered by quantum computing will achieve Reduced storage costs in the long term through more efficient quantum compression.

5. Conclusion

- With the adoption of quantum computing technology, we can analyse the reasons for reducing costs and achieving benefits.
- Under the use of both activity-based cost and based –management (ABC-M), we will be able to calculate the costs - benefits of rationalizing activities in total and in units.
- Quantum computing will accelerate search and retrieval processes thanks to quantum algorithms (such as Grover), enhance digital security using quantum cryptography (QKD), and enable the parallel analysis of massive historical datasets to uncover the temporal, political, and cultural patterns of the National Library and Archives

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