# Non-Linear Financial Intelligence Mixed-Integer Framework for Strategic Planning in Cost Management

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## Abstract

Presently, a survey reflects on research issues involving the complexity of the strategic planning, cognitive tests of policy planners, and computerized support for planning approaches that use artificial intelligence techniques. A non-linear financial intelligence mixed-integer framework (NFIMF) is proposed to support strategic management decisions in IT-based business. Furthermore, Counter interpretation of financial performance improvements with a lower cost has been developedin this research. Consequently, a model-based method for analyzing these early phases using artificial intelligence helps create a strategic decision to analyze unstructured behavior. This paper is intended to establish a better measuring structure and an effective strategic cost management evaluation system. There aretwo main parts of the article: to find a way of accurately measuring strategic costs and then to use it more closely. The numerical findings show that the proposed NFIMF method achieves high Firms' performance ratio of 98.9%, prediction ratio of 97.4%, an efficiency ratio of 96.2%, values, and a firm's profitability ratio of 95.6% and cost reduction ratio of 10.1% when compared to other existing approaches.

**Keywords:** Strategic planning,finance, structural model, artificial intelligence

## Overview of the Strategic Planning in Cost Management

Cost management is the strategy and budget management process within a business [1]. Byestablishing a good cost management system, businesses can better estimate and allocate their budgets [2]. Cost management is anaccounting management method that helps a business estimate impending costs to reduce the budget's risk [3]. For specific projects and the general business plan, many companies use cost control strategies [4]. The estimated cost is measured for a project when the project is still in the planning phase and is approved in advance [5]. The project records and monitors all expenses to ensure that they are under the cost management plan [6]. Upon completing the project, it can compare and analyze the cost estimates and the real costs, predicting future expenditures and budgets [7]. Implementing a project cost management structure will allow a business to control the overall budget [8]. Resource planning is the initial step. This involves determining resource requirements for future projects, the work to do them, how or what will be done, and the work duration [9]. With this information, a business will predict the costs of the resources required [10]. The business will assign resources. Cost performance should be assessed and analyzed [11]. Variances should be calculated concerning cost baselines. If the expectations and measurements differ, corrective measures can be introduced to avoid budget infesting. There can be measured process changes. Several business intelligence systems, such as Oracle Hyperion, offer cost management software that supports enterprises' cost control and performance growth. Although the software will help, its use in implementing cost control plans is not imperative [12]. Vendors may refer to business applications cost control as cost accounting, expense management, or product cost transparency [13].

Business enterprises have heavily relied upon information technology (IT) [14]. Therefore, IT has been an important topic to study, in particular, to argue against IT productivity in study areas and quantify its value in comparison and investment. In the meantime, IT has given the firm certain benefits in practice, such that almost no business associations without including IT in their operations. In comparison, both the internal and the external values work composed to generate the information technology value found in currency or other types [15]. The value of IT as a consequence of the IT function division by its expense thereby receives the intrinsic value. Meanwhile, extrinsic value is a result of the management of the intrinsic IT worth in the industry. Similarly, if the intrinsic IT is correctly associated with the company structure, it will be an outstanding attribute since the intrinsic values and the aggregate of the external values [16]. Alternatively, where IT and corporation alignment become corrupt, the entire of the ideals will be corrupt.

Artificial Intelligence seeks to build smart systems that can learn, reason, adapt, and implement tasks that are similar to people. IT systems are designed to collect, store, analyze, and evaluate data in a way that communicates the best outcomes as an information piece. AI systems are considered smarter than information systems since they work more on improving knowledge and data. AI technologies rejuvenate old concepts to develop IT systems for efficient operations [17]. AI is the step ahead for the IT industry in transforming its networks into smart systems for IT optimization. The main functionalities of AI in IT are automation and optimization. Implementing value engineering principles can efficiently be utilized to reduce costs andenhance project value. Artificial intelligence in IT-based business will enhance data security, better information systems, process automation, cost management, and strategic decision making to achieve high organizational performance [18].

In this paper, a Non-linear financial intelligence mixed-integer framework (NFIMF) has been proposed to support cost management with strategic decision making in IT-based business. This study introduces the IT value engineering method to reduce costs by adding value and enhancingservices' quality. This concept has benefited tremendously from cost reductions from resource allocation, especially from incorporating IT value. In addition, maximizing cost-effectiveness with superior performance is key to maintaining the firm's competitiveness. Strategic management includes establishing long-term targets, responding to market factors, and fulfilling the organization's task. It is determined that effective strategic decision-making suggestively increases the performance and achievement of IT-based firms.

The major contributions of the study are,

- To propose the Non-linear financial intelligence mixed-integer framework (NLFIMIF) to support cost management with strategic decision making in IT-based business.
- This study aims to analyze the valuation method to assess the IT value, which makes from the IT use within a corporation as a capability, a mixture of assets, environment interactions consequences in the productive utilization of IT.
- The findings disclose that the IT value engineering

method has functioned, and where the model has to provide the firms with enhancedefficiency at reduced costs.

The remainder of the study is structured as follows: section 1 and section 2 deliberated the strategic planning in cost management and existing approaches. In section 3, a Non-linear financial intelligence mixed-integer framework (NFIMF) has been suggested. In section 4, the simulation results have been executed. Finally, section 5 concludes the research paper.

## Background study and the features of this research paper

Ying Hong et al. [19] proposed an Artificial neural network (ANN) for predicting net costs associated with business information modeling (BIM). The suggested neural network is customized to suit a business's investment plan forbusiness information modeling implementation. Multi-class and multi-label classifications are implemented to derive the cost and advantage functions for business information modeling and development employment levels. The suggested neural network offers decision-makers a tool to evaluate which Non-BIM/BIM applications to establish, accompanied by the level of development that is most suited to the organization's technical and financial ability.

Gregory Wegmann et al. [20] suggested the activity-based costing (ABC) for cost accounting practices. The research aims to examine the strategic component of the mentioned approaches and construct a typology that is useful to managers. The advances demonstrate that ABC is a strategic cost control tool: it helps to guide any step of the plan, to track the achievement of strategic priorities, to confirm strategic decisions, and to build strategies. This strategic factor is central to understanding the importance of cost generators, the processes, and cross-functional approaches.

Ferreira et al. [21] introduced the integrated framework with strategic cost management (IFSCM) utilizing the approaches target costing and activity-based costing based on the product's life cycle. The framework of ABC provides accurate cost information based on manufacturing processes and operations. The suggested ABC approach specifies that operations absorb energy and the goods and services absorb those. The convergence of ABC, the cost strategy, and the company MBA product life cycle culminated in cost savings. Thus, the study results improve decision-making in the management of strategic costs, especially in an MBA in the context of business management.

Tung et al. [22] initialized the Structural Equation Modeling (SEM) for analyzing the factors affecting the application of activity-based costing methods in manufacturing firms. The perception of administrators, competitiveness level, the cost control approach, the methodology for implementation, accountant levels, preparation, and IT levels have beneficial effects on ABC system implementation. Simultaneously, the ABC approach has a positive impact on the improvement of company performance in manufacturing companies. The findings of the study indicate that using the ABC method is beneficial.

In this paper, a Non-linear financial intelligence mixed-integer framework (NFIMF) has been proposed to support cost management with strategic decision making in IT-based business to overcome these issues. This paper analyses a range of components that build on the IT value engineering model in providing value for businesses. The research focused on the internal components of businesses: ITRs that express the capacity to develop operational skills and reduce coststo benefit the company's competitiveness.

## Non-linear financial intelligence mixed-integer framework

In this paper, a Non-linear financial intelligence mixed-integer framework (NFIMF) has been proposed to support cost management with strategic decision making in IT-based business.The datasets taken for this research form (https://data.world/finance/saudi-arabia-largest-companies) [23]. Technological developments in artificial intelligence will essentially change business models in the manufacturing industry because they speed updigitizing processes and cost management. Artificial Intelligence in the field of cost management or cost accounting to automate the complete accounting processes. Artificial Intelligence can be utilized extensively for financial transaction auditing systems. Artificial Intelligence can be a great help when processing a huge number of pages for tax changes. Organizations dependent on Artificial Intelligence can be predictable to make main firm-related decisions in the near future. Artificial Intelligence canrecognize how consumers should respond to diverse circumstances and difficulties. Artificial Intelligence can help people and businesses make smarter choices at a very fast pace. The key here is to discover the right human-machine balance and interactions. Financial intelligence is an obligation in the process of decision-making. Financial intelligence reflects an attitude or individual's capability to enhance their financial knowledge toresolve money issues for a better financial condition as each aspect of life is connected one way or the other with money. Financial intelligence has the benefit of enlightening individual managers' capability within an organization to enhance their decision-making based on the organization's financial condition and further decrease the conflict of interest between departmental managers since each manager can understand the financial conditionof the organization. This will enableadvancement in firm performance and value.

**Figure 1: The architecture of Non-linear financial intelligence mixed-integer framework (NFIMF) method**

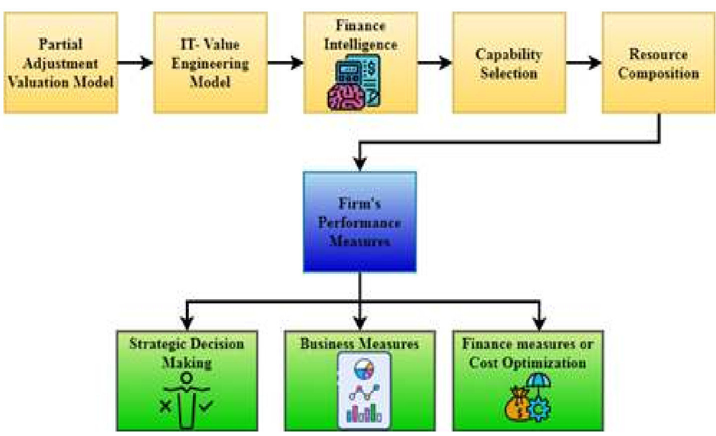



**Figure 1** shows the architecture of the Non-linear financial intelligence mixed-integer framework (NFIMF) method. The application of Artificial intelligence and machinelearning in financial management can be implemented in four ways. First, it is the customer-based (front-end), including credit scoring, insurance, and customer-focused business robot applications; second, the administration of back-end (back-end) software, which include resources optimization, risk control, and market effects analysis; thirdly, the financial and portfolio management transactions; and finally, in financial services for Registry and machine learning. In addition, in particular contexts such as financial quantity trades, natural language analysis, syntactic and semantic search, and investment intelligence, AI and machine learning are commonly used. The task of IT is to strengthen these competencies, improve efficiency, and promote competitiveness. As a single product, it is anticipated that large gains from role analysis and modeling will illustrate how a person, sector, or market works. Many results are the effects even from a basic method (e.g., screen information, devices, or simulation). On the other hand, the exploration of whether and how exactly decisions are made strengthens strategic thinking.

**Figure 2: AI-based Expert System for Strategic Decision Making**

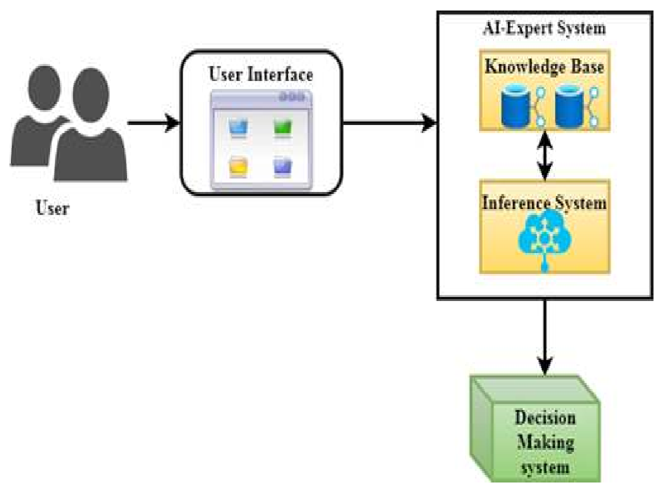



**Figure 2** shows the AI-based expert system for strategic decision making in IT-based firms. Artificial intelligence, and knowledge-based expert systems, initialize quantitative modeling methods in finance and offer more user-friendliness.Everyactor in the organization relies on online information so that intelligent data screens, even if dependent on natural language analysis and knowledge-based expert systemprocessing, determine enthusiastic acceptance provided one can realizesmart decision making.

## Preposition 1: Partial adjustment valuation Theory

**Solution 1:** This research explores the sustainable competitive advantage in IT inclusion using the system engineering approach through IT value engineering. IT value supports processes because it endorses productivity, innovation, and efficiencyin business practices. Therefore, the engineering process is the inventive development of resources, power, and data in formalized human organizations, resources, and environments that profit by up-to-date human principles.To build an IT spending model system,everycomponent or subsystems measure relates one to another is quantitatively rational andqualitatively probable. The mathematical formula to construct this paper's correlation is the partial adjustment valuation theories, which involve Cobb–Douglas (CD) production transformation as the input function. Besides, this function comprises three input parameter, i.e., $L, K$, and $J$ for the IT value-based business,

$$f(Y_t; \alpha) = \beta L_t^{\delta_1} K_t^{\delta_2} J_t^{\delta_3}, \quad t = 1,2, \dots w \quad (1)$$

As inferred from the equation (1) where Cobb–Douglas function with $Y_t$ contains production factors, $L_t$, $K_t$ and $J_t$, whereas$K_t$ is the labor expense,$L_t$ is the capital, and $J_t$ is the IT capital over a period. At the same time, $\beta, \delta_1, \delta_2, \delta_3$ are unknown variables and $v_t \sim |M(0, \rho_v^2)|$. The production factors do not divide the capital into other elementsand simply encompass L, K, and J. However, the above subsystems (firm performance, firm core competence, firm competence, and ITR) do not directly address the production aspects. Thus, the interpretation must be taken by way of all the equity capitals of every subsystem (firm performance, firm core competence, firm competence, and ITR) are categorized as the equity or as a production attributeL. Similarly, all the labor costs of every subsystem are clustered as a factor K, while all capital expenditures are categorized as a factor J. Therefore, the approximation process can run utilizingpartial adjustment valuation theory with the followingexpression,

$$x_t - x_{t-1} = W_t\big(f(Y_t; \delta)\big) - x_{t-1}) + \epsilon_t,$$

$$x_t = W_t f(Y_t; \delta) + (1 - W_t) x_{t-1} + \epsilon_t, \quad t = 1,2, \dots w \quad (2)$$

As shown in equation (2) where $x_t$ denotes the actual output (profit) of a production process unit, for instance, a firm, in time t, as for $x_{t-1}$ indicates the actual output of equal production unit at time $t - 1$. While $f(Y_t, \delta) = x_t^*$ is the substitute function of the preferred output $x_t^*$, which can beobvious in the form of a production function, $\delta$ is the elasticity of output, and $W_t$ is the coefficient representing a static speed of modification. In an approximation process, an old-shaped random error signified by $\epsilon_t$ essentials to deliberate completing the expression.

**Figure 3:** IT value and Business Environment

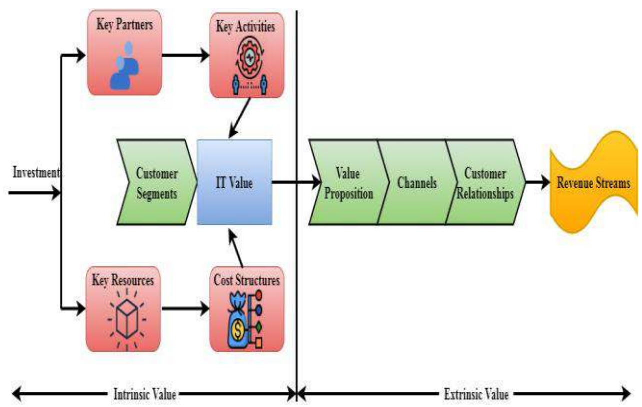



Figure 3 shows the IT value and business environment. The business model could be a business environment to enable a business context of the IT value. The business model containsnine components: value propositions, customer relationships, customer segments, revenue streams,channels, key resources, key activities, cost structures, and key partners. The finalfour blocks, key activities, key resources, cost structure, and key partners, can make up IT resources' internal power as the inherent value, as illustrated in Figure 3. Consequently, they are part of those blocks positioning the function constraintsdepicted by the cost parameters and key activities depicted by the cost structurestrengthened by the key resources and key partners.

## Preposition 2: Cost Optimization

**Solution 2:** To determine the optimum costs at superior firm performance, several assumptions regarding the optimization must progress. For example, the first preassumption is that the Cobb–Douglas functionsubstitutesevery subsystem desired output (the starred $x_{jt}^{*}, j = 1,2,3$). This expression follows as shown in equation (1),

$$x_t^* = \beta L_t^{\delta_1} K_t^{\delta_2} J_t^{\delta_3},\ t = 1,2, \ldots w \qquad (3)$$

As discussed in equation (3) where $x_t^*$ denotes the desired output, $L_t$ indicates the usual investment, $K_t$ represents the labor payment, $J_t$ depicts the IT spending, $\beta$ denotes the overall factor production and $\delta_1, \delta_2, \delta_3$indicates an elasticity of output. Thus, every partial subsystem adjustment,

$$x_t = W_t x_t^* + (1 - W_t) x_{t-1} = W_t \beta L_t^{\delta_1} K_t^{\delta_2} J_t^{\delta_3} + (1 - W_t) x_{t-1} \qquad (4)$$

**Figure 4: Cost Optimization**

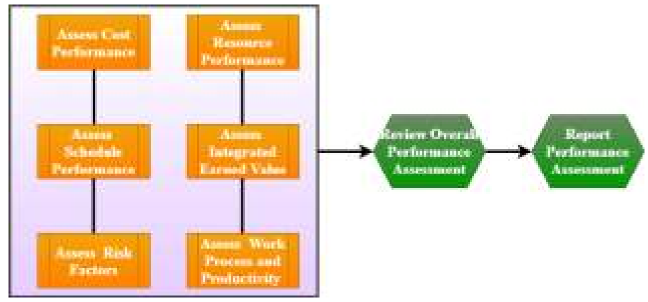



Figure 4 shows the cost optimization in IT-based firms. Assessment of every parameter can utilize the concept of value as a function divided by cost. This research generates a value evaluation approach, which aims to redesign the relationship dynamics between IT costs and company performance in another way and to lead to quantitative measurement of the IT costs and company performance.Moreover, for the cost minimization, the partial derivatives of (4) should encounter these requisites,

$$\frac{\partial x_t}{\partial L_t} = 0 \quad \frac{\partial x_t}{\partial K_t} = 0 \quad \frac{\partial x_t}{\partial J_t} = 0 \qquad (5)$$

If equation (5) is derived to $L, K,$ and $J$, it correspondingly resulting in the following expression [whereas $q_1, q_2$ and $q_3$ are added to the function as the unit cost of the fixed capital ($L$), the labor expenses ($K$), and the IT capital ($J$)]

$$\frac{\partial x_t}{\partial L_t} = W_t \beta \delta_1 q_1 L^{\delta_1 - 1} q_2 K^{\delta_2} q_3 J^{\delta_3} \qquad (6)$$

$$\frac{\partial x_t}{\partial K_t} = W_t \beta \delta_2 q_1 L^{\delta_1} q_2 K^{\delta_2 - 1} q_3 J^{\delta_3} \qquad (7)$$

$$\frac{\partial x_t}{\partial J_t} = W_t \beta \delta_3 q_1 L^{\delta_1} q_2 K^{\delta_2} q_3 J^{\delta_3 - 1} \qquad (8)$$

$$L = \frac{q_3}{q_1}\frac{\delta_1}{\delta_3} J K = \frac{q_1}{q_2}\frac{\delta_2}{\delta_1} L J = \frac{q_2}{q_3}\frac{\delta_3}{\delta_2} K \qquad (9)$$

Utilizing equation (6) condition, hence, (7) = (8) = (9), furtherexpressions appear as follows,

$$x_t = W_t \beta L^{\delta_1} \left[\frac{q_1}{q_2}\frac{\delta_2}{\delta_1} L\right]^{\delta_2} \left[\frac{q_1}{q_3}\frac{\delta_3}{\delta_1} L\right]^{\delta_3} + (1 - W_t) x_{t-1} \qquad (10)$$

If equation (4) is substituted by equation (10), the new equation appears in the capital $L$ parameter, the expression is reviewed as (11) and then shortened as(12)

$$x_t = W_t \beta \delta_1^{-\delta_2 - \delta_3} \delta_2^{\delta_2} \delta_3^{\delta_3} q_1^{\delta_2 + \delta_3} q_2^{-\delta_2} q_3^{-\delta_3} L^{\delta_1 + \delta_2 + \delta_3} \qquad (11)$$

$$L^{\delta_1 + \delta_2 + \delta_3} = W_t^{-1} \beta^{-1} \delta_1^{\delta_2 + \delta_3} \delta_2^{-\delta_2} \delta_3^{-\delta_3} q_1^{-\delta_2 - \delta_3} q_2^{\delta_2} q_3^{\delta_3} \left[x_t - (1 - W_t)_{x_{t-1}}\right] \qquad (12)$$

Furthermore, (12) will be as $L$ parameter as in (13) and then simplified as in (14) as follows

$$L = W_t^{\frac{-1}{(\delta_1+\delta_2+\delta_3)}} \beta^{\frac{-1}{(\delta_1+\delta_2+\delta_3)}} \delta_1^{\frac{\delta_2+\delta_3}{(\delta_1+\delta_2+\delta_3)}} \delta_2^{\frac{-\delta_2}{(\delta_1+\delta_2+\delta_3)}} \delta_3^{\frac{-\delta_3}{(\delta_1+\delta_2+\delta_3)}} q_1^{\frac{-\delta_2-\delta_3}{(\delta_1+\delta_2+\delta_3)}} q_2^{\frac{\delta_2}{(\delta_1+\delta_2+\delta_3)}} q_3^{\frac{\delta_3}{(\delta_1+\delta_2+\delta_3)}} [x_t - (1-W_t)x_{t-1}]^{\frac{1}{(\delta_1+\delta_2+\delta_3)}}$$

(13)

$$K = W_t^{\frac{-1}{(\delta_1+\delta_2+\delta_3)}} \beta^{\frac{-1}{(\delta_1+\delta_2+\delta_3)}} \delta_1^{\frac{-\delta_1}{(\delta_1+\delta_2+\delta_3)}} \delta_2^{\frac{\delta_1+\delta_3}{(\delta_1+\delta_2+\delta_3)}} \delta_3^{\frac{-\delta_3}{(\delta_1+\delta_2+\delta_3)}} q_1^{\frac{\delta_1}{(\delta_1+\delta_2+\delta_3)}} q_2^{\frac{-\delta_1-\delta_3}{(\delta_1+\delta_2+\delta_3)}} q_3^{\frac{\delta_3}{(\delta_1+\delta_2+\delta_3)}} [x_t - (1-W_t)x_{t-1}]^{\frac{1}{(\delta_1+\delta_2+\delta_3)}}$$

(14)

Furthermore, these parameter denotes the scales of policy, business, and financial streams. This recommends adding performance effectiveness attributes as correction factors to every scale of the stream. Based on these expressions, the proposed model predicts IT spending to reduce the cost. By the equivalent manner, the parameter$K$ and $J$ will be reviewed as follows:

$$J = W_t^{\frac{-1}{(\delta_1+\delta_2+\delta_3)}} \beta^{\frac{-1}{(\delta_1+\delta_2+\delta_3)}} \delta_1^{\frac{-\delta_1}{(\delta_1+\delta_2+\delta_3)}} \delta_2^{\frac{-\delta_2}{(\delta_1+\delta_2+\delta_3)}} \delta_3^{\frac{\delta_1+\delta_2}{(\delta_1+\delta_2+\delta_3)}} q_1^{\frac{\delta_1}{(\delta_1+\delta_2+\delta_3)}} q_2^{\frac{\delta_2}{(\delta_1+\delta_2+\delta_3)}} q_3^{\frac{-\delta_1-\delta_2}{(\delta_1+\delta_2+\delta_3)}} [x_t - (1-W_t)x_{t-1}]^{\frac{1}{(\delta_1+\delta_2+\delta_3)}}$$

(15)

If $L, K$, and $J$ are multiplied by $q_1$ , $q_2$, and $q_3$ as unit costs correspondingly, it appears as follows:

$$q_1 L = W_t^{\frac{-1}{(\delta_1+\delta_2+\delta_3)}} \beta^{\frac{-1}{(\delta_1+\delta_2+\delta_3)}} \delta_1^{\frac{\delta_2+\delta_3}{(\delta_1+\delta_2+\delta_3)}} \delta_2^{\frac{-\delta_2}{(\delta_1+\delta_2+\delta_3)}} \delta_3^{\frac{-\delta_3}{(\delta_1+\delta_2+\delta_3)}} q_1^{\frac{-\delta_1}{(\delta_1+\delta_2+\delta_3)}} q_2^{\frac{\delta_2}{(\delta_1+\delta_2+\delta_3)}} q_3^{\frac{\delta_3}{(\delta_1+\delta_2+\delta_3)}} [x_t - (1-W_t)x_{t-1}]^{\frac{1}{(\delta_1+\delta_2+\delta_3)}}$$

(16)

$$q_2 K = W_t^{\frac{-1}{(\delta_1+\delta_2+\delta_3)}} \beta^{\frac{-1}{(\delta_1+\delta_2+\delta_3)}} \delta_1^{\frac{-\delta_1}{(\delta_1+\delta_2+\delta_3)}} \delta_2^{\frac{\delta_1+\delta_3}{(\delta_1+\delta_2+\delta_3)}} \delta_3^{\frac{-\delta_3}{(\delta_1+\delta_2+\delta_3)}} q_1^{\frac{\delta_1}{(\delta_1+\delta_2+\delta_3)}} q_2^{\frac{\delta_2}{(\delta_1+\delta_2+\delta_3)}} q_3^{\frac{\delta_3}{(\delta_1+\delta_2+\delta_3)}} [x_t - (1-W_t)x_{t-1}]^{\frac{1}{(\delta_1+\delta_2+\delta_3)}}$$

(17)

$$q_3 J = W_t^{\frac{-1}{(\delta_1+\delta_2+\delta_3)}} \beta^{\frac{-1}{(\delta_1+\delta_2+\delta_3)}} \delta_1^{\frac{-\delta_1}{(\delta_1+\delta_2+\delta_3)}} \delta_2^{\frac{-\delta_2}{(\delta_1+\delta_2+\delta_3)}} \delta_3^{\frac{\delta_1+\delta_2}{(\delta_1+\delta_2+\delta_3)}} q_1^{\frac{\delta_1}{(\delta_1+\delta_2+\delta_3)}} q_2^{\frac{\delta_2}{(\delta_1+\delta_2+\delta_3)}} q_3^{\frac{\delta_3}{(\delta_1+\delta_2+\delta_3)}} [x_t - (1-W_t)x_{t-1}]^{\frac{1}{(\delta_1+\delta_2+\delta_3)}}$$

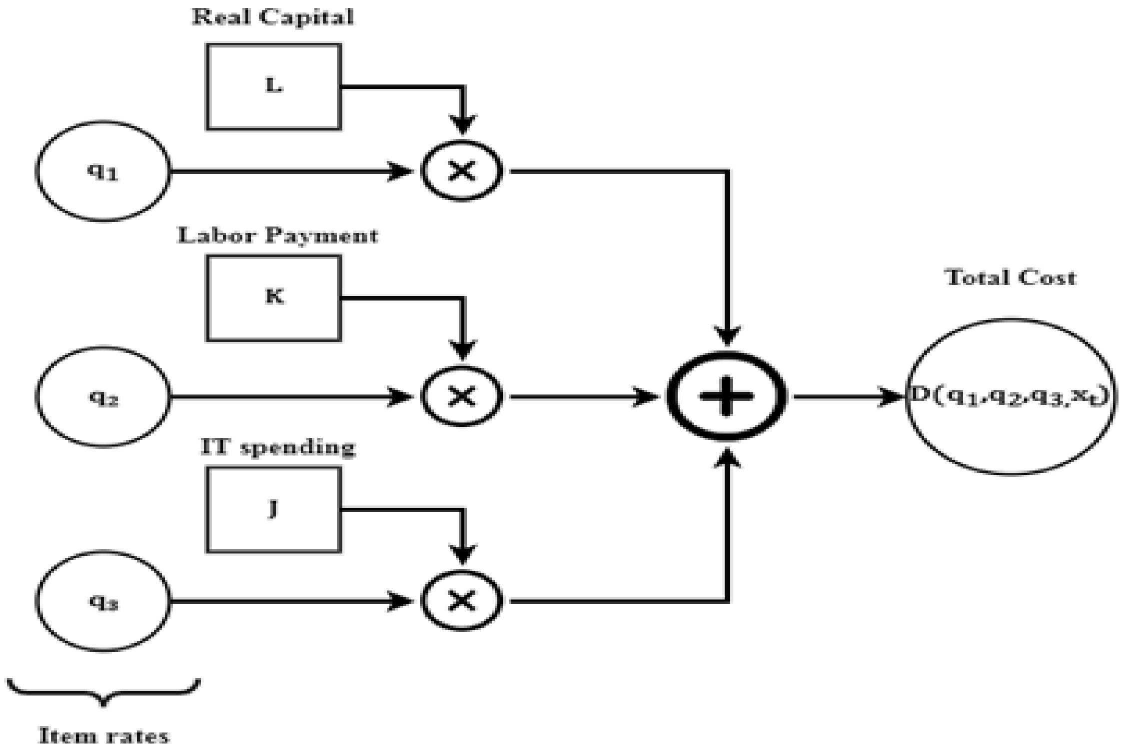
(18)

This factor executes based on the extensiveness of every stream's IT functions in the field's execution. The more complete functions in the implementation, the more effective functions; therefore, it illustrates an index unit. Furthermore, equation (16), (17), and (18) replaced into (19), which is the total cost of resilient$x$ units in the likely low-cost process,

$$D(q_1, q_2, q_3, x_t) = q_1 L + q_2 K + q_3 J$$

$$= A q_1^{\frac{\alpha_1}{(\alpha_1+\alpha_2+\alpha_3)}} q_2^{\frac{\alpha_2}{(\alpha_1+\alpha_2+\alpha_3)}} q_3^{\frac{\alpha_3}{(\alpha_1+\alpha_2+\alpha_3)}} [x_t - (1-W_t)x_{t-1}]^{\frac{1}{(\alpha_1+\alpha_2+\alpha_3)}} \quad (19)$$

**Figure 5: Total Cost**




Where $A$

$$A = W_t^{\frac{-1}{(\alpha_1+\alpha_2+\alpha_3)}} \beta^{\frac{-1}{(\alpha_1+\alpha_2+\alpha_3)}} \left[ \left(\frac{\alpha_1}{\alpha_2}\right)^{\frac{\alpha_2}{(\alpha_1+\alpha_2+\alpha_3)}} \left(\frac{\alpha_1}{\alpha_3}\right)^{\frac{\alpha_3}{(\alpha_1+\alpha_2+\alpha_3)}} + \left(\frac{\alpha_2}{\alpha_1}\right)^{\frac{\alpha_1}{(\alpha_1+\alpha_2+\alpha_3)}} \left(\frac{\alpha_2}{\alpha_3}\right)^{\frac{\alpha_3}{(\alpha_1+\alpha_2+\alpha_3)}} + \left(\frac{\alpha_3}{\alpha_1}\right)^{\frac{\alpha_1}{(\alpha_1+\alpha_2+\alpha_3)}} \left(\frac{\alpha_3}{\alpha_2}\right)^{\frac{\alpha_2}{(\alpha_1+\alpha_2+\alpha_3)}} \right] \quad (20)$$

Figure 5 and equation (20) shows the total cost in IT-based firms, where q1-q2 and q3 are item rates of the real capital L, the labor expense K, and IT expenditure Jseparately. xt indicates the actual output of periodt,xt-1 is is the actual output of prior time t-1 and D denotes the overall cost.

The proposed Non-linear financial intelligence mixed-integer framework (NFIMF) supports cost management with strategic decision making in IT-based business. The experimental results show that the proposed NFIMF method enhances Firms' performance ratio, prediction ratio, efficiency ratio, values, firm profitability ratio, and cost reduction ratio compared to other existing methods.

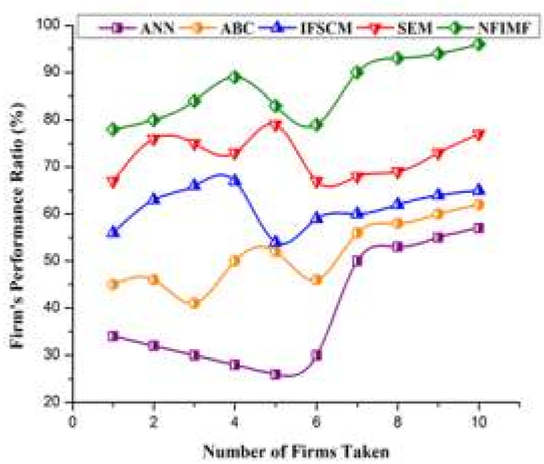
## Results And Discussion

The proposed Non-linear financial intelligence mixed-integer framework (NFIMF) supports cost management with strategic decision making in IT-based business. The study databases for financial management are recognized and based on the selected companies in the Saudi Arabia from all field (https://data.world/finance/saudi-arabia-largest-companies) [23]. The simulation results have been performed, and the performance metrics are Firms' performance ratio, cost reduction ratio, prediction ratio, efficiency ratio, values, and firms profitability ratio.

## Firm's Performance Ratio

There has been significant exposure in recent years to the performance implications of investment in information technology (IT) organizations. The cost factors impacted by such expenditure are examined in this study. The IT automation effect applies to the replacement of service occupations for IT capital. For example, electronic order entry, invoicing, payroll, and other processes whose key goal is to substitute clerical labor with cheaper IT resources and, in the end, achieve lower costs. IT's automated effect is best known in labor savings and local impacts, easier to calculate. IT's knowledge impact refers to IT management's improved control, monitoring, and decision making. The proposed NFIMF method achieves high performance ratio of 98.9%. Figure 6 demonstrates the Firm's Performance ratio using the suggested NFIMF model.

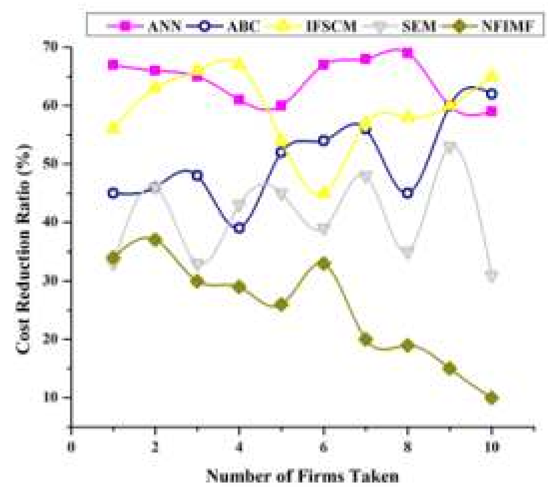
**Figure 6: Firm's Performance Ratio**




## Cost Reduction Ratio

The best prices and conditions for IT consumption, which are to consider requirements, should be obtained when dealing with IT purchases. For this reason, many activities may be carried out, such as acquisition delays, infrastructure maintenance contract negotiations, sales and leasing of equipment, and ability development. Opportunities for IT cost reduction by project control to off-peak hours to minimize capacity and avoid cost overruns related to the processor, freeze IT expenditure on upgrading or new tools provisionally, subsidize cyclical testing software, decrease IT office space, etc. In addition, it strategically carries out total cost leadership in the industry by reducing enterprise costs, product costs, customer costs, etc. Using techniques for helping the business reduce money, such as the need to validate production support levels, each has a link with the corporation, strategic tasks to meet organizational objectives, and consolidating non-standard networks. Moreover, this change should be introduced consistently to control the costs, improve and strengthen the processes incorporated.The proposed NFIMF method achieves cost reduction ratio of 10.1%. Figure 7 demonstrates the cost reduction ratio using the suggested NFIMF model.

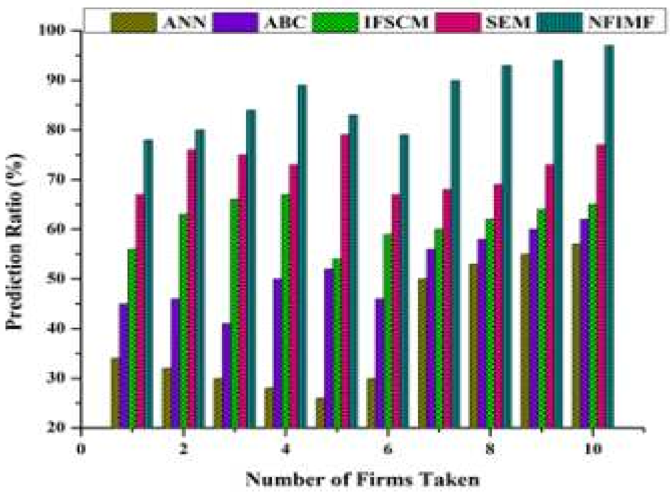
**Figure 7: Cost Reduction Ratio**




### Prediction Ratio

The cost-benefit analysis approach based on financial intelligence estimates the strengths and weaknesses of substitutions utilized to identify options that allow the better method to achieving reimbursements while preserving cost savings (for instance, in activities, transactions, and functional business desires). A cost-benefit analysis may be utilized to compare potential courses of action or to assess the value against the cost of a decision, project, or strategy. It is commonly utilized in commercial transactions, business or strategy decisions, and project reserves. The cost-benefit analysis supports predict whether the benefits of a strategy outweigh its costs, relative to other substitutions.The proposed method NFIMF method achieves prediction ratio of 97.4%. Figure 8 demonstrates the prediction ratio using the suggested NFIMF model.

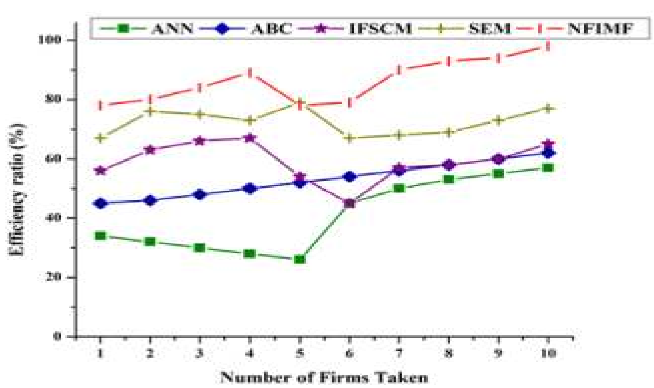
**Figure 8: Prediction Ratio**




## Efficiency Ratio

Cost-efficiency is a type of business efficiency strategy. Valuable terms denote the resource should allow the firm to enhance and implement strategies to increase efficiency and effectiveness. In IT-based firms, the resource can provide the firm to manipulate it efficiently or effectively, intending to no other resources can exchange the original resource. The proposed NFIMF method helps managers make decisions that essentially minimiz edeter minin gappli cable opportunities for investments, sourcing, and deploying non-financial and financial resources in the most efficient manner reliable with the aims of increasingIT value based on risk trade-off.The proposed NFIMF model achieves high efficiency ratio of 96.2%. Figure 9 efficiency ratio using the proposed NFIMF method.

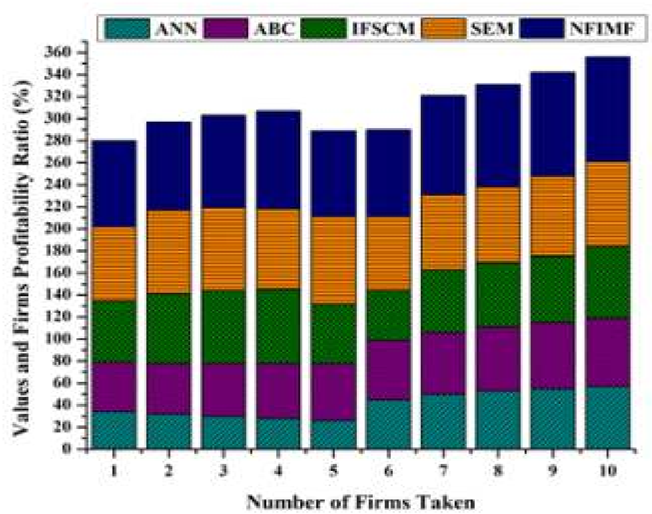
**Figure 9: Efficiency ratio**




## Values and Firm's Profitability ratio

This paper analyzes the IT values that have the highest impact on firm profitability,whichillustrates a profitable firm's organizational innovation. Facilitate innovation in the development of goods or business processes that needs a fundamental transformation of the organization. The results show the domination of business values that are product-related and customer-focused. Moreover, values related to capital, labor expenses play animportant role. The proposed NFIMF method has a high IT-value and Firm profitability ratio of 95.6% when compared to other existing approaches. Figure 10 shows the values and firms profitability ratio using the proposed NFIMF method.

**Figure 10: Values and Firm's Profitability Ratio**




The proposed Non-linear financial intelligence mixed-integer framework (NFIMF) supports cost management with strategic decision making in IT-based business achieves high Firms' performance ratio, prediction ratio, efficiency ratio, values, and firms profitability ratio and cost reduction ratio when compared to other existing Artificial neural network (ANN), activity-based costing (ABC), integrated framework with strategic cost management (IFSCM), Structural Equation Modeling (SEM) methods.

## Conclusion And Future Work

This paper presents the Non-linear financial intelligence mixed-integer framework (NFIMF) to support cost management with strategic decision making in IT-based business. The object of this study is to estimate the IT value using the concept of economic PAV. The approximate solutions form the basis of the engineering material for the IT value study. The PAV method provides a space to measure the IT value business in the time series. This analysis imperatively results in real and visible IT value. The research aims to provide a solution for the IT valuation through value engineering, extracted from two types of evaluations. The proposed model could facilitate cost optimizations of the IT business. The first is the internal value of IT capital held by the IT owner. The second comes from the company IT resources environment, which seeks to hold IT in a corporate context while increasing or reducing the internal IT value depending on the corporate environment's capacity. The proposed artificial intelligence-based or financial intelligence framework provides organizations to develop accounting data towards strategic decision-making and orientation to help the strategic business progressions, evolving the present information supply of financial accounting and integrating the information provided by management accounting. Thus, the accounting data available to businesses' will support their strategic progressions more effectively. The numerical findings show that the proposed NFIMF method achieves high Firms' performance ratio of 98.9%, prediction ratio of 97.4%, an efficiency ratio of 96.2%, values, and a firm's profitability ratio of 95.6% and cost reduction ratio of 10.1% when compared to other existing approaches.

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## Data Availability Statement

Not applicable

**Declarations**

Authors declare that all works are original and this manuscript has not been published in any other journal.

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