

The impact of artificial intelligence on development of the flexible budget Case study at Middle -Euphrates Oncology Center

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Abstract. *This research aims to explain the impact of artificial intelligence on developing flexible budget and improving its accuracy and flexibility in financial planning and control, through its application at Middle -Euphrates Oncology Centre. The research mainly relies on the descriptive analytical approach, studying a case based on the financial and administrative reports belonging to the above-mentioned centre, and comparing the results of the traditional flexible budget with the results of artificial intelligence -based budget. The outcomes demonstrated that, in comparison to the traditional budget, the artificial intelligence-based flexible budget is more effective at lowering deviations and raising prediction accuracy, demonstrating its ability to boost strategic productivity. The value of the research lies in highlighting the role of integrating artificial intelligence with traditional accounting practices in supporting financial planning and control. It also recommends expanding the scope of future research and studies to include additional service industries.*

Keywords: Artificial intelligence, Flexible budget.

1- Introduction

Given their limited resources and rising service demand, institutions—including the health care sector—face significant challenges. Because of this, depending only on traditional planning and control techniques is insufficient to attain the required level of efficiency. In this context, the flexible budget is an important tool for providing more realistic estimates compared to the traditional one and its effectiveness increases when combined with artificial intelligence techniques, which have many merits including its ability to process huge and speed data, and provides more reliable financial expectations. The center, situated in Najaf province, is selected as a population and study sample, based on its financial and administrative data for 2023 and 2024. In addition to, it plays a crucial role in offering specialist medical services and there has been ongoing efforts to improve the efficiency of its resources management. The study's results demonstrated



that, in comparison to the traditional budget, the artificial intelligence-based flexible budget has remarkably improved cost prediction accuracy, which has a favorable impact on the indicators of strategic productivity .Accordingly, the study recommends adopting the flexible budget based on artificial intelligence as a basic tool for planning and financial control in health institutions, due to its ability to reduce deviations and improve efficiency of resource allocation in healthcare, which contributes to enhancing the quality of health services and strategic productivity.

2. Study methodology

2.1-Study problem:

The study problem lies in the following question:

- 1- What is the impact of artificial intelligence regarding development of flexible budget to achieve greater accuracy and flexibility in financial planning and control?

2.1.1 The aim of the study

This research aims to clarify the impact of artificial intelligence on developing flexible budget and thus enhancing its accuracy and flexibility in planning and financial control.

2.1.2 The importance of study

The importance of this research lies in highlighting the role of artificial intelligence as a modern tool for developing flexible budgets, and enhancing their accuracy and efficiency in facing fast-growing changes. It also contributes to providing accurate information supporting managements in making appropriate decisions, and it also helps researchers to take advantage of artificial intelligence tools to develop accounting practices.

2.1.3 Study hypothesis

Based on the search problem, the following hypothesis can be formulated:

(Using the artificial intelligence technologies contributes in developing flexible budget, which enhances its accuracy and efficiency in financial planning and control)

2.1.4 Study methodology

The research relies on the descriptive analytical approach by reviewing the previous literature reviews related to the topic, in addition to using the case study method by collecting data and information from this centre and analysing them to reach results and recommendations.



2.1.5 Study limitations

1. Time limitation: adopting statistical data, reports and financial data for the sections of Middle - Euphrates Oncology Centre for (2024_2023).
2. Spatial limitation: Najaf Health Department / Middle -Euphrates Oncology Centre represents a field for the applied aspect of the search.

2.1.6 literature reviews

1- Study (Tatar: 2015)

Seq.	Details	Study Details
-1	Researcher and Year	(Tatar: 2015)
	Study Title	The role of the flexible budget in applying responsibility accounting and enhancing the efficiency of administrative decisions and evaluating its performance
	Study Sample	The study sample is a purposive sample represented by decision -makers in institutions (responsibility centres) and (60) accountants, (52) questionnaires are recovered, and due to the small study community, the study sample includes all population sample.
	Study Objective	The aim of the study is mainly to identify the role of a flexible budget in applying of responsibility accounting and enhance the efficiency of administrative decisions and evaluate its performance in all its dimensions.
	Key Findings	Using a flexible budget facilitates the application of responsibility accounting, improves the effectiveness of administrative decisions, and allows obtaining accurate performance evaluation. Nevertheless, there are challenges and barriers that restrict their efficacy.

2- Study:(Boustani:2022)

Seq.	Details	Study Details
-2	Researcher	(Boustani,2022)



	and Year	
Study Title	Artificial intelligence impact on banks’ clients and employees in an Asian developing country.	
Study Sample	Data of the banking sector in Lebanon is used, the data is collected and analyzed in quantitative research models with the application of the hypothetical regression models.	
Study Objective	The aim of the study is to discuss the application of artificial intelligence in banking sector, and its impact on bank employees and consumer behaviour alike when buying financial services and studying the importance of artificial intelligence in providing social services in a developing country in West Asia, Lebanon.	
Key Findings	Artificial intelligence raises the quality of banking transactions to a higher level. It also makes a big difference in the financial sector through improving the accuracy of operations and providing tools available to all involved parties.	

2.2 conceptual framework.

2.2.1: Concept of Artificial Intelligence

Artificial intelligence (AI) is referred to as a set of techniques capable of learning, analyzing and predicting, which aim to address the consecutive cash flow trends (Cheng et al, 2009: 4). Simon Greenman defines, the term, artificial intelligence, as a set of theories and technologies used to develop machines that can mimic human intelligence depending on advanced algorithms. These systems aim to provide effective and intended solutions to users by integrating devices and software. Moreover, artificial intelligence seeks to exploit knowledge in various fields to improve performance and provide more precise outcomes (Green man, 2017, 89). Wahid believes that AI is a science of modern technology concerned with processing data and converting it into information



through systems capable of thinking, learning and acting independently that can accomplish complex tasks faster and more accurate than humans (Wahid, 2024: 27).

2.2.2 Artificial Intelligence Objectives:

The development of artificial intelligence applications aims to achieve a set of goals, including the following:

1. Creating innovative methods to extract information.
2. Creating new methods to build and create information and maintain information.
3. Enabling machines to process information in a method in a way that resembles that of humans
4. Presenting better understanding of what human intelligence is through simulation techniques
5. Developing cutting-edge methods to convert needs into implementable programs (Abdel Halim, 2022: 16).

2.2.3the impact of artificial intelligence on managerial accounting:

Artificial intelligence (AI) has a significant impact on the field of managerial accounting because it has brought about a number of improvements and changes. While some of these changes may be a normal process of technological advancement, others can be technically classified as artificial intelligence. AI can contribute in reducing expenses in managerial accounting operations, which enables institutions to allocate resources more effectively and improve financial performance (AI – Naqib, 2024: 424). The primary advantage of technological developments brought about by artificial intelligence is the replacement of manual manufacturing processes with cutting-edge technology, which will alter managerial accounting practices particularly when it comes to product cost estimation, and managerial accountants will be allowed to focus on strategic decisions instead of operational decisions. Additionally, the cost of supporting the infrastructure of economic units was significantly decreased by cloud computing technology. Apparently, artificial intelligence systems and fourth generation technology allow managerial accountants to analyze and discuss the new cost factors for their products (Assaf, 2022: 516).

2.2.4 The concept of flexible budget:

Eddie McLaney and Peter Atrill indicated that the flexible budget is a financial tool that allows performing accurate comparisons within budget, using flexible numbers, and actual results. This type of budge is prepared based on assumptions related to the behaviour of revenues and costs where the costs and revenues change with different levels of activity, while some other costs, such



as public expenditures, remain fixed. The flexible budget provides the ability to compute the differences or variations between expected performance and actual performance, which helps in strictly analyzing financial performance according to the actual activity level (McLaney, 2021: 248 & Atrill). Furthermore, according to Hansen et al., budgets are effective control measures; nevertheless, there are two key factors that need to be taken into account when using them for performance evaluation. The first is to figure out how to compare the budgeted amounts with the actual outcomes. The second relates to the impact of budgets on human behaviour (Hansen et al, 2022: 403).

2.2.5 The importance of flexible budget:

Flexible budget is considered a key management tool for modern institutions because it improves resource allocation and helps make rational decisions. It is also crucial for operational decisions because it improves cost control by adjusting to activity levels. Additionally, this budget enables managers to efficiently assess and manage resources (Fauziaah & Razak, 2023: 32). Moreover, Syah Putri indicated that flexible budgets are critical to organization's ability to develop a budget based on actual production levels, which provides managements with a more accurate and transparent view of organization's position and condition. In other words, a flexible budget analysis can compare the actual activity level so that company would not be focused only on the value of deviations (syhi putri et al, 2023: 6).

2.2.6 Steps to prepare a flexible budget:

1. Selecting an activity scale, identifying the activity scale on which a flexible budget will be relied upon, such as production hours or operation time.
2. Computing variable costs relying on the activity level, variable cost rate of each activity unit is also computed, for example, the cost of electricity per hour of production.
3. Preparing a flexible budget for different activity levels. Then, multiple levels of activity are determined within the expected range, and costs are estimated for each level based on the change in the activity (Hilton & Plaat, 2020: 477).



2.2.7 The concept of deviation analysis in flexible budgets.

Differences between the actual results and the flexible budget for the level of actual achieved production are seen as a deviation in the flexible budget. The flexible budget differences reflect the deviation extent of the actual results from the expected, given the level of achieved activity. Economic units utilize a cycle of deviation analysis, to evaluate and improve performance. This cycle starts when accounting department prepares performance reports. These reports shed light on deviations, which are the differences between actual results and what should have happened according to the budget (Horngren et al 2023: 333).

3- Practical framework

3.1 Research sample description.

The Middle Euphrates Oncology Centre is a specialized oncology institution, located in Al-Najaf province, in Iraq, under the authority of the Najaf Health Directorate and Iraqi Ministry of Health. Established in 2015, the facility spans 40,000 m², with 270 beds spread across 20 medical lounges, and includes around 835 employees. The centre provides integrated treatment services including early diagnosis, chemotherapy and radiotherapy, as well as medical consulting. In recent years, it has witnessed a remarkable development by expanding and equipping lines with the latest devices, such as (True Beam Radiotherapy Treatment for Cancer), constructing specialized buildings for consulting, laboratory, reserve drugs and doctor house). Additionally, it has also witnessed enhancing infrastructure and increasing medical staffs, and setting up training courses, which considerably contribute in improving health care quality and adopting modern administrative and financial methods that depend on information technology and artificial intelligence.

3.2 Description of the artificial intelligence application in the flexible budget

The flexible budget is one of the most important tools of modern management, as it allows adjusting financial plans based on actual activity levels, which makes them more accurate than traditional budgets. The introduction of artificial intelligence into this field has enhanced its ability to process data and generate accurate predictions, assisting the relevant management in making better strategic decisions.



One of the most prominent applications used in this field:

Grok (xAI): This application is capable of rapidly analyzing vast volumes of data and creating flexible budgets based on scenarios with precise analytical recommendations. Grok is a distinct choice due to its ability to learn from historical data, integrates with multiple sources, and provides an easy -to -use interface that enables users to simulate multiple scenarios accurately. In other words, artificial intelligence has added a great value to flexible budgets by reducing differences, improving response times, and increasing the reliability of financial information. To clarify the practical impact of artificial intelligence in flexible budgets, we will review, in this research, a case study of middle Euphrates oncology Center, in Najaf province, a medical center treats cancer patients, which faces financing challenges and increasing pressures on its resources.

3.3 Steps to prepare a budget for oncology center using artificial intelligence applications.

1- Determining hypotheses

- A. Various activity levels (5000, 10,000, 15,0000 and 20,000 patient per year)
- B. Covering all the centre sections, 13 sections, including: X-ray, Echo, CT scan, ultrasound, MRI department.
- C. Dividing the costs into fixed such as (salaries, administrative costs) and variable costs such as (medication, Consumables)

Using Grok app: It is used to prepare a flexible budget based on these hypotheses, to conduct a cost analysis and allocate them to departments, and estimate the cost for each patient based on the activity level.

- The flexible budget covers the center's annual variable and fixed activity costs. The number of patients for 2024 is 46,379, including:

- 1) Ultrasound Department: 5,284 patients
- 2) MRI Department: 4,787 patients



- 3) CT Scan Department: 2,413 patients
- 4) Radiology Department: 1,951 patients
- 5) Echocardiography Department: 895 patients
- 6) Laboratory Department: 50,966 patients
- 7) Radiology Department: 8,547 patients

2- The main results:

- A. **Fixed costs**, which include salaries, equipment maintenance, and operational expenses, total 3,390,000,000 Iraqi dinars annually and are allocated according to the requirements of each section.
- B. Variable costs per patient: it is estimated 287,000 thousand Iraqi dinars, distributed on services such as pharmacies (47,000 thousand dinars), radiotherapy 100 thousand Iraqi dinars, laboratory 30 ,000 thousand Iraqi dinars, patient -lying down service (50 ,000 thousand dinars).
- C. Therapeutic departments (radiation, pharmacy, patient lying down services): These services represent the largest rate of variable costs due to the high cost of medications and treatment sessions
- D. Diagnostic departments (X-Ray, MRI, CT scan,): they require periodic maintenance (part of fixed costs) because they are highly advanced devices.
- E. C. Maintenance and human resources: they are mainly included within the fixed costs, which reflect its importance in the continuity of operations.

4. Conclusions and recommendations:

4.1 Conclusions

- 1. The application of the artificial intelligence - based flexible budget leads to improvement in the cost accuracy. This type of budge shows a remarkable improvement in the accuracy of cost estimation compared to the traditional budget in most strategic productivity indicators, especially in Ultrasound services (improved by 35.3%), MRI services (improved by 35.5%), CT scan services (64.1%), X-rays (deviation rate turns from negative to positive), Echo (57.9%), and radiotherapy (23%). This illustrates how artificial intelligence can handle cost



fluctuation more effectively. This reflects the ability of artificial intelligence to deal with more efficient cost fluctuations.

2. Artificial intelligence –based flexible budget records a huge negative deviation in the cost of patient lying down services (370,694-) compared to the traditional budget (235,536-), indicating the need to improve artificial intelligence models in this field.
3. . Artificial intelligence -based budget tends to more conservative estimates compared to the traditional budget, which reduces the risk associated with unexpected costs and enhances strategic productivity.

4.2 Recommendations:

1. Middle - Euphrates Oncology Center should implement the flexible budget based on artificial intelligence as a fundamental instrument for cost planning and monitoring because of its capacity to lower deviations and increase prediction accuracy.
2. Employees at Oncology Center should receive training on how to use budgeting tools based on artificial intelligence in order to to ensure the maximum benefit from this technology in making financial and strategic decisions
3. To enhance the accuracy of the artificial intelligence budget, additional data such as changes in drug prices, and demand for health services should be combined.

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