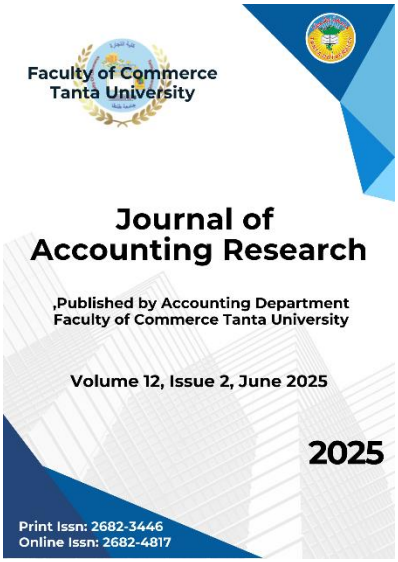

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Developing VBSC-DEA Based Benchmarking for Improving the Firm's Performance with a Case Study

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Abstract

Purpose: In today's fast-paced and shift in the competitive business landscape, continuous improving for a firm's performance efficiency is no longer a nice-to-have, but a must-to-have. Performance benchmarking is a powerful navigational tool for continuous improving a firm's performance efficiency for driving a firm success. This paper proposes a decision model that focuses on unlocking the secrets of success through developing VBSC-DEA based benchmarking model as an approach for transforming a firm's vision into reality. A case study was carried out on five of Banque Misr branches in Tanta city, adopting Banque Misr's ambitious strategy for sustainable growth to support the Egyptian economy and employing the latest trend of performance measurement of throughput measures. The researchers evaluated the feasibility of the model by employing VBSC as an instrument for translating Banque Misr's strategy, identifying the perspectives and the strategic objectives for constructing the VBSC structure, and finally efficiency rating by running DEA for creating a conducted benchmarking.

Design/Methodology/Approach: The researchers adopted 1- The Deductive Approach for deriving the most suitable value and cost based KPIs that would fit within the firm's strategy. The researchers suggested the latest trend in measuring the performance concerning with throughput accounting and its derived KPIs [the researchers selected this trend guided by El-Helbawy, 1995]. 2- The Constructive Approach for developing a proposed model that serves the research objectives. It is a form of problem solving approach for determining the best structure for the real life system and transforming from current state to the desired state, in attempting to construct the VBSC-DEA based benchmarking model for improving the firm's performance efficiency.

Findings: The model allowed for improving a firm's performance efficiency through identifying areas for performance improvement and performance bottleneck, in addition to extracting the frontiers of KPIs as a conducted benchmark on the basis of the latest trend in measuring the performance concerning with throughput trend [input and output performance measurement] and which will be derived from applying VBSC-DEA.

Key Words: Firm's performance efficiency, Performance Benchmarking, Value Based Scorecard, Data Envelopment Analysis.

1- Introduction

The Arena Shifts: The competitive landscape has subtly, yet profoundly, transformed as customers have increasingly showed preference to fast delivery of innovative and high quality yet economical products and services. Performance efficiency is critical aspect of a firm ‘s success and survival. The power of having an efficient firm is more important now than ever. However, many firms struggle to identify areas for improvement and bottleneck in its performance. Therefore, creating benchmarking as a navigational firm’s performance tool for continuously improving it becomes an essential foundation for firms to achieve sustainable competitive advantages and to ensure their survival. This lead to the emergency need to formulate and translate the firm’s strategy into strategic objectives and performance measures taking into account the emergence of multiple performance measures based on value and cost drivers as a cornerstone for achieving the continuous improvement programs, toward supporting the efforts for achieving the mission, objectives, and the firm’s strategy.

2- General Research Framework

2-1. Research Problem

The main research problem lies in answering the question of **how to develop VBSC-DEA based benchmarking for improving the firm’s performance efficiency?** Accordingly, the research problem involves several aspects will be clarified as a follow:

- **The first aspect:** Explaining the role of benchmarking as a navigational tool in improving a firm’s performance efficiency
- **The second aspect:** The importance of VBSC as a value based performance tool with a balanced measurable system for a firm’s strategy
- **The third aspect:** Explaining the unique role played by DEA in extracting the optimal input-output measures [The frontiers]
- **The fourth aspect:** Explaining the importance of developing VBSC-DEA based benchmarking for improving a firm’s performance efficiency

The first aspect: Explaining the role of benchmarking as a navigational tool in improving a firm’s performance efficiency; In today’s fast-paced business environment, a firm that fail to have benchmarking for its performance is like a ship without a rudder, drifting aimlessly without a clear direction. Without performance benchmarking, a firm is unable to see the opportunities for improvement. Performance benchmarking enables a firm to compare its performance measures with those of its peers or best practices for identifying the factors of strength and weakness in its performance, the areas in which the performance is not satisfyingly done comparing to the best practices, and also for identifying the required improvements {El-Helbawy and El-Nashar, 2020}. Performance benchmarking involves setting performance targets and implementing improvements to bridge the gap between current and desired performance levels. Then, having benchmarking for a firm’s performance efficiency is a crucial navigational tool encouraging a firm to engage in continuous improvement which is essential for staying ahead of the curve in the competitive market.

The second aspect: Explaining The importance of VBSC as a value based performance tool with a balanced measurable system for a firm’s strategy; VBSC is an abbreviations to Value Based ScoreCard which is an approach can be employed as a value based performance tool with balanced measureable system for translating a firm’s strategy. It incorporates the value-based business philosophy while creating a link between the scorecard and the ‘value–added’ corporate strategy. VBSC represents an influential relationship between

the perspectives - namely; ***innovation and learning, internal process, stakeholders, and financial*** - based on cost drivers and value drivers, and which means the presence of cost and value based performance measures. This approach focuses on formulating a strategy, linking it to a vision and turning it into particular actions to achieve the strategic objectives. Then, the contribution granted by VBSC is translating a firm's strategy into a set of value and cost based performance measures distributed among the four perspectives. For each of the four perspectives, strategic objectives, CSFs, and KPIs are developed.

The third aspect: Explaining the unique role played by DEA in extracting the optimal input-output measures [The frontiers]; By employing VBSC, the researchers can study value and cost based performance measures. But, by employing it alone, the efficiency cannot be computed and the analysis of the results is difficult. It is also inconvenient to use if the objective to create benchmarking for improving the performance. Therefore, the unique role played by DEA is emerged here. DEA - is an abbreviation to Data Envelopment Analysis - can be used for serving as a tool for benchmarking creation to be proven as a helpful effective tool generating valuable information with ability to deal with the trade-off cases that have been resistant to other approaches. It is a nonparametric approach to frontier estimation, i.e. DEA does not rely on the definition of the specific role that the variables perform to specify the relationships or trade-offs among the performance measures in the calculation of efficiency enabling managers to evaluate any measures efficiently as they do not need to find any relationship or any trade-off that relates to them {Peng Wong and Yew Wong, 2007}. Moreover, DEA utilizes the concept of efficient frontier as an empirical conducted benchmark {Chen et al., 2010}. Accordingly, the contribution granted by DEA is that extracting the frontiers of input and output performance measures which can be considered as a conducted benchmarking. Then, it can be said that DEA is suitable for measuring the best practice of the VBSC indicator.

The fourth aspect: Explaining the importance of developing VBSC-DEA based benchmarking for improving the firm's performance efficiency; Here, we can point out the possibility of benefiting from a cooperative work of VBSC and DEA as a model suitable for identifying the best practice of the firm's performance indicator. That is; VBSC can translate a firm's adopted strategy into set of value and cost based KPIs. The measures created by VBSC will be divided into two groups of inputs and outputs to be used in DEA model. In addition, DEA can utilizes the concept of efficient frontier as an empirical benchmark and identifies the frontiers of input and output of firm's performance measures. The above can be explained through the following figure:

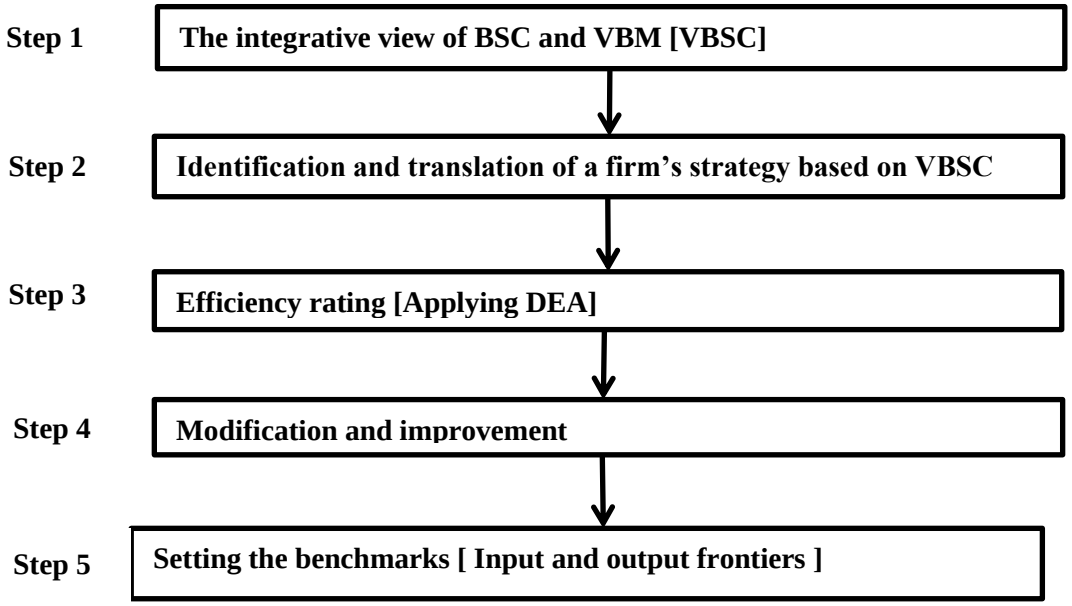

Figure [1]: Proposed framework for developing VBSC-DEA based benchmarking for improving the firm's performance efficiency {The source; the researchers}

2-2. Research Objective

The main objective of this research is to **develop VBSC-DEA based benchmarking for improving the firm's performance efficiency.** This main objective can be achieved through the following:

1- Explaining the role of benchmarking in improving a firm's performance

2- Identifying the importance of using the VBSC as a value based performance tool with a balanced measurable system for a firm's strategy

3- Emerging the unique role played by DEA in extracting the optimal input-output measures [input-output frontiers]

4- Constructing VBSC-DEA model as an approach for creating benchmarking for improving a firm' performance efficiency

5- Applying the proposed model in Banque Misr in Tanta city branches.

2-3. Research Importance

The research importance comes from the contribution of the proposed model with its ability to go along with the competitive arenas shifts. That is; VBSC-DEA model enables a firm for identifying the optimal combination of modified performance measures [input and output measures frontiers] and which means the perfect availability of all engines and drivers of creating benchmarking that will align with the strategic objectives a firm hopes to achieve. Also, providing information enabling a firm form catching the inefficiencies for each input and output measure, thus, helping in determining which input/output measures that need further improvements, and closing the gap in and improving a firm's performance. Moreover, the possibility of providing information help in identifying the performance bottlenecks and granting the opportunity to apply the latest trend in measuring the performance of throughput trend.

2-4. Research Dissertation

In the light of the research problem, its importance, and for achieving its objectives, the researchers will dissertate the paper as follow:

Frist: Literature Review

Second: The General Framework For A Firm's Performance Benchmarking

Third: The VBSC Structure For A Firm's Strategy

Fourth: The DEA Model For A Firm's Performance Efficiency

Fifth: The Proposed Model

Sixth: The Case Study

Seventh: Conclusions, Implications, And Recommendations

3- Literature Review

To provide a backdrop for my review relating to constructing a VBSC-DEA based benchmarking for improving the firm's performance efficiency, the researchers concentrate on a selected number of studies and papers as they have been published by leading journals and cited widely in the research literature. however, this is not an exhaustive list of studies. the researchers classify the previous studies associated with the research topic as follows:

3-1. Studies Related To Improving A Firm's Performance Efficiency: The Role Of Performance Benchmarking As A Navigational Tool

{Tian & Ketsaraporn, 2013} assessed and found the best practices through learning from other firms, competitors, and industry leaders to gain the competitive advantage in global competition. This paper had a more specific aim to contribute to the field of related literature was specially focus on performance benchmarking by separating for four themes. Frist, studying of benchmarking practice. Second, discussion of implementing benchmarking. Third, performance benchmarking for building best practice. Fourth, the case study by analyzing in four dimensions as operation performance, firm performance, business performance, and quality management with five case studies of different industries.

The study founded that each industry has different business characteristics and business environment. In considering similar criteria for performance benchmarking with five case studies founded that, in dimension of operation performance, all five industries focused on flexibility operation and high productivity. In dimension of firm performance, the aim was to improve business processes by reducing cost or meeting customer satisfaction. For dimension of business performance, the emphasis was on human resource development, staff retention and satisfaction and building firm culture. Finally, in dimension of quality management, the focus was on productivity. On the other hand, different criteria founded that each industry was different in operation strategy, business objective and organization strategy. Thus, the results were different and depended on industry characteristic. Thus, the benchmarking can be employed to promote performance directly through identification of practices and performance goals. Furthermore, benchmarking can increase a firm's understanding of its position. Performance benchmarking when applied appropriately can allow to determine why something is better by using a comparison of criteria or indicators as facilitator of improvement focus. Moreover, the most important benefits derived from benchmarking included improved customer satisfaction and improved response time. Therefore, identifying appropriate performance indicators.

{Alosani et al., 2016} investigated the importance of benchmarking as a tool that can enhance a firm's performance and to discuss the most important studies of benchmarking and the nature of problems and obstacles that confront firms during implementation of benchmarking. The researchers mentioned that benchmarking has spread fast and become one of the most used competitive techniques that improve the performance of a firm by identifying, understanding, and adapting good practices. The main use of benchmarking is to find best practices and then trying to apply them for the sake of achieving a firm's goals.

The paper concluded that majority of studies reported that benchmarking affects positively on a firm's performance and it has become an effective performance improvement tool that assists in gaining competitive advantage. It is concluded that benchmarking is an effective tool to accomplish continuous improvements in business operations, where it provides the necessary information, helps to know shortfalls in performance, and sets the priorities that in turn results in achieving a firm's goals.

{Omoregie, 2019} presented an expository review of contemporary views and approaches to benchmarking using gap analysis, given that most outcomes from benchmarking analysis are gap identifications. Graphs and spider charts were used to illustrate the adoption of gap analysis and to demonstrate multi-process/performance benchmarking. It highlighted factors essential for successful benchmarking projects, which include the commitment of people most directly concerned in the activities of the firm. The study also provided some new insights on approaches and tools for benchmarking as a way of improving corporate performance in a measurable way.

The study concluded that benchmarking as a comparison, innovation adoption and improvement method is an essential tool significant to the improvement plan of firms. It assists firms to fast track their innovation pipeline with reducing time and route to market. It helps firms to meet the requirements of their customers at low level of risk and cost.

{Markin et al., 2022} empirically examined the relationship between benchmarking and strategic orientation utilizing the five dimensions of entrepreneurial orientation: risk-taking, innovativeness, pro-activeness, competitive aggression, and autonomy. The researchers examined firm performance implications regarding deviation in key entrepreneurial orientation dimensions from those of top performing firms using a sample in a time period of dismal economic conditions.

The study had valuable theoretical and practical implications that can be used to further understanding of benchmarking, strategic orientation, and entrepreneurial orientation. It founded that the alignment of various dimensions of entrepreneurial orientation with those of top performers are more out-standing than others and that the direction of deviation from the benchmark connotes performance implications.

3-2. Studies Related To Using VBSC As A Value Based Performance Tool With A Balanced Measureable System.

{Faupel, 2012} methodically developed a scorecard that encompasses the implementation of a value based corporate strategy. The VBM and BSC concepts were presented in this study as two of the most influential developments in accounting in the past decades. On the one hand, both concepts are highly popular in both management theory and business practice. On the other hand, renowned academics heavily criticized both concepts. So far, VBM and BSC traditionally been regarded as separate. They are also sometimes considered to be competing business management philosophies. This paper offered an integrative model of VBM and BSC. In this model, the value orientation concept provided the framework in which the scorecard is implemented.

The study founded that considering both concepts side by side enables managers to realize the value based corporate strategy while connecting the scorecard with the corporate strategy value added. In addition, the study founded that the integration has caused a quite a few disadvantages to appear. A comparison of the drawbacks of both concepts will reveal that the specific characteristics of one tool weaken or even invalidate the drawbacks of other.

{Ryzhakina et al., 2016} discussed the implementation of the concept of cost management based on BSC. Integrating VBM concept with BSC becomes more effective due to the formalization of the strategy of financial and non-financial indicators of enterprise value creation. In the process of implementation of strategy aimed at increasing enterprise value, using BSC and factor models, enterprise value indicators are forecasted.

The study's conclusions were the model allowed firms to formulate a value creation strategy and bring it to each employee's attention by the most available and sequential means. Strategy as well as the architecture of processes necessary for performance of this strategy is determined within a strategic management system. The approved strategic objectives were developed up to the level of processes by decomposition of objectives and indicators. At the upper levels of management the target values of indicators were set in the framework of a strategic planning system. So, as a result of integration with BSC, the concept of enterprise value becomes more effective due to: 1- formalization of strategy by using BSC of enterprise value on strategic and operational planning levels; 2- dissemination of strategy at all levels of the enterprise in the process of cascading of BSC on all structural subdivisions; 3- possibility of management of strategy realization process at all levels; 4- the use of non-financial indicators in BSC, which are also involved in the creation of value.

3-3. Studies Related To Using DEA For Measuring A Performance Efficiency

{Neves & Lourenço, 2009} used DEA to analyze the worldwide performance of hotel industry. Two illustrative cases are applied to show the usefulness of DEA for strategic management. The most distinct features of this paper were the use of data from worldwide hotel companies, large sample size, the longitudinal analysis, and the use of two cases operating at different return to scale to show how DEA can be used to drive strategic guidelines to improve the performance.

The paper showed that DEA can be used for strategic design and performance management through analysis of two cases. Additionally, for a sample of 83 hotel companies, there were three main conclusions: a focused strategy performed better than a diversification strategy; for the bulk of the sample, the scale efficiency was higher than the pure technical efficiency, hence, hotel managers should concentrate on productivity improvements; that is how transform inputs to outputs and not on the scale issues such as increase or decrease in the size of operations; and the majority of the hotel companies were operating under decreasing return to scale, which implied that the decrease in the size of the companies would have a positive effect on the average efficiency level of the industry.

{Jain et al., 2011} evaluated the use of DEA for performance measurement and target setting in two real manufacturing firms involved in discrete part of production. For each of the two firms, inputs and outputs of interest to the respective decision makers and coherent with the DEA assumptions were selected. Several DEA models were tested to identify the ones that provided desired discriminatory power and could be validated against the major trends experienced during the respective observation periods.

The paper found that the results useful for decision makers' ability to distil down number of measures to a single efficiency measure with objectively determined weights. It also found value in the identification of peer groups for comparing performance among periods with similar circumstances and for identifying the factors contributing to lower efficiencies. Further discussion indicated strong interest in the potential for target setting customized to the circumstances of a period. The impact of DEA results on decision making has been identified. The capability of setting realistic targets based on the circumstances for a particular period for the manufacturing system has significant opportunity. One option is to execute DEA including the future periods with the scheduled levels of input and output goals. The analysis would indicate if the goals are set realistically or they are overachieving or underachieving based on the system capability as indicated by the past performance.

{Shewell & Migiro, 2016} examined the DEA methodology, and more specifically, the value added DEA model of { Chen and Zhu, 2004 } as a potential means of both linking business support unit performance to overall corporate performance, and allowing for benchmarking of such performance against a set of peers units such that targets for improvement of performance can be established. It examined the benefits of DEA in evaluating the performance of DMUs. The problem identified in establishing business support units as value adding business units. A case was made for applying DEA when evaluating the performance of such business support units.

The study concluded that DEA can identify efficient performers in a given population and, therefore, allowing for benchmarking against the best in class performer. This is as opposed to more commonly used parametric methods. In addition, the findings indicated that in respect of business support units, DEA methodology can allow for the incorporation of intermediate outcomes, which facilitates the measurement of the contribution of these units to overall performance..

3-4. Studies Related To Using VBSC-DEA For A Firm Performance Efficiency

{Najafi & Aryanezhad, 2011} proposed a method to utilize BSC as a tool for designing performance evaluation KPIs of a firm. The researchers presented an integrated BSC-DEA model which included four major strategies of learning and growth, internal process, customer, and financial. These factors were the major KPIs of BSC part. Then, inputs and outputs could be extracted by using BSC and could be measured by using DEA model. This process needs to be executed continuously to help the firm reach its goals. Therefore, by integrating BSC model, in addition to focusing on financial factors as past perspectives, the researchers used three future perspectives indicators for the growth and the importance of DMU capacities to take effective steps. Also, the integrated BSC-DEA has been applied for a real-world as an empirical case for a major private bank and the results were analyzed.

A study concluded that DEA has input and output, but BSC has got multi-viewpoint evaluations and concluded that in DEA, there is no future view, but BSC focuses on future view based on financial perspective which is the result of the past performance and three perspectives of learning and growth, internal processes, and customer. Also, the researchers concluded that the integration of BSC and DEA could improve the overall capabilities of both and it could reduce the faults of each one. In addition, using the proposed BSC-DEA could determine suitable strategies for different branches of banks.

{Haggag, 2016} constructed a model to show how DEA can be integrated and used along with BSC, and to determine the effect of this integration on measuring the efficiency of the performance units. The research used linear programming DEA model to overcome the BSC weak points in addition it used the two approaches of composite unit and efficiency score to apply the model. The researcher tried to introduce the BSC-DEA model in the banking industry, specifically, he applied the model on actual data of six Alex branches of Banque Misr in Egypt.

The research concluded that the proposed model could improve the overall capabilities of both models and it could also reduce the faults of each one. The results of BSC-DEA model showed that banks will be able to identify the potential areas for modification and improvements. Applying the model could help in spotting the areas of inefficiencies regarding each input and output measure. Knowing such piece of information could help in determining which input/output measures need further improvement, and thus helping in improving the efficiency of the branches.

{Horvathova et al., 2019} provided answer for the research problem of Is the DEA a suitable method of measuring and improving the performance of a firm? Is it possible to calculate goal values of the KPIs based on BSC using the DEA results? Is it possible to link the results of BSC and DEA to improve business performance? This paper aimed to find out which financial indicators of the firm are KPIs. The researchers selected the KPIs using BSC principles. These indicators were then applied as inputs/outputs in DEA model. The partial aim was also to propose goal values for selected KPIs.

The study's conclusions were that successful implementation of the BSC-DEA model will achieve results that can be considered highly positive and beneficial. The first step is to identify KPIs using the BSC principles and the second is to use these indicators as input/output values in the DEA model. The advantages of this model was that it uses a combination of several input-output values when evaluating the performance.

4- The Firm's Performance Benchmarking; The Key To Staying Ahead Of The Curve

One of the most important effects of the arena shifts in competitive landscape was the increased awareness of the importance of achieving the continuous improvement, so that, a firm remains in competition and does not exit the labor market. It is also required to identify the factors of strength and weakness in the performance, in comparison with the best practices whether inside or outside a firm. Then, the management of a firm needs for identifying the areas in which the performance is not satisfyingly done comparing to the best practices, and also for identifying the required improvements for supporting a firm's competitive position. Therefore, it is become necessary to use benchmarking in the field of performance evaluation in addition to in the field of performance improvement through simulating the best practices {El-Helbawy and El-Nashar, 2020}.

Initially, benchmarking focused on comparable internal processes for comparing them with the performance of the other firms. Now, benchmarking become focused on and related to CSFs especially related to throughput, resource consumption, defect ratio, process quality, process efficiency, process time {El-Helbawy and El-Nashar, 2020}. Benchmarking can somewhat philosophically be defined as {APQC, 1993 translated from Krishnamoorthy and D'Lima, 2014}: the practice of being humble enough to admit that someone else is better at something, and being wise enough to learn how to match them and even surpass them at it. This definition captures the essence of benchmarking, namely learning from others. The core of the current interpretation of benchmarking is:

- Measurement, of own and the benchmarking partners' performance level, both for comparison and for registering improvements.
- Comparison, of performance levels, processes, practices, etc.
- Learning, from the benchmarking partners to introduce improvements in your own firm.
- Improvement, which is the ultimate objective of any benchmarking study.

In addition to providing useful comparisons with other companies and best practices, firm's performance benchmarking have multi-benefits such as:

- It can be considered as a complementary part for kaizen technique to conduct continuous improvement and reaching to a mechanism for identifying the opportunities for improvements.

- It is more beneficially in the issue of separating between the value- added cost and non-value-added cost. This is on the basis that if the outcomes of processes performance are not good in comparison with the best practices and are not achieving the benchmarking. This may be due to that the process may include activities that do not add value.

- It is necessary for applying ABM and activity analysis because benchmarking can be used as a criterion for activity performance during processing [i.e., speed limit sign] {El-Helbawy, El-Nashar, 2024}.

- Baseline information for goal setting, prioritization, and ongoing performance measurements { Khelil et al., 2010 }.

In conclusion, a firm without performance benchmarking is like a firm stumbling in the dark, lacking direction, wandering aimlessly without a clear sense of direction. Performance benchmarking is a powerful navigational tool for driving a continuous improvements for supporting a firm success. Then, based on what was mentioned, there is an emergency need to translate the firm's strategy into strategic objectives and measures as a cornerstone for achieving the continuous improvement programs. The following figure, illustrates the relationship between the strategy, performance, and performance measures as a benchmarking { El-Helbawy and El-Nashar, 2020; see figure 2 } as follow:

1. The relationship between the firm's strategy and its performance is that the predicted outcome of the firm's performance is that the performance is done in the light of the firm's strategy.
2. The relationship between the firm's strategy and its performance measures is that the measures represent the strategic measurement of performance.
3. The relationship between the firm's performance and its performance measures is that the performance measurement process reflects the strategic measurement of performance.

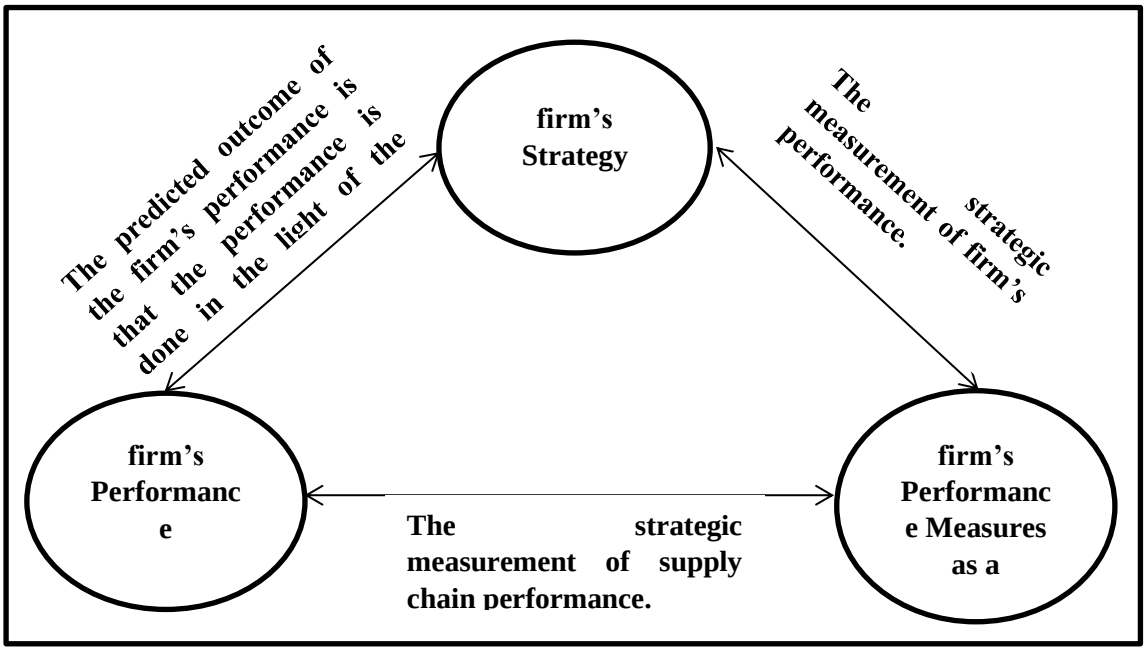

Figure [2]: The relationship between the strategy, firm's performance, and firm's performance measures {El-Helbawy and El-Nashar, 2020}.

The question here is, in the light of current competitive environment, **Is it possible to develop a model enabling the firm to extract the frontiers of KPIs [conducted performance benchmarking] and to identify the areas for performance improvement and performance bottleneck as a cornerstone for achieving the continuous improvement programs, toward supporting the efforts for achieving the mission, the objectives, and the strategy?** The answer of this question is what this paper searched for it.

5- The VBSC Structure For A Firm's Strategy

{Faupel, 2012} indicated that VBSC is developed as follow, firstly, a vision and strategy are formulated. Using this as a basis, strategic objectives are defined. Afterwards, the strategic objectives should be linked via cause-and-effect relations in order to expose any interdependencies for target achievement. The entire scorecard development process serves to derive value based approaches. More precisely, firm-wide objectives need to be identified that can leverage VBM. Also, VBSC should be complemented by industry and firm-specific objectives, key indicators and measures. The vision of VBSC also includes the long-term creation of firm values. A strategy is derived from the firm's mission and vision in the shape of strategic guidelines and is the basis for designing the scorecard. It describes how each detail of the vision should be achieved. In order to fully realize the value based corporate strategy, it is necessary to have a basic understanding of the formal interrelationships associated with value creation. In the line with BSC, it is necessary to transfer the formal implications to a comprehensive concept. Hence first strategic goals must be defined that support value added in the long term. The challenge is deriving non-financial targets, so that actual financial value can be created in the first place.

{Kaplan and Norton, 1996} mentioned that a scorecard makes it possible to substitute or modify individual perspectives. Bearing the value based framework in mind, this option should be exercised. A value perspective should therefore be integrated in addition to the four standard perspectives. To ensure VBSC remain manageable, the internal process and learning and growth perspectives should be merged to form a new process and potential perspective. Adding the new value perspective and merging the two existing ones would again reduce the scorecard to four perspectives. Furthermore, the financial perspectives should be renamed to read financial and investor perspective in order to reflect the importance of investors in this context. In conclusion, the following four perspectives form VBSC {Faupel, 2003}:

1) Value perspective,
2) Financial and investor perspective,
3) Customer perspective,
4) Processes and potential perspective.

However, the researchers suggest that there is no need to merge the internal process and learning and growth perspectives to form a new process and potential perspective. Instead, customer perspective should be replaced by **value or stakeholders perspective**. then, the four perspectives are:

1) Financial and investor perspective,
2) Value/stakeholders perspective,
3) Processes perspective,

4) learning and innovation perspective.

It should be possible to deduce the strategic objectives for each of the perspectives after understanding the value drivers.

6- The DEA Model For A Firm's Performance Efficiency

DEA can be used for serving a firm's performance efficiency to be proven as a helpful effective tool generating valuable information. DEA is a data-oriented approach for measuring the performance of a set of peer entities called SBU, which have the ability to convert multiple inputs into multiple outputs {Cooper et al., 2011}. The interesting thing about DEA is it depends on the frontiers methodology. As, DEA can measure multiple inputs and outputs measures quantitatively and qualitatively, and returning important benchmarking measures for serving a firm's performance efficiency. It does not rely on the definition of the specific role that the variables perform to specify the relationships or trade-offs among the performance measures in the calculation of efficiency enabling managers to evaluate any measures efficiently as they do not need to find any relationship or any trade-off that relates to them {Peng Wong and Yew Wong, 2007}.

DEA is an extreme point method and compares each variable with only the 'best' variable. The basis of DEA is in finding the optimal virtual variable for each real variable. If the virtual variable is better than the original variable, because it either makes more output with the same input or the same output with less input, then the original variable is inefficient. DEA does not require assigned numeric weights or modeling preferences for analysis. However, it is possible to introduce these numeric weights if the information is available, and it is believed to be helpful. DEA model automatically computes weights that give the highest possible efficiency score to a DMU whilst keeping the efficiency scores of all DMUs less than or equal to one under the same set of weights. This helps to prevent the bias of different analysts from influencing the selection of the criteria used in the analysis {Peng Wong and Yew Wong, 2007}.

According to {Lee, 2012}, there are **three directions; input oriented model** that aims at reducing the input amounts by as much as possible while keeping at least the present output levels, and the other, called **output oriented**, maximizes output levels under at most the present input consumption. There is a third choice, represented by the **additive models** that deal with the input excesses and output shortfalls simultaneously in a way that maximizes both. In this topic, the researchers will deal with one approach of DEA, the composite unit approach [minimization]. The researchers will try to introduce and present a formulation of the general form of the composite unit approach {Haggag, 2016}.

6-1. The Composite Unit Approach, [Minimization Approach]

In this approach, a hypothetical composite unit is constructed. This composite unit represents the optimal unit. The inputs and outputs of the composite unit are based on the inputs and outputs of all the operating units with the same goal in the system.

The Conceptual structure of composite unit approach

The conceptual structure of DEA model under the composite unit approach includes {Anderson et al., 2018}:

1. Determine the different operating units.

2. Determine the operating testing unit.

3. Determine the outputs measures and its values to the operating units.

4. Determine the inputs measures and its values to the operating units.

5. Determine weights that will be assigned to each operating unit measure of input or output. To determine the composite unit total inputs or outputs.

6. Make a constraint that the output for the composite unit is greater than or equal to the output measure for the testing unit.

7. Make a constraint that the input of the composite unit is less than or equal to the testing unit input.

8. Determine [E], which will represent the fraction of input available from the testing unit to the composite unit. [E will be minimized].

If E =1: Then the composite unit requires as much as input as tested unit i.e. there is no evidence that the tested unit is inefficient.

If E < 1: Then the composite unit requires less input to obtain the output achieved by tested unit i.e. composite unit is more efficient, thus tested unit is relatively inefficient.

The analytical Structure

The analytical structure of DEA model under the composite unit approach is as follow {Anderson et al., 2018}:

Letting:

j: Index for operating units, where j= 1, 2, …, n.

l: Index for output measures, where 1= 1, 2, …, k.

i: Index for input measures, where 1= 1, 2, …, m.

t: Index for the testing unit.

E: Efficiency index.

$\mathbf{X_j}$**:** Weight will be applied to inputs and outputs for operating units {j}.

$\mathbf{O_{lj}}$**:** Value of output measures {l}, from unit {j}.

$\mathbf{I_{ij}}$**:** Value of input measures {i}, in unit {j}.

$\mathbf{O_{lt}}$**:** Value of output measures {l}, from the testing unit {t}.

$\mathbf{I_{it}}$**:** Value of input measures {i}, in the testing unit {t}.

The output of the composite unit:

The output of the composite unit is determined by computing the weighted average of the corresponding outputs for the entire operating unit.

$$\sum_{j=1}^{n} \mathbf{O_{lj}}\ \mathbf{X_j}$$

The input of the composite unit:

The input of the composite unit is determined by computing the weighted average of the corresponding inputs for all the operating units using the same weights used to determine the output of the composite unit.

$$\sum_{j=1}^{n} \mathbf{I_{ij}}\ \mathbf{X_j}$$

The objective function:

The objective function for this approach is to minimize the value of {E}, which will represent the fraction of input available from the testing unit to the composite unit {E will be minimized}.

Min. E

The constraints

1- The first constraint requires that the sum of the weights applied to be equal one.

$$\sum_{j=1}^{n} X_j = 1$$

2- The linear programming model requires that all the outputs for the composite unit to be greater than or equal to the outputs of the tested unit, {unit being evaluated}.

$$\sum_{j=1}^{n} O_{lj} X_j \geq O_{lt}$$

Where t, j = 1, 2, …, n

l= 1, 2, …, k

3- The linear programming model requires that all the inputs for the composite unit to be smaller than or equal to the resources available to the composite unit, which is a percentage of the input values for the tested units.

$$\sum_{j=1}^{n} I_{ij} X_j \leq E * I_{it}$$

Where t = 1, 2, …, n

i = 1, 2, …, m

4- Non negativity constraint that ensures that all the decision variables in the model are greater than or equal to zero.

$$\text{All } X_j \ \& \ E \geq 0$$

If E = 1: there for the composite unit requires as much as input as tested unit i.e. there is no evidence that the tested unit id inefficient.

If E < 1: there for the composite unit requires less input to obtain the output achieved by the tested unit i.e. the composite unit is more efficient, thus, the tested unit is relatively inefficient.

The overall model

Min. E

Subject to:

$$\sum_{j=1}^{n} X_j = 1$$

$$\sum_{j=1}^{n} O_{lj} X_j \geq O_{lt}$$

Where t, j = 1, 2, …, n
l= 1, 2, …, k

$$\sum_{j=1}^{n} I_{ij} X_j \leq E * I_{it}$$

Where t = 1, 2, …, n
i = 1, 2, …, m

All X_j & $E \geq 0$

7- The Proposed Model

In order to achieve this research objective, this topic will present the following proposed model for improving the firm's performance efficiency.

Step 1

The integrative view of BSC and VBM [VBSC]

The main downside leveled at VBM is that it is rarely applied in business practice. By contrast, BSC is mainly criticized for its insufficient integration into corporate strategy. The integrative view resulting **'Value-Based ScoreCard'** [VBSC] incorporates the value-based business philosophy while creating a link between the scorecard and the 'value–added' corporate strategy. This minimizes a multitude of other critical aspects of both concepts. Then, employing VBSC as a value based performance tool with a balanced measurable system.

Step 2

Identification and translation of firm's strategy

Firm's strategy is identified based on VBSC, which means, translating firm's strategy based on studying the influential relationship between its four perspectives namely; ***innovation and growth, internal process, stakeholders, financial;*** based on **value driver analysis** and **cost driver analysis**. For each of the four perspectives, strategic objectives, CSFs, and KPIs are developed. Therefore, the presence of set of value and cost based performance measures distributed among the four perspectives. The measures will be chosen should be in balance.

Step 3

Efficiency rating [**Running DEA]**

Running DEA as a benchmarking creation tool. Then, the measures created by VBSC will be divided into two groups of inputs and outputs to be used in DEA model. That is DEA does not rely on the definition of the specific role that the variables perform to specify the relationships or trade-offs among the measures.

Step 4

Modification and improvement

Having the results of DEA and identifying inefficiencies, and identifying potential for modification and improvement through the interpretation of the results of DEA. The optimal solution will tell us about the value of objective function E. In addition to the information of the value of objective function, the **complementary slackness** [primal and dual problem] provides some additional information about the efficiency of the evaluated DMU compared to the composite DMU.

Step 5

Setting the benchmarks [Input and output frontiers]

DEA determines the measurement goals and places them as conducted benchmarks for the next performance evaluation. Identifying the gaps and finding out novel methods to not only reduce the gaps but to improve the situations

Figure [3]: Proposed framework for improving a firm's performance efficiency in some details {The Source; the researchers}

7-1. VBSC For Firm's Strategy

VBSC can be used to identify and translate a firm's strategy into set of value and cost based performance measures. Firm's strategy by VBSC is the influential relationship between four perspectives namely; ***innovation and growth, internal process, stakeholders, financial;*** based on value driver analysis and cost driver analysis. Then, employing VBSC as a value based performance tool with a balanced measurable system for a firm's strategy with focusing on linking it to a firm's vision and turning it into particular actions to achieve the strategic objectives. Then, the contribution granted by VBSC is translating the strategic objectives into a set of value and cost based performance measures distributed among the four perspectives. For each of the four perspectives, strategic objectives, CSFs, and KPIs are developed.

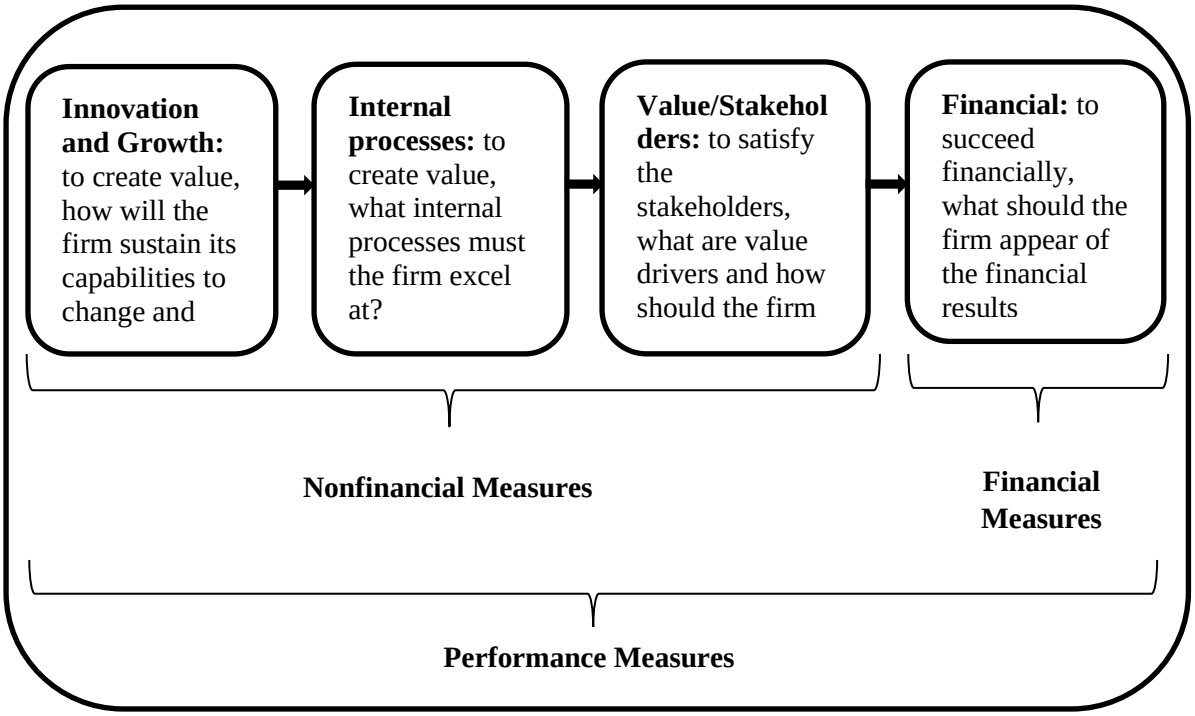

Figure [4]: Value based Scorecard structure {Kaplan & Norton, 1996; emphasis added}

7-2. Identification And Translation Of A Firm's Strategy Using VBSC

A firm's strategy is translated based on VBSC [see figure 5]. The ***strategic objectives*** for each perspective should be formulated. In addition, cause-and-effect relationships between them must be built up. Then, it should be to define the ***critical factors that lead to the success*** of these strategic objectives and have the greatest impact on a firm's performance. CSFs have to be classified by priority. In addition, cause-and-effect relationships between them must be built up, as well as cause-and-effect relationships between the factors and the objectives that these factors influence. Then, ***KPIs [high-level measures involves value and cost measures]*** which measure the degree of accomplishment of strategic objectives and the degree of influence of CSFs on them will be defined.

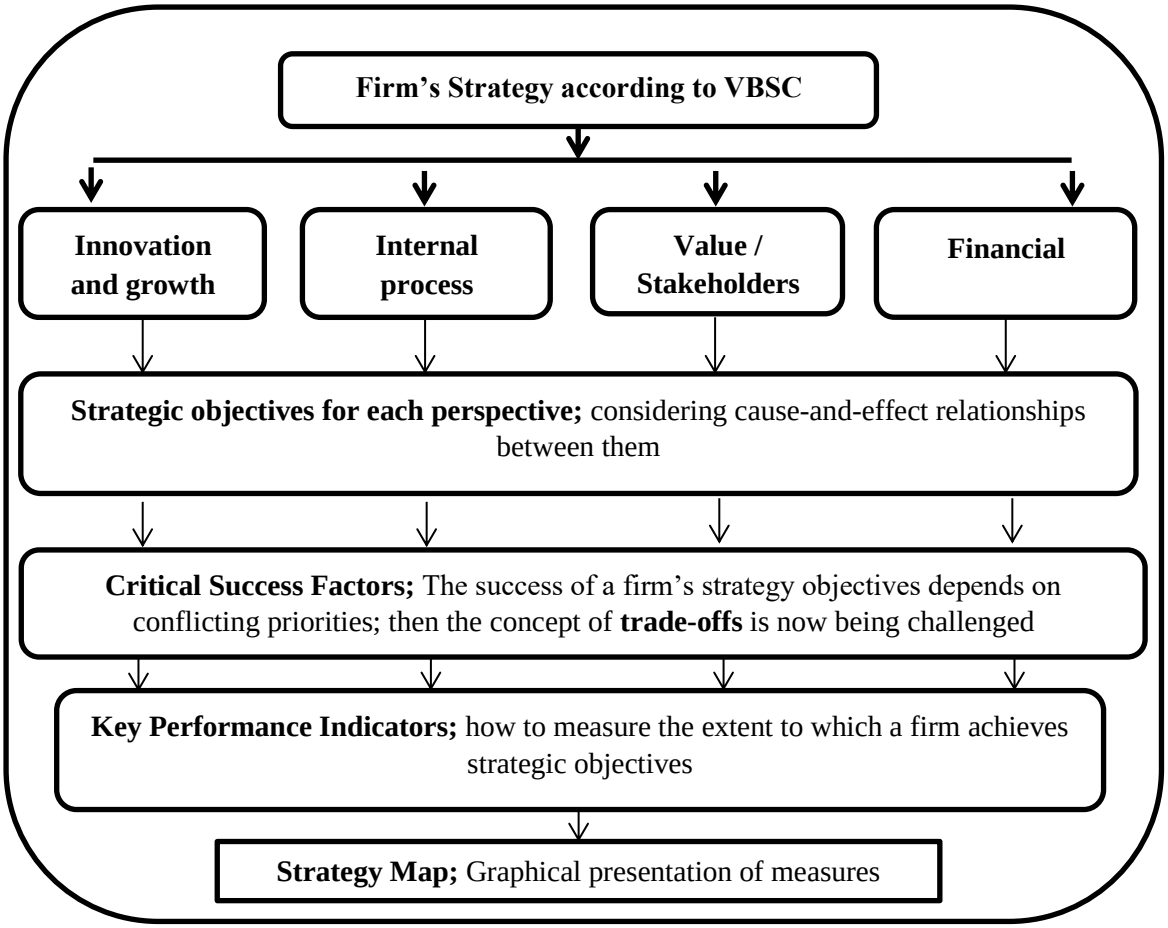

Figure [5]: Firm's strategy translation according to VBSC {Kádárová, et al. 2013; emphasize added}

A well-defined performance KPIs can potentially support identification of performance gaps between a current firm's performance and desired firm's performance. Finally, graphical presentation of measures will be made [strategy map].

7-2-1. Trade-Offs Between Competitive Priorities Of The Firm

The success of the firm's strategy objectives depends on mutually exclusive competitive priorities; to choose between the conflicting priorities, the concept of **trade-offs** is now being challenged. The management of these **trade-offs** involve the optimization of decision variables. Optimization aims to find a solution that is located at some point on the existing trade-off frontier. Competitive priorities in a firm can vary depending on your business model, customer needs, and market conditions, but they usually involve aspects such as **quality, Value, Time, innovation** as follow;

- **Higher value;** producing products or services at lowest possible cost to create value. Thus, the ability of a firm to compete against its competitors based on low price and which means focusing on reducing the costs and eliminating non-value added costs.

- **Higher quality;** the ability to develop high performance design, maintain product or service consistency; which means the product or service developed has superior, high durable, meets exact design specification, error free product release and excellent service.

- **Shorter time;** every minute in the internal process to reduce throughput time. It plays a major role in a firm's performance. Then, focusing on reducing time and eliminating waste of time.
- **Greater innovation;** employing the latest technological techniques for having the ability to introduce new innovative products to market and the ability to improve designs for existing products and introduce products to a new market better than competitors [existing product improvement or new product development].

7-2-2. Trade-Off Matrix

Studying the effect of decreasing one or more key factors and simultaneously increasing one or more other key factors realizing that these factors are opposite [mutually exclusive]. Simply, the opportunity to have critical something, but in order to get that thing, you have to give up, or sacrifice, anther critical something else. For achieving the continuous improvement, it should to classify the conflicting competitive priorities using Trade-off Matrix on two axles; the researchers will focus on four competitive priorities; namely innovation, quality, time, value as follow:

The first; the extent to which a firm depends on measures that align with offering a higher value product or service with shorter time consistently deliver on the agreed due date for achieving the success of its strategic objectives. [KPIs for measuring the achieved value and time]

The second; the extent to which a firm depends on measures that align with providing an innovative and new product or service at the agreed specifications for achieving the success of its strategic objectives. [KPIs for measuring the quality and innovation]

Cell [A]; The combination of measures in that cell provides innovative product or service at the agreed specifications with higher value on the agreed due date, and this means the perfect availability of all engines and drivers of creating benchmarking for improving a firm's performance; it's we can called frontiers.

Cell [B]; The combination of measures in that cell, provides innovative product or service at the agreed specifications but with low value and longer time, therefore, it must to checkup value added and non-value added costs and so too, value added and non-value added time, and focusing on eliminating waste of time and costs. So, it can be converted to the frontier of measures in cell [A].

Cell [C]; The combination of measures in that cell, provides low innovative product or service not at agreed specifications but with higher value on the agreed due date, therefore, it necessary to reconsider in quality control and on the other hand, allowing to allocate a part of resources to innovative opportunities.

Cell [D]; the combination of measures in that cell, provides low innovative products not at agreed specifications with low value and longer time, therefore, these measures must be completely avoided.

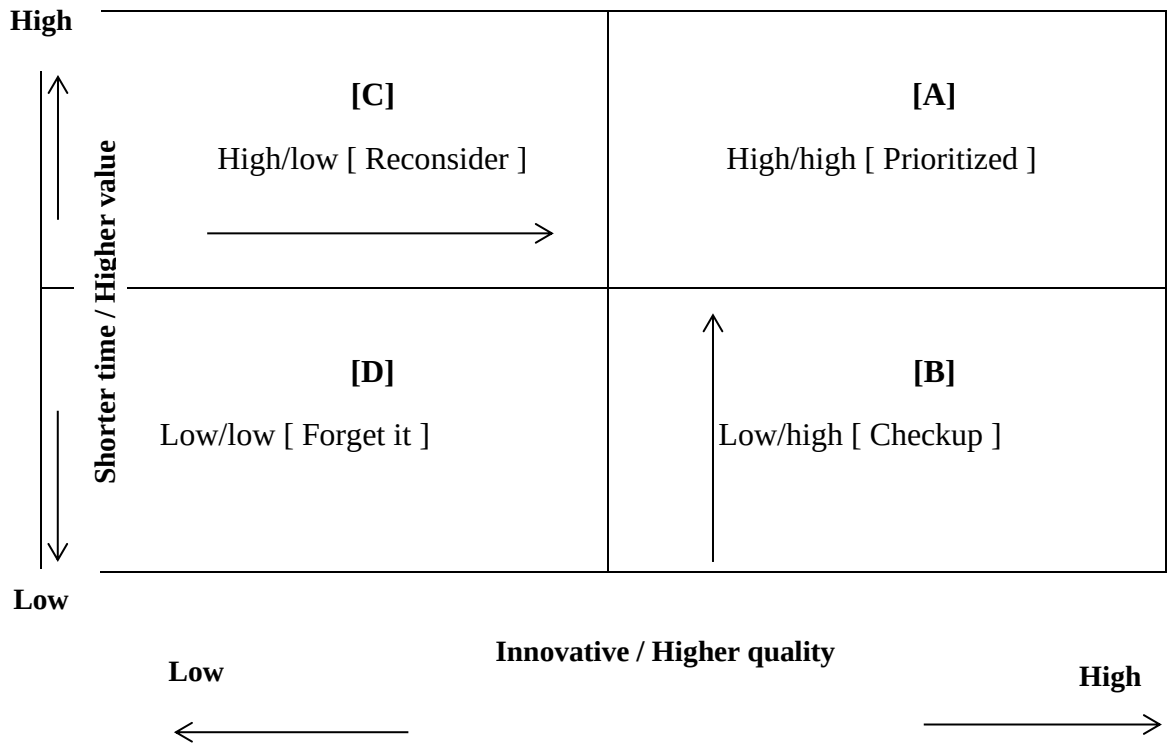

Figure [6]: Trade-Off Matrix {The Source; the researchers}

We can express the above mathematically using the partial differentiation

P = f [I, Q, C, T]

Where;

P = The level of firm's performance.

I = X_1 = Innovation

Q = X_2 = Quality

C = X_3 = Cost

T = X_4 = Time

$$\frac{\partial P}{\partial Xi \neq j} = \frac{\partial}{\partial Xi \neq j} [\, a + \sum_{i \neq j}^{4} b_i X_i X_j \,]$$

7-3 Efficiency Rating: Applying DEA

DEA has been combined with VBSC. That is, DEA is suitable for measuring the best practice of the VBSC indicator. Then, the measures created by VBSC will be divided into two groups of inputs and outputs to be used in DEA model. The researchers will use the measures of first two perspectives [innovation and learning perspective and internal process perspective] as **input measures**, and the measures of the other two perspectives [stakeholders and financial and investor perspectives] as the **output measures** [see figure 7].

- **DEA input measures:** Overview of the various inputs which play role in the value creation process. These are the resources / KPIs that play role in creating value. Those we usually try to minimize such as operating costs
- **Processing:** The central process [the black box] of value creation that occurs within DMU is detailed. It's the core engine that drives a value creation journey.
- **DEA outputs measures:** The results generated through the value creation process. These are KPIs that measure the value created to stakeholders. Those we are usually try to maximize such as throughput.

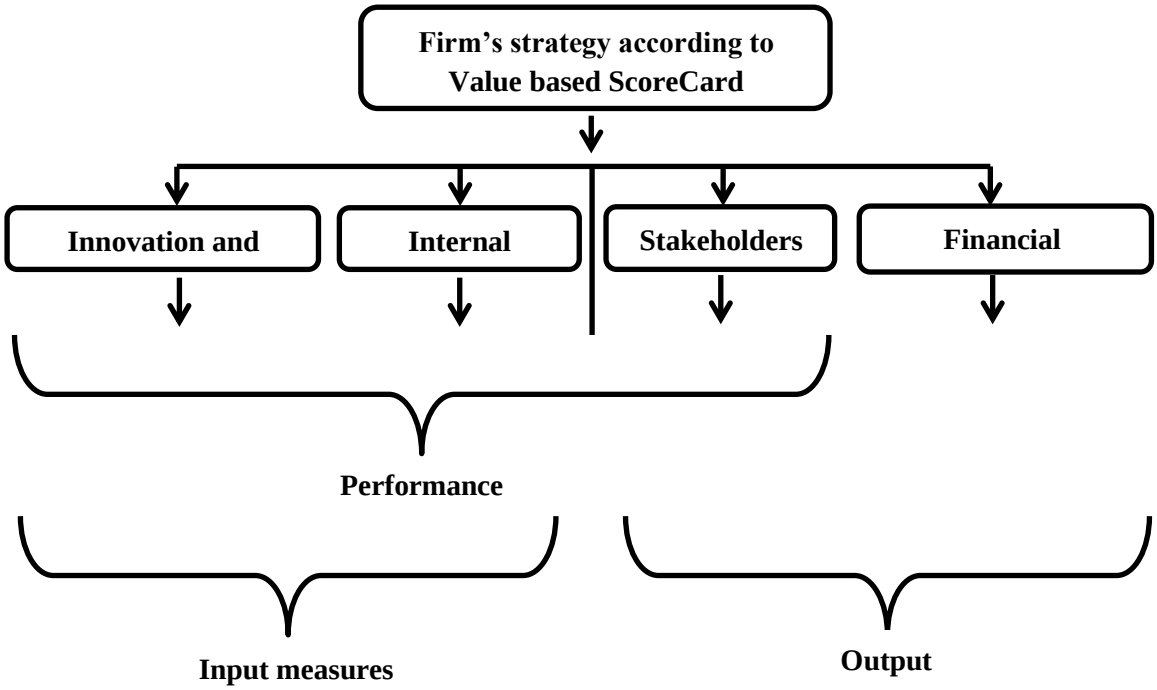

Figure [7]: Efficiency rating for firm's performance according to VBSC {The source; the researchers}

7-3-1. Running DEA For Benchmarking Creation

In the application of DEA, the operating units have multiple inputs as well as multiple outputs. In these situations, it is often difficult to determine which operating units are inefficient in converting their multiple inputs into multiples outputs {Anderson et al., 2016} especially that these inputs and outputs involves Trade-Offs. This particular area is where DEA has proven to be a helpful tool. To illustrate DEA modeling process, the researchers depending on {Anderson et al., 2018} formulates a linear program that can be used for achieving the proposed framework objectives.

In the adoption of **composite unit approach of DEA**, a linear programming model is developed in order to obtain **the best structure for creating a conducted benchmarking** for a firm's performance based on VBSC measures. Using a linear programming model, the researchers construct ***a hypothetical composite unit*** based on contributions given by the outputs and inputs for all operating units with the same goals. Each operating unit [may be a focal firm's branch] has **performance contribution** for each input measure constraint and output measure constraint ranging from 1٪ to 100٪; in other words, each operating unit

contributes a percentage in constructing a composite unit. On the other hand, each **Right Hand Side [RHS]** for each input measure constraint and each output measure constraint represents aspiration level for that constraint [exogenous variable prepared to enter the model as a given; uncontrollable].

Therefore, it can be said that; **" Each operating unit contributes a percentage ranging from 1٪ to 100٪ in constructing the composite unit in order to arrive at the aspired unit ".** In addition, **constraints** in the linear programming model require all outputs for the composite unit to be greater than or equal to a given corresponding outputs for the aspired unit. Also, if the inputs for the composite unit can be shown to be less than the given corresponding inputs for aspired unit, the composite unit is shown to have the same, or more, output for less input. So, **DEA optimal solution** will tell us **" How much a percentage each operating unit will contribute in constructing the composite unit for arriving at the aspired level? "** the optimal solution is the frontiers of input and output performance measures for each operating unit; that is we can called conducted benchmarking!

7-3-2. DEA Linear Programming Model

To determine the weight that each operating unit will contribute in constructing the composite unit, the following decisions variables will be used:

X = Weight applied to inputs and outputs for each operating unit

The DEA composite approach requires that the sum of these weights equal 1. Thus, the first constraint is

$$\sum_{j=1}^{n} X_j = 1$$

Formulation of output constraints

For each output measure, the output for the composite unit is determined based on contributions given by the corresponding output for all operating units by computing a weighted average of the corresponding outputs for all operating units. For each output measure, there is a need to write a constraint that requires the output for the composite unit to be greater than or equal to the corresponding output for the aspired unit. Thus, the general form of the output constraints is:

Output for the composite unit $\geq$ ***Output for the aspired unit***

In similar fashion, formulating a constraint for each of output measures. The output constraints require the linear programming solution to provide weights that will make each output measure for the composite unit greater than or equal to the corresponding output measure for the aspired unit.

Formulation of input constraints

Next, there is a need to consider the constraints needed to model the relationship between the inputs for the composite unit and the resources available to the composite unit. A constraint is required for each input measure. The general form for the input constraints is as follows:

Input for the composite unit $\leq$ ***Fraction of the aspired unit input***

For each input measure, the input for the composite unit is a weighted average of contributions given by the corresponding input for all operating units. In similar manner, writing expressions for each input measure. To complete the formulation of the input constraints, we must write expressions for RHS values for each constraint. First, note that the RHS values are resources available to the composite unit. In DEA approach, these RHS values are a percentage of the input values for the aspired unit. Thus, we must introduce the following decision variable:

E = the fraction of the aspired unit input available to the composite unit

Because of the effect that E has in determining the resources available to the composite unit, E is referred to as ***the efficiency index***. The objective function for the DEA composite approach is to minimize the value of E, which is equivalent to minimizing the input resources available to the composite unit. Thus, the objective function is written as

Min E

7-4. Modification And Improvement

Having the results of DEA and identifying inefficiencies, and identifying potential for modification and improvement through the interpretation of the results of DEA. The optimal solution will tell us about the value of objective function E. In addition to the information of the value of objective function, the **complementary slackness** provides some additional information about the best structure for creating a conducted benchmarking.

7-4-1. The Primal And The Dual Models; The Complementary Slackness

The researchers will depend on the Primal and the Dual Models in order to impose complementary slackness and to obtain the best structure of conducted benchmarking and the complete solution of efficient units being in the reference set of an inefficient unit [see figure 8].

Letting;

j: Index for operating units, where j= 1, 2, …, n.

l: Index for output measures, where 1= 1, 2, …, k.

i: Index for input measures, where 1= 1, 2, …, m.

t: Index for the aspired unit.

E: Efficiency index; the fraction of the aspired unit inputs available to the composite unit [E will be minimized].

$\mathbf{X_j}$**:** Weight will be applied to inputs and outputs for operating units {j}.

$\mathbf{O_{lj}}$**:** Value of output measures {l}, from unit {j}.

$\mathbf{I_{ij}}$**:** Value of input measures {i}, in unit {j}.

O_{lt}: Value of output measures {l}, from the aspired unit {t}.

I_{it}: Value of input measures {i}, in the aspired unit {t}.

Ϭ: a dual variable is derived from the first constraint of the primal model.

U_l: a dual variable related to the second set of constraints in the primal model.

V_i: a dual variable related to the third set of constraints in the primal model.

The primal model	**The dual model**
Min. E Subject to: $\sum_{j=1}^{n} X_j = 1$ $\sum_{j=1}^{n} O_{lj} X_j \geq O_{lt}$ **Where** $l = 1, 2, \ldots, k$ $\sum_{j=1}^{n} I_{ij} X_j - E * I_{it} \leq 0$ **Where** $i = 1, 2, \ldots, m$ **All X_j & $E \geq 0$** **Where** $j = 1, 2, \ldots, n$	Max. $\sum_{l=1}^{k} O_{lt} U_l + Ϭ$ Subject to: $\sum_{i=1}^{m} V_i I_{it} = 1$ $Ϭ + \sum_{l=1}^{k} O_{lj} U_l - \sum_{i=1}^{m} I_{ij} V_i \leq 0$ **Where** $j= 1, 2, \ldots, n$ $V_i , U_l, Ϭ \geq 0$ **Where i = 1, 2, …, m** **l =1, 2, …, k**

Figure [8]: The formulation of primal and dual problem for DEA for obtaining the best structure of conducted benchmarking {source; the researchers}

A first information provided by the complementary slackness is related to **a shadow price value** which is associated with each constraint whether input or output constrain of the model. Generally, if a slack for input constrain \ surplus for output constraint equal to zero, then the constraint is **a binding constraint** and the shadow price have a value which means there are no inefficiencies. On the other hand, if a slack for input constrain \ surplus for output constraint have a value, then the constraint is **an unbinding constraint** and the shadow price equal to zero which means there are areas of inefficiencies. It is the instantaneous change in the objective value of the optimal solution obtained by changing the RHS by one unit. In the other word, if the RHS of a given constraint increases by one unit, what is the impact on the objective function value.

Another information provided by the complementary slackness is related to **an opportunity/reduced cost value** which is associated with each variable of the model. It is the amount by which an objective function parameter would have to improve. If the a reduced cost equal to zero, then there is no evidence about the inefficiency. On the other hand, if the reduced cost have a value, then we need to improve an objective function parameter with the amount of this reduced cost.

Then, the proposed model will contribute in providing information [the optimal solution information for the DEA model] should be used in creating conducted benchmarking

and in improving a firm's performance. From these information are the following [Guided by and formulated on the same approach of El-Helbawy, 1995] ;

1) The optimal value for each input and output measure, i.e. the combination of modified measures in the light of what DEA provides [frontiers], and which means the perfect availability of all engines and drivers of creating benchmarking for improving a firm's performance.
2) Catching the inefficiencies for each input and output measure, and which will be equal to the value of slack / surplus variables related to each input / output constraint thus, helping in determining which input / output measures that need further improvements, and thus, helping in closing the gap in and improving the performance efficiency of a firm.
3) The optimal value of weighted output measures for aspired unit generated by using a fraction of the aspired unit resources available to the composite unit.
4) The possibility of providing information help in identifying the firm's performance bottlenecks – the measures that limit the efficiency - by monitoring and tracking firm's KPIs and allowing them to be compared with the current performance. [Firm's performance bottlenecks will be at the constraints where shadow price is positive].
5) Providing the opportunity to apply the latest trend in measuring the performance which revolves around **three key indicators**:

1. **Maximizing the throughput; the rate of money generation [output measure]** of sold good outputs [products/services], which represent generated money on its way to a firm, and generated by converting supplies and raw materials into sales revenues.
2. **Minimizing the inventory [input measure];** where inventory means the money tied up within the system, it is not limited to products only, but extends to everything that is purchased and can be sold [buildings / equipment /…….]. It is all the money spent by the firm in turning materials into throughput.
3. **Minimizing the operating costs [input measure];** operating costs represent money that is on its way out of a system, and is spent to generate the throughput. [El-Hebawy, 1995; El-Helbawy and El-Nashar, 2024].

The trend of throughput accounting depends on the previous key indicators as well as **derived indicators as follow;**

- **Throughput Time =** the total time a firm takes from receiving materials to delivering finished goods to customers including processing time, inspection time, move time, queue time.
- **Productivity =** Throughput / operating costs **or** total units produced / value added throughput time.
- **Throughput cash flow =** Throughput – inventory – operating costs
- **Net Profit =** Throughput – operating Costs
- **Quality Yield =** Number of good units / Total units produced that is the percentage of products produced that meet the required quality standards.
- **Defect / failure Rate =** Number of defects / Total units produced; that is the percentage of products produced that don't meet the required quality standards.
- **Return on Investment [ROI] =** Net profit / Investment in inventory
- **Inventory Turnover =** Throughput / inventory

7-5. Setting The Firm's Performance Benchmarks

Based on the interpretation additional information generated from the complementary slackness, DEA identifies a set of corresponding efficient units that can be utilized as

benchmarks for improvement for every inefficient unit. The proposed DEA model provides a basis for measuring the continuous improvements in a firm performance over time. The use of the time as a measure of performance, identifying gaps and finding out novel methods to not only reduce the gaps but to improve the situations, so that, the gaps are positive for a firm. For benchmarking to behave the direction of continuous improvement in the relationship between the firm's performance and the time, it is necessary to be based on the differentiation science.

In Case of Linear Function:

$$F[T] = P = a + b\,T$$

Where;

F [T] = The level of firm's performance as function of time.

P = A firm's performance [dependent variable]

T = Time [independent variable]

a = Constant

b = Slop; the rate of change in a firm performance when time changes by one unit.

Thus, the rate of change in a firm performance when time changes by one unit is the derivative of a function which is the rate of change of that same function [see figure 9].

$$\frac{\Delta P}{\Delta T} = \frac{P2-P1}{T2-T1} = \mathbf{b}$$

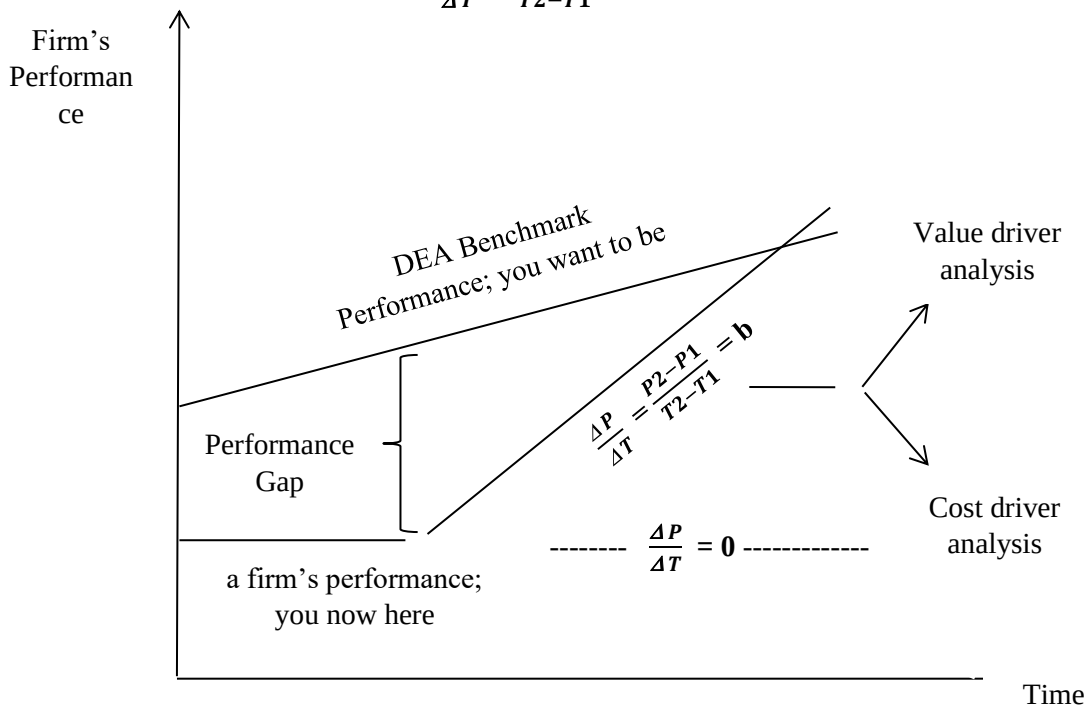

Figure [9]: Benchmarking a firm's performance based on the information provided from the complementary slackness [Linear function] {The source; the researchers}.

In Case of Quadratic Function

$$F[T] = P = aT^2 + bT + c$$

Where;

F [T] = The level of firm's performance as function of time.

P = A firm's performance [dependent variable]

T = Time [independent variable]

c = Constant

a, b = Intercepts

Thus, $\frac{\Delta P}{\Delta T} = \frac{P2-P1}{T2-T1} = \mathbf{2aT + b}$

Then we will differentiate to obtain the second order derivative [the derivative of the derivative = rate of change for the original rate of change] [see figure 10].

$$\frac{\Delta P}{\Delta T} \cdot \frac{\Delta P}{\Delta T} = \mathbf{2a}$$

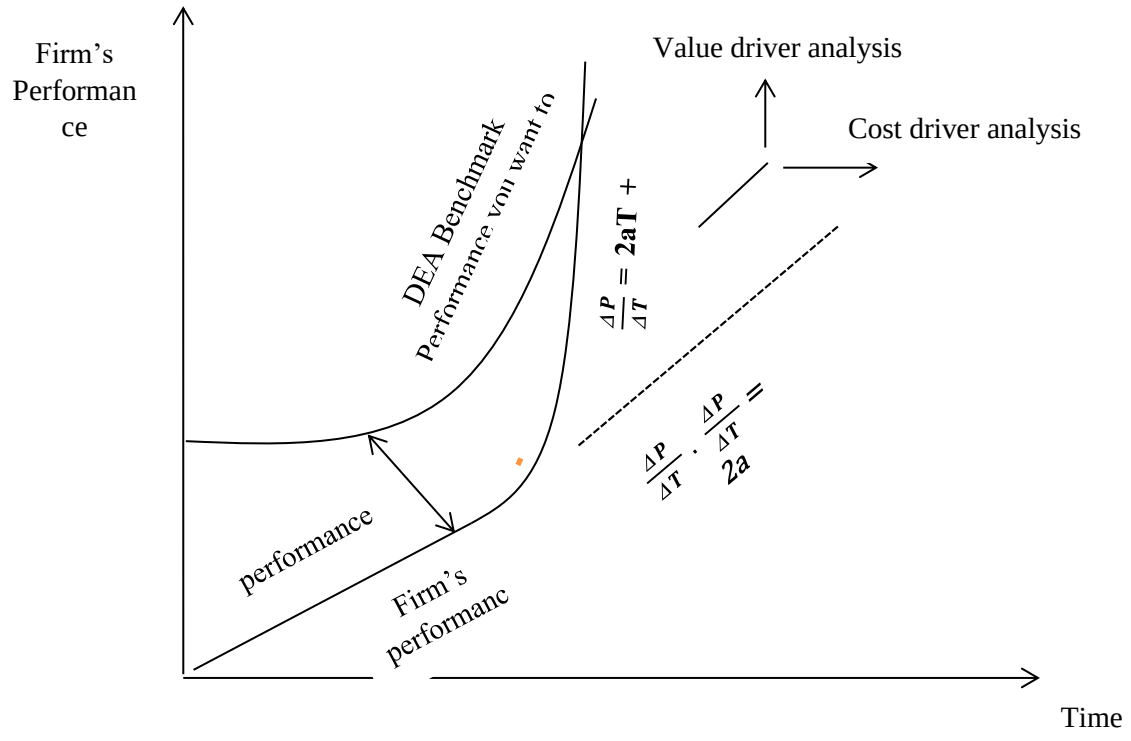

Figure [10]: Benchmarking a firm based on the information provided from the complementary slackness [Quadratic function] The source; the researchers}.

From linear and quadratic charts, once a firm have identified the optimal combination of KPIs [frontiers] using the optimal solution of DEA that align with its strategic objectives, it's vital to track and measure these measures regularly to identify areas of improvements. This involves analyzing data over a period to identify patterns and trends that could indicate any potential issues or opportunities for improvements. And finally, we must be aware of creating benchmarking using DEA for improving a firm's performance efficiency should be based on

studying the influential relationship between its perspectives based on **value driver analysis** and **cost driver analysis**; which in turn, accelerates improvements and changes and emphasizes attaining so-called breakthrough improvements. The performance should be constantly reviewed to identify where improvements can be made. One method is to perform a series of benchmarking tests. Here, it's necessary to note on the concepts of value driver analysis and cost driver analysis.

Cost driver analysis concerned with identifying and giving quantitative values to the causes of costs and deals with the various effects of the causes of costs and the areas of benefiting from studying these effects. In general, the cause of cost represents the factor or event that causes the occurrence of the cost {El-Helbawy and El-Nashar, 2020}. Thus, focusing on which measures drive the least costs for a firm.

Value driver analysis concerned with identifying and giving quantitative values to the causes of value and deals with the various effects of the causes of value and the areas of benefiting from studying these effects. In general, the cause of value represents the factor or event that causes the occurrence of the value {El-Helbawy and El-Nashar, 2020; emphasis added}. Thus, focusing on which measures drive the most value for a firm.

8- The Case Study

In its theoretical aspect, the study concluded that using VBSC-DEA model contributes in providing valued information should be used for a frontier analysis of input and output measures. Therefore, in order to achieve the desired benefit from the study or to link the theoretical study to the field reality, it was necessary to confirm the validity of the results the researchers reached to it in the theoretical part.

Because of the vital role that falls on the banking sector in the wellbeing of the economy and that the weakness of this sector not only jeopardizes the long term sustainability of an economy, it can also be a trigger for a financial crisis, the researchers select the banking sector - specifically Banque Misr's branches in Tanta city- as a case study to apply the proposed model of this thesis. Creating benchmarking for bank's performance efficiency must be an ongoing process and that requires commitment and continues improvement mindset. By proactively identifying frontier of input and output measures, identifying areas for improvements and bottlenecks, and implementing best practices, banks can optimize their operations, boost their competitive edge, and deliver superior value to their stakeholders and the society as whole. Hence, in this topic, the researchers will try to apply the proposed model in order to create benchmarking for improving Banque Misr's performance through deriving the optimal measures from the performance of Bank Misr's branches-specifically Banque Misr's branches in Tanta city.

8-1. Banque Misr Vision, Mission, And Values

Banque Misr's vision is distinguished performance guarantees the leadership. Banque Misr's mission is excellence in fulfilling all of customers' banking needs, maximizing the value of shareholders, inspiring employees' loyalty and playing a leading role in the prosperity and development of Egypt. Banque Misr's core values define who Banque Misr are and how it conduct its business.

8-2. The Research Population And Sample

The researchers apply the proposed model for improving the bank performance on five Bank Misr's branches in Tanta city. Five branches are **[Al-Bahr]** branch [**1**], **[Mohamed Farid]** branch [**2**], **[Down Town]** branch [**3**], **[Al-Fath]** branch [**4**], **[Ali Mubarak]** branch [**5**].

8-3. Data Collection

The researchers used **interviews**, and Bank Misr's **documentary Analysis** as means of data collection.

8-3-1. Interviews

The researchers asked a series of predetermined questions to participants, in person, over the phone, and through online platforms and used open-ended questions because it offer the advantage that the respondents are able to give their opinions as precisely as possible in their own words. The researchers conducted interviews with various categories of Banque Misr officials, including the chief operating officer, the chief finance officer, and the head of human resources. Multiple questions were posed to those groups with the aim of understanding the practical circumstances of the banking sector in general and Banque Misr in particular.

8-3-2. Documentary Analysis

Written documents such as Banque Misr's business and CSR, sustainability, and progress reports, were analyzed by the researchers as a good sources of bank information. Using written documents allowed the researchers to gain a complete picture about Banque Misr's adopted strategy. It also provided the researchers with specific details that support information gathered from interview.

8-4. Where Banque Misr Want To Be ? [Destination]

Banque Misr have adopted a very ambitious strategy focusing on sustainable growth by providing high-quality services and products driven by the customers' needs and by promoting world-class customer experience through diverse innovative channels and solutions and extended local, regional, global presence. It is a fully transformative experience that boosts Banque Misr's role in the national economy and support financial inclusion within Egypt. Banque Misr pursues sustainability as a leading national bank with simultaneous duty to support the Egyptian economy and national strategic objectives while remaining financially viable {Banque Misr's business and CSR report, 2022}.

Banque Misr recognizes the importance of sustainability and its commitment to integrating it into its strategic direction and into its culture and that aligns with the United Nation's Sustainable Development Goals [SDGs]. Indeed, Banque Misr has adopted the culture and principles of responsible banking strategic framework by signing the United Nations Environment Programme Finance Initiative [UNEP FI] on 22 September 2019 in New York to be among responsible banks that conduct their business in accordance with to the SDGs, Egypt vision 2030, and Paris agreement goal. This culture fosters a sense of accountability and ensuring that the bank operates in sustainable manner while generating and prioritizing long-term value for stakeholders and society as a whole {Banque Misr's progress report, 2023}.

Banque Misr is dedicated to value creation for all stakeholders. In pursuit of this goal, the bank has devised a comprehensive strategy that emphasizes mapping out stakeholder needs, concerns, and expectations, as well as employing frameworks for responsible banking. Overall,

Bank Misr's focus on value creation, stakeholders mapping, and responsible banking frameworks demonstrates its commitment to being a responsible and sustainable financial institution. In addition, Bank Misr's vision is focused on achieving and maintaining leadership through their distinguished performance. It places a strong emphasis on providing outstanding customer service, ensuring that their clients have access to a wide range of innovative, high quality financial products and services to meet their unique needs {Bank Misr's progress report, 2023}.

As a trusted partner of choice for wholesale clients in Egypt and beyond, Bank Misr aims to prioritize the needs of their clients at the center of their proposition. This means providing top-notch services that leverage the latest in digital solutions, as well as their extensive local, regional, and international network, to consistently exceed their clients' expectations. To achieve this, Bank Misr recognizes the importance of strategic partnerships, both within their ecosystem and beyond. These partnerships enable them to continuously enhance their offerings and stay ahead of the curve in an ever-evolving industry. Bank Misr desires to provide unwavering of the best possible services to their clients, and their dedication to their vision is what sets them apart from competition.

The bank implements these goals as standards in its policies toward customers, employees, suppliers and services providers, and the society as whole. **In its policies toward customers,** Banque Misr desires to do everything revolving around bringing customer to the front and building mutual profitable relations. It seeks to provide innovative financial products and services designed to promote economic growth and support sustainability that are in best interests to its customers. In addition, Banque Misr seeking to respond quickly to changes of market conditions to provide innovative and impactful solutions, and put customers first in everything the bank dose in the manner that meets customers' evolving needs and drives sustainable growth while delivering positive outcomes for all stakeholders. **In terms of employees,** the bank desires to take proactive steps to educate and empower its employees, actively encourage open communication and freely expression of employees' opinions, and raise any concerns they may have to foster a culture of sustainability. Also, the bank seek to place a strong emphasis on fostering a safe, diverse, and inclusive work environment, with opportunities for professional development and career advancement, all help the bank to continuously improve and evolve. As well as, **the bank works closely with suppliers and service providers** to ensure that they meet its high standards for sustainability to avoid any detrimental influence on its performance. Banque Misr focuses on the suppliers' capacity to deliver quality work to mitigate reputational risks and on the suppliers' adhere to a code of professional and ethical conduct. In addition, Banque Misr guides suppliers to operate responsibly, such as prohibiting child labor and managing hazardous materials. Moreover, Banque Misr seeks to generate a multitude of indirect job opportunities through outsourcing the activities in the areas of IT, HR, ATMs and cash handling,…etc. and it desires to make optimal progress by turning its sustainability commitment into collaborative action. In addition of all the above, Banque Misr recognizes the importance of **giving back to society** and supports initiatives that address social and environmental issues, such as poverty, education, unemployment, and climate change. The senior management standing committees manage Banque Misr's operations as Banque Misr constantly looks toward ensuring a sustainable impact, a self-assessment approach is at the core of its strategy. The executive committee reviews the performance based on adopted goals and is responsible for identifying and tracking the primary impacts and setting forward-looking measures to optimize the positive operational impacts and minimize the negative impacts {Banque Misr progress report, 2023}

8-5. Evaluating The Feasibility Of The Proposed Model

8-5-1. VBSC As An Instrument For The Banque Misr's Strategy

Employing VBSC as an instrument for Banque Misr's strategy with focusing on linking it to the bank's vision and turning it into particular actions to achieve the strategic objectives. Therefore, developing a value based performance tool with a balanced measureable system for Banque Misr's strategy.

8-5-2. Translation Of The Bank's Strategy According To VBSC

Banque Misr's strategy is identified and translated based on VBSC, the following ***four perspectives*** construct Banque Misr's strategy VBSC structure [see table 1]. Under each perspective, the researchers will select KPIs that will align the bank's performance to its strategic objectives and vision. The researchers suggested adopting the latest trend in measuring the performance concerning with ***throughput accounting measures*** [input and output performance measurement] {guided by El-Helbawy, 1995} and that will be a reasonable number of about 3-4 KPIs under each perspective. **Note** that, the standard KPIs are not exhaustive and the bank can therefore add or vary these KPIs to reflect their unique situation or circumstance.

Table [1]: Translating Banque Misr's strategy according to VBSC {Source: the researchers}

Banque Misr's Strategy according to VBSC

Perspective	Strategic Objectives	KPIs
Innovation and Growth	- Fostering a culture of sustainability and encouraging employees contribution to the bank's efforts to become a more responsible institution. - Investing in employee high-level strategic trainings, workshops, and round – table discussions for providing valuable insights and decisions about the bank's sustainability initiatives.	- Banque Misr's Operating Expenses related to Learning and innovation Employee turnover rate
Internal Processes	- Integrating a value driven model into the bank processes to ensure bank-wide commitment to its sustainability goals. - Boosting the latest technology adoption - Optimizing bank's portfolio management	- Bank's Operating Costs related to business processes - Bank's Throughput Time - Failure rate - Bank's Portfolio
Value / Stakeholders	- bringing customers front in everything the bank dose in the manner that meets customers' evolving needs and drives sustainable growth while delivering positive outcomes for all stakeholders. - operating responsibly in order to exceed stakeholders needs and expectations - Making optimal progress by turning its sustainability commitment into collaborative action - boosting Banque Misr's role in the national economy and support financial inclusion within Egypt. - fosters a sense of accountability and ensuring that the bank operates in sustainable manner while generating and prioritizing long-term value for stakeholders and society as a whole	- Customer loyalty and satisfaction score - Social responsibility index
Financial and Investor	- Pursuing sustainability as a leading national bank with simultaneous duty to support the Egyptian economy and national strategic objectives while remaining financially viable - Increasing the bank' money generation, reducing the bank' operating costs and optimizing the Bank's portfolio - Driving sustained and profitable growth	- Bank's throughput rate = rate of money generation - Bank's net profit - Bank's throughput CF - Portfolio turnover

Input measures; minimization

Output measures; maximization

Table[2]; Measures values calculations for each operating unit entering the model as a given {Source: the researchers}

Perspective	Measures Calculations
Learning and Innovation	- **Bank's Operating Expenses related to Learning and innovation such as;** Wages and salaries, resources invested in R&D, training costs, technology adoption, and programs costs, training courses time, innovation introduction time into the market, and other initiatives. - **Employee turnover rate** : [interview question]
Internal Processes	- **Bank's Operating Costs related to internal processes such as;** Expenses incurred in streamlining processes and optimizing efficiency - **Throughput Time** = The total time it takes for financial transactions or services to be processed, from the initiation to the service completion stage [Interview question]. - **Bank's portfolio** Collection of financial assets and liabilities including loans, investments, deposits, bonds, securities, other financial instruments - **Failure rate** = Number of failure times / Total transactions and services processed; that is the proportion of transactions/services that have errors, discrepancies, or require rework such as; The proportion of system downtimes, crashes, other technical failures, and customer's bankruptcy and inability to repay the debt.
Stakeholders	- **Customer loyalty and satisfaction score:** Customer Net Promoter Score [Scoring model] - **Social responsibility index:** stakeholder engagement surveys, data analysis, third party verification such as social audits
Financial and Investors	- **Throughput rate [rate of money generation] = [**Sales Revenue – Truly variable costs] /throughput time related to major bottleneck - **Bank's portfolio Turnover** = bank's throughput / the total value of bank's portfolio. That is the rate at which financial assets within a bank's portfolio are bought and sold during specific period - **Net Profit** = Throughput – Bank's Operating Costs - **Throughput cash flow** = Throughput – Bank's portfolio – Operating costs

8-6-3. Efficiency Rating For The Bank's Strategy According To VBSC

The measures created by VBSC will be divided into two groups of inputs and outputs to be used in DEA model. The researchers will use the measures of first two perspectives [innovation and growth perspective and internal process perspective] as **input measures**, and the measures of the other two perspectives [stakeholders and financial perspectives] as the **output measures**. If we assume that the number of Banque Misr branches in Tanta city, each of which contributes a percentage in constructing the composite unit [SBUs], are equal to [n=5]

and each SBU has [i] input measures and [l] output measures, then the input and output measures as follows:

Title	Sign	Interval
Input measures	I	1, 2, 3, 4, 5, 6
Output measures	L	1, 2, 3, 4, 5, 6
SBUs	J	1, 2, 3, 4, 5

In the adoption of **composite unit approach of DEA**, a linear programming model is developed in order to obtain **the best structure for creating a conducted benchmarking** for Banque Misr's performance based on VBSC measures. First, using a linear programming model, the researchers construct *a hypothetical composite unit*, based on contributions given by the outputs and inputs for all operating units with the same goals.

Each branch of the five branches has performance contribution for each input measure constraint and output measure constraint ranging from 1٪ to 100٪ [weights]; in other words, each branch contributes a percentage in constructing a composite branch and that represents the best performance from each branch for each input and output measure [frontiers; conducted benchmark]. On the other hand, each RHS for each input measure constraint and each output measure constraint represents aspiration level for that constraint set by Federation of Egyptian Banks " FEB" or set by Banque Misr's top management [exogenous variable prepared to enter the model as a given by FEB or Banque Misr's top management; uncontrollable]. Therefore, it can be said that; **" Each branch contributes a percentage ranging from 1٪ to 100٪ in constructing the composite branch in order to arrive at the aspired branch ".**

In addition, **constraints** in the linear programming model require all outputs for the composite bank's branch to be greater than or equal to a given corresponding outputs for the aspired bank's branch. Also, If the inputs for the composite bank's branch can be shown to be less than the given corresponding inputs for aspired bank's branch, the composite bank's branch is shown to have the same, or more, output for less input. So, **DEA optimal solution** will tell us **" How much a percentage each branch will contribute in constructing the composite bank's branch for arriving at the aspired branch? "** the optimal solution is the frontiers of input and output performance measures for each branch; that is we can called conducted benchmarking! Then, in order to reach the best structure and transform from current state [own Banque Misr's performance] to desired state [where Banque Misr want to be as a set by FEB or top management], DEA model will identify the frontiers of input and output measures that align with its strategic objectives that the bank hopes to achieve.

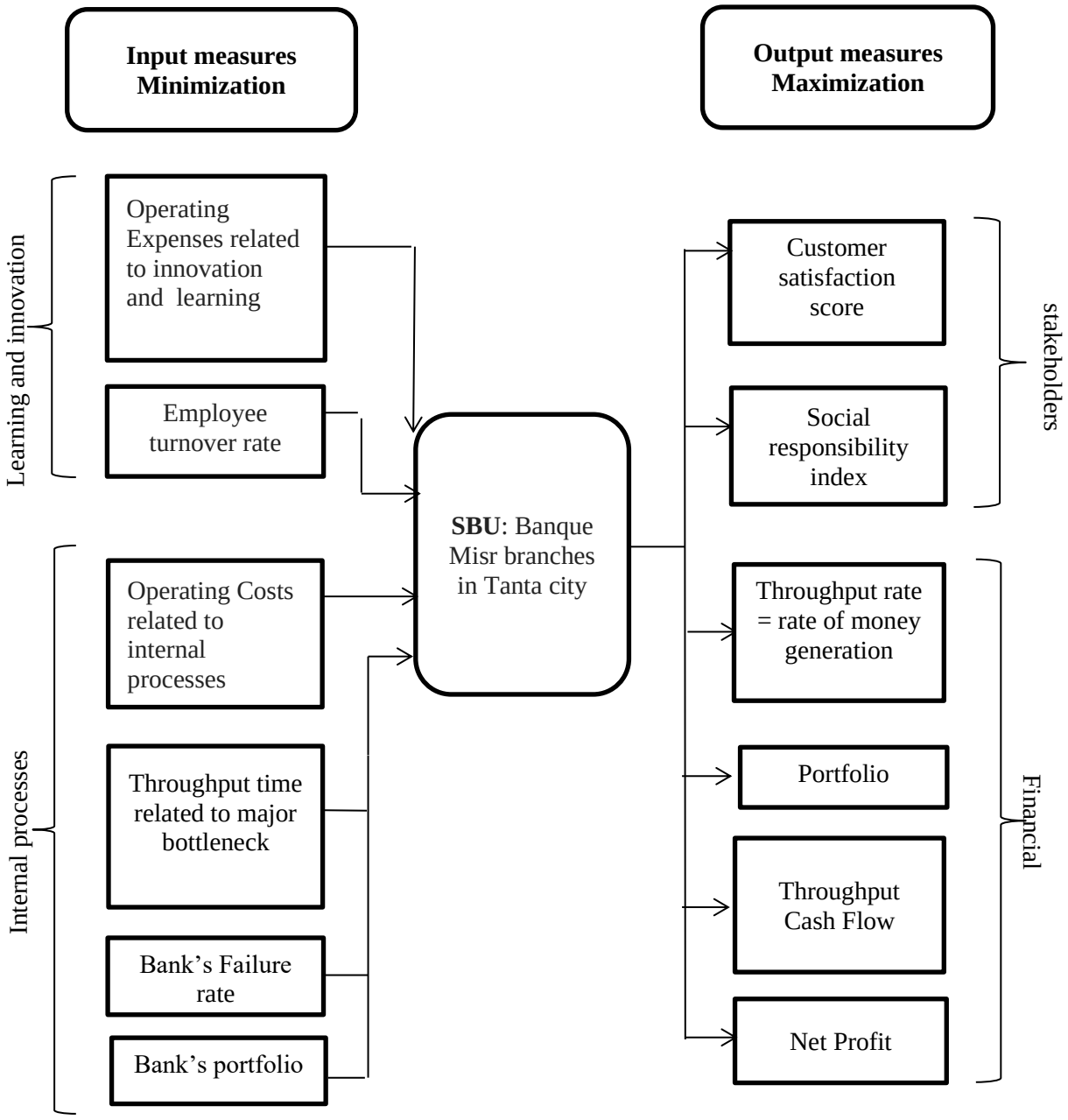

Figure [11]; Input and output measures of DEA model for of Banque Misr's strategy {Source: the researchers}.

DEA Linear Programming Model

To determine the weight or percentage that each Banque Misr branch will contribute in computing the outputs and inputs for the composite branch, the following decisions variables will be used:

X_1 = weight applied to inputs and outputs for [1] bank branch.

X_2 = weight applied to inputs and outputs for [2] bank branch.

X_3 = weight applied to inputs and outputs for [3] bank branch.

X_4 = weight applied to inputs and outputs for [4] bank branch.

X_5 = weight applied to inputs and outputs for [5] bank branch.

The DEA composite approach requires that the sum of these weights equal 1. Thus, the first constraint is

$$X_1 + X_2 + X_3 + X_4 + X_5 = 1$$

1- Formulation of output constraints

For each of the six output measures, the output for the composite branch is determined based on contributions given by the corresponding output for all five branches by computing a weighted average of the corresponding outputs for five branches [percentage contributed by each branch for each output measure in constructing the composite bank's branch; conducted benchmark] and there is a need to write a constraint that requires the output for the composite branch to be greater than or equal to the output for the aspired branch. Thus, the general form of the output constraints is:

Output for the composite bank's branch $\geq$ ***Output for the aspired branch [given and set by FEB]***

Therefore, the output constraints can be formulated as follow:

For customer satisfaction score output measure

[Customer satisfaction score] X_1 + [Customer satisfaction score] X_2 + [Customer satisfaction score] X_3 + [Customer satisfaction score] X_4 + [Customer satisfaction score] X_5 $\geq$ [Customer satisfaction score] for the aspired bank's branch

For Social responsibility index output measure

[Social responsibility index] X_1 + [Social responsibility index] X_2 + [Social responsibility index] X_3 + [Social responsibility index] X_4 + [Social responsibility index] X_5 $\geq$ [Social responsibility index] for the aspired bank's branch

For throughput rate output measure

[Throughput rate] X_1 + [Throughput rate] X_2 + [Throughput rate] X_3 + [Throughput rate] X_4 + [Throughput rate] X_5 $\geq$ for the aspired bank's branch

For throughput cash flow output measure

[Throughput cash flow] X_1 + [Throughput cash flow] X_2 + [Throughput cash flow] X_3 + [Throughput cash flow] X_4 + [Throughput cash flow] X_5 $\geq$ [Bank's throughput cash flow] for the aspired bank's branch

For net profit output measure

[Net Profit] X_1 + [Net Profit] X_2 + [Net Profit] X_3 + [Net Profit] X_4 + [Net Profit] X_5 $\geq$ [Net Profit] for the aspired bank's branch

For portfolio turnover output measure

[portfolio turnover] X_1 + [portfolio turnover] X_2 + [portfolio turnover] X_3 + [portfolio turnover] X_4 + [portfolio turnover] X_5 $\geq$ [portfolio turnover] for the aspired bank's branch

Substituting the values of each output measure for each branch, we obtain the output measures for the composite branch.

2- Formulation of input constraints

Next, for each input measure, the input for the composite branch is a weighted average of the corresponding input for each of the five branches [percentage contributed by each branch for each input measure in constructing the composite branch; conducted benchmark].. Then, for each of the eight input measures, there is a need to write a constraint that requires the input for the composite bank's branch to be less than or equal to resources available to the composite branch [fraction of the aspired branch inputs] . Thus, the general form of the input constraints is:

Input for the composite bank's branch $\leq$ ***Resources available to the composite bank's branch [fraction of the aspired bank's branch inputs]***

In the DEA approach, RHS values are a percentage of the input values for the aspired bank's branch. Thus, we must introduce the following decision variable:

E = the fraction of the aspired bank's branch input available to the composite bank's branch

Because of the effect that E has in determining the resources available to the composite branch, E is referred to as ***the efficiency index***.

If E = 1, the value of input measure available to the composite branch is the same as input measure used by aspired branch. However, if E is greater than 1, the composite branch would have available proportionally more input measure. While, if E is less than 1, the composite branch would have available proportionally fewer input measure.

Therefore, the input constraints can be formulated as follow:

For operating Expenses related to innovation and learning input measure

[Operating Expenses related to innovation and learning] X_1 + [Operating Expenses related to innovation and learning] X_2 + [Operating Expenses related to innovation and learning] X_3 + [Operating Expenses related to innovation and learning] X_4 + [Operating Expenses related to innovation and learning] X_5 $\leq$ [Operating Expenses related to innovation and learning] for the aspired bank's branch E

For employee turnover rate input measure

[Employee turnover rate] X_1 + [Employee turnover rate] X_2 + [Employee turnover rate] X_3 + [Employee turnover rate] X_4 + [Employee turnover rate] X_5 $\leq$ [Employee turnover rate] for the aspired bank's branch E

For operating costs related to business processes input measure

[Operating Costs related to business processes] X_1 + [Operating Costs related to business processes] X_2 + [Operating Costs related to business processes] X_3 + [Operating Costs related to business processes] X_4 + [Operating Costs related to business processes] X_5 $\leq$ [Operating Costs related to business processes] for the aspired bank's branch E

For bank's throughput time input measure

[Throughput Time] X_1 + [Throughput Time] X_2 [Throughput Time] X_3 + [Throughput Time] X_4 [Throughput Time] X_5 $\leq$ [Throughput Time] for the aspired bank's branch E

For bank's Failure rate input measure
For bank's portfolio input measure

[Bank's failure rate] X_1 + [Bank's failure rate] X_2 + [Portfolio] X_1 + [Portfolio] X_2 + [Portfolio] X_3 + [Bank's failure rate] X_3 + [Bank's failure rate] X_4 + [Portfolio] X_4 + [Portfolio] X_5 [Banks failure rate] X_5 $\leq$ [Bank's failure [Portfolio] for the aspired bank's branch E

Substituting the values for the input measures for each branch, we obtain the input measures for the composite bank's branch.

3- Formulation of the objective function

The objective function for the DEA composite approach is to minimize the value of E, which is equivalent to minimizing the input resources available to the composite branch. Thus, the objective function is written as

Min E

If E = 1, the input to the composite bank's branch is the same as input set by FEB" or by Banque Misr's top management. However, if E is greater than 1, the composite bank's branch would have available proportionally more input, whereas if E is less than 1, the composite bank's branch would have available proportionally fewer input.

8-6-4. Modification And Improvement

Having the results of VBSC-DEA and identifying potential for modification and improvement through the interpretation of the results of DEA. The optimal solution will tell us about the value of objective function E in addition to some additional information will be provided by the **complementary slackness**.

8-6-5. Setting The Benchmarks

Based on this optimal solution information, Banque Misr's management can identify a conducted benchmarking for improving the performance efficiency. Also, by focusing on the less productive branches, Banque Misr is able to identify ways to reduce the input resources required without significantly reducing the volume and quality of service. In addition, DEA analysis will provide Banque Misr's management with better understanding of the factors that contribute most to the bank's performance efficiency. Finally, once Banque Misr have identified the input and output frontiers using the optimal solution of DEA that align with its strategic objectives, it's vital to track and measure these measures regularly to identify areas of improvements. This involves analyzing data over a period to identify patterns and trends that could indicate any potential issues or opportunities for improvements.

9- Conclusions, Implications, And Recommendations

9-1. Conclusions

The study concluded that;

- Performance benchmarking is powerful navigational tool for continuously improving a firm's performance.
- Considering VBSC concept enables managers to adopt the strategic value based framework and develops a value based performance management tool with a balanced measureable system. for formulating and translating a firm's strategy.
- DEA with its unique role in identifying the input-output frontiers is extremely required if the objective is to create benchmarking for a firm's performance in light of existing multiple inputs and multiple outputs involving a multiple of trade-offs.
- The proposed model can assist firms in facing the challenges in the competitive landscape. It will contribute in providing information [the optimal solution information for the VBSC-DEA model] should be used in creating benchmarking.
- Creating benchmarking for improving firm's performance efficiency and reaching the peak level of efficiency should be based on studying the influential relationship between its perspectives based on **value driver analysis** and **cost driver analysis**;

which in turn, accelerates improvements and changes and emphasizes attaining so-called breakthrough improvements.

- By harnessing the proposed model in Banque Misr environment, the management can identify the best structure of conducted benchmarking in order to transform from current state to desired state for improving the bank's performance.
- Creating benchmarking for Banque Misr's performance efficiency must be an ongoing process and that requires commitment and continues improvement mindset.
- By proactively identifying frontier of input and output measures, identifying areas for improvements and bottlenecks, and implementing best practices, banks can optimize their operations, boost their competitive edge, and deliver superior value to their stakeholders and the society as whole.

9-2. Recommendations

The researchers provide some recommendations may carry right or wrong as far as she knows for both academics and banking sector to leverage the use of VBSC-DEA based benchmarking. By addressing the needs of both academic and practical spheres, the researchers outline the proposed recommendations that can contribute to the advancement of knowledge.

- **For academics**, interdisciplinary research, publication of their study and findings in reputable academic journals, and presenting them at relevant conferences to contribute to the existing knowledge base on VBSC-DEA-based benchmarking for improving a firm's performance. Also, curriculum development and networking to foster a deeper understanding of VBSC-DEA-based benchmarking and its applications in various industries. These efforts will contribute to the development of skilled professionals.
- **For Banque Misr**, the recommendations emphasize top level management's support for and commitment to the implementation of the VBSC-DEA-based benchmarking process for Banque Misr's. Moreover, encouraging and training employees on continuous improvement culture with adoption of the proposed paper model. The proposed model serves as a roadmap for Banque Misr to maintain its position as a leading financial institution.

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مستخلص

هدف البحث: في ظل الوتيرة السريعة والتحول الذي تشهده بيئة الأعمال التنافسية اليوم، لم يعد التحسين المستمر لكفاءة أداء الشركة أمرًا اختيارًا، بل أصبح أمرًا ضروريًا. يعد استخدام المقاييس المرجعية للأداء كبويصلة السفينة لتحقيق التحسين المستمر لكفاءة أداء الشركة لتحقيق نجاح الشركة و ضمان بقائها. تقترح هذه الدراسة نموذج قرار يركز على كشف أسرار النجاح من خلال تطوير مقياس مرجعي قائم على تطويع نموذج ال VBSC–DEA كنهج لتحويل رؤية الشركة إلى واقع ملموس. وقد تم إجراء دراسة الحالة على خمسة من فروع بنك مصر في مدينة طنطا، وذلك بتبني استراتيجية بنك مصر للنمو المستدام لدعم الاقتصاد المصري وتوظيف أحدث اتجاه لقياس الأداء والمتعلق بمقاييس محاسبة الإنجاز { Throughput Accounting }. و قد قام الباحثون بتقييم جدوى النموذج من خلال توظيف بطاقة الأداء المعتمدة على القيمة VBSC كأداة لترجمة استراتيجية بنك مصر، وتحديد الأبعاد والأهداف الاستراتيجية لبناء هيكل بطاقة الأداء المعتمدة على القيمة، وأخيرًا تم استخدام نموذج ال DEA لإنشاء مقياس مرجعي يتم الاسترشاد به.

منهجية البحث: اعتمد الباحثون 1– المنهج الاستنتاجي لاستخلاص مؤشرات الأداء المعتمدة على التكلفة و القيمة الأكثر ملاءمة والتي تتلاءم مع كل منظور لبطاقة الأداء لاستراتيجية المنشأة. واقترح الباحثون أحدث اتجاه في قياس الأداء المتعلق بمحاسبة الإنجاز ومؤشرات الأداء الرئيسية المشتقة منها 2– المنهج البنائي لتطوير النموذج المقترح لخدمة أهداف البحث. و يعد المنهج البنائي شكل من أشكال مناهج حل المشكلات لتحديد أفضل هيكل لنظام الحياة الواقعية والتحول من الحالة الحالية إلى الحالة المرغوبة، في محاولة بناء مقياس مرجعي قائم على VBSC–DEA لتحسين كفاءة أداء الشركة.

نتائج البحث: قد وجد أن النموذج قد يسمح بتحسين كفاءة أداء الشركة من خلال تحديد مجالات تحسين الأداء واختناقات الأداء، بالإضافة إلى استخلاص الحدود المثلى لمؤشرات الأداء الرئيسية على أساس أحدث اتجاه في قياس الأداء فيما يتعلق باتجاه محاسبة الإنجاز [قياس أداء المدخلات و المخرجات] والتي سيتم استخلاصها من تطبيق VBSC–DEA.

الكلمات المفتاحية: كفاءة أداء الشركة، قياس الأداء، بطاقة الأداء المعتمدة على القيمة، تحليل مغلف البيانات.