

**T.C.  
ISTANBUL AYDIN UNIVERSITY  
INSTITUTE OF SOCIAL SCIENCES**



**A FRAMEWORK FOR ENHANCEMENT OF HUMAN RESOURCE  
PRODUCTIVITY BY USING BALANCED SCORECARDS  
A DECISION BASED APPROACH**

**THESIS  
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**Department of Business  
Business Management Program**

**Thesis Advisor: Assist. Prof. Dr. Nima Mirzaei**

**JUNE, 2018**



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T.C.  
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## **DECLARATION**

I hereby declare that this master's thesis titled as "A Framework for Enhancement of Human Resource Productivity by Using Balanced Scorecards; A Decision Based Approach" has been written by me in accordance with the academic rules and ethical conduct. I also declare that all materials benefited in this thesis consist of the mentioned resources in the reference list. I verify all these with my honor.

**Hamidreza MOHEBBI**





*To those who may benefit from it,,*

## **FOREWORD**

The most significant thing a research can offer is the result of it being publicized, when I started working on balanced scorecard, I thought of it as a human resource framework that utilized the resources the organization already has with the goal of the company. Although this is true, as I learned, business decision making and benchmarking techniques have multiple variables which resulted in a well-constructed study.

Different ideas were added to the initial framework, but the real challenge was the integration of management and decision-making methods. I expanded the project horizon with the help of my supervisor Dr. Nima Mirzaei, I am thankful for his recommendation and suggestions in every step of my project.

I am also grateful to the companies participating in the shaping of my thesis. Especially giving me feedbacks and their words of encouragement. The thesis completion would not have been possible without their help. I also want to give my special thanks to my family for their support and encouragement throughout the completion of my dissertation.

---

**June 2018**

**Hamidreza MOHEBBI**

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## **ABBREVIATIONS**

<b>BSC</b>	: Balanced Scorecard
<b>AHP</b>	: Analytical Hierarchical Process
<b>ROA</b>	: Return on Assets
<b>ROI</b>	: Return on Investment
<b>SBA</b>	: Small Business Administration
<b>CRM</b>	: Customer Relationship Management
<b>TQM</b>	: Total Quality Management
<b>EPS</b>	: Earnings per Share
<b>LGO</b>	: Local Government Organizations
<b>PMS</b>	: Performance Management System
<b>OPM</b>	: Organizational Performance Measurement
<b>BPM</b>	: Business Performance Measurement
<b>KPI</b>	: Key Performance Indicators
<b>PROMETHEE</b>	: Preference Raking Organization Method Enrichment Evaluation
<b>CPM</b>	: Contemporary Performance Measurement
<b>ERP</b>	: Enterprise Resource Planning
<b>MCDM</b>	: Multi-Criteria Decision-Making
<b>HR</b>	: Human Resources

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# **A FRAMEWORK FOR ENHANCEMENT OF HUMAN RESOURCE PRODUCTIVITY BY USING BALANCED SCORECARDS; A DECISION BASED APPROACH**

## **ABSTRACT**

“A chain is only strong as its weakest link”; this is an incredible example of a business unit which is left behind, a production line of which one workstation lags behind, and a service line faces delay. This dissertation presents a conceptual framework that adequately evaluates and controls the productivity process. The research utilizes the Balanced Scorecard (BSC) which is an organizational management tool, and Analytical Hierarchy Process (AHP) to evaluate three company’s performance cycle. The research BSC model contains four perspectives that are Financial, Customer, Internal business processes and Training and innovation. These measures are explicitly defined and categorized using key performance indicators (KPI) for the decision-making purposes. The AHP method is adopted for weighting the BSC criteria and the PROMETHEE method is used to select the best strategy to be implemented in the organization. The conceptual framework of the research integrates the theories of strategic evaluation and management science and divides the model into measurable business objectives to enhance and improve productivity.

**Keywords:** *Performance measurement, Performance Dashboard, PROMETHEE, Human Resource Productivity, Balanced Scorecard, Analytical hierarchy process*

# DENGE SİSTEMLERİNİ KULLANARAK İNSAN KAYNAĞI VERİMLİLİĞİNİN GELİŞTİRİLMESİ İÇİN BİR ÇERÇEVE; BİR KARAR DAYALI YAKLAŞIM.

## ÖZET

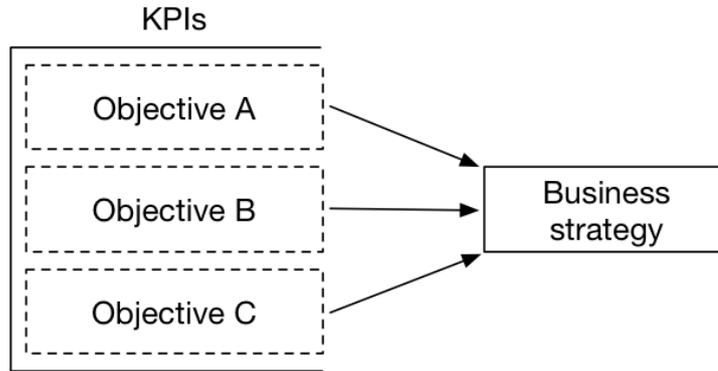
“Bir zincir sadece en zayıf halkası kadar güçlüdür” Bu, geride kalan bir iş biriminin harika bir örneğidir, bir geride kaldığı iş istasyonununla üretim hattı, ve gecikmeli bir servis hattı. Bu fikir, üretkenlik sürecini değerlendiren ve kontrol eden kavramsal bir çerçeve sunar. Araştırma, üç şirketin performans döngüsünü değerlendirmek için bir organizasyonel yönetim aracı olan “Balanced Scorecard (BSC) ” ve “Analytical Hierarchy Process (AHP)” kullanmaktadır. Araştırma BSC modeli, Finansal, Müşteri, İç iş süreçleri ve Eğitim ve yenilik olan dört perspektif içerir. Bu önlemler, karar verme amacıyla "key performance indicators (KPI)" kullanılarak açıkça tanımlanmış ve kategorize edilmiştir. BSC kriterlerinin ağırlıklandırılması için AHP yöntemi benimsenmiştir. PROMETHEE yöntemi, organizasyonda uygulanacak en iyi stratejiyi seçmek için kullanılır. Araştırmanın kavramsal çerçevesi, stratejik değerlendirme ve yönetim bilimi teorilerini birleştirir ve verimliliği arttırmak ve geliştirmek için modeli ölçülebilir iş hedeflerine ayırır.

**Anahtar Kelimeler:** *Performans ölçümü, Performans Gösterge Tablosu, PROMETHEE, İnsan Kaynakları Verimliliği, Balanced Scorecard, Analitik Hiyerarşi Süreci*

## **1. INTRODUCTION**

Organizations are striving to meet the challenges of the rapidly growing competitive market; many factors significantly impact the organizations; these factors can be fluctuation in the prices, lack of competitive advantage and instability which all reduces the companies' edge in generating value and increasing potential risk as a result. The strategic direction of the business is crucial to stockholders as it creates an organizational structure around the industry. Therefore, the future stability of the company rests upon the senior manager who measures and manage the business progress. An implication of a deliberately well-formulated strategy is an organized system which creates a growth mechanism. Therefore, a definition of strategy is critical and understanding the logical explanation indicates clarity in the professional environment.

A comprehensive definition of business strategy is “organization’s direction which has a long-term progress”; the governing strategy ensures the sustainability of the system; although other strategy thinkers such as Peter Drucker and Henry Mintzberg have a different approach. Peter Drucker who is the originator of modern management defines strategy as a theory that helps businesses to gain a competitive edge; moreover, Henry Mintzberg defines strategy as a chain of decision patterns which has a more factual approach (Henry Mintzberg, 2007). Creation of a vision for the organization is an enthusiastic commitment to strategy since no strategy can be curated without purpose procurement. Nevertheless, these objectives should have measurable, attainable, purposeful characteristics, capable of delivering an extensive range of possibilities. Balanced Scorecard (BSC) as a management tool for performance evaluation categorizes these objectives known as key performance indicators (KPI) and assists the organization in implementing the business strategy; this concept is explicitly manifested in Figure 1.1.



**Figure 1.1:** Objectivized Business Strategy

Every strategical decision has a responsive driver, an initiator of change who helps progressive movement, triggering actions and managing change, these incremental adjustments in the long-term radically revolutionize the company. While these principles are sufficient, there is also the factor of speed which initiates accuracy in the processes.

If chosen correctly, KPIs significantly contribute to performance measurement process by focusing on outputs of past activities as well as future performance indicators (Niven, 2014).

This thesis employs quantitative data surveyed and ranked using a fully anchored rating scale from a group of companies in Iran. The survey in the study was adopted from Analytical hierarchy process (AHP) and the weights collected from respondents were analyzed and evaluated. The study is divided into four sections which are perspectives of BSC; these are financial, customer, internal business processes and the learning and innovation perspective; these aspects are the most common measurable attributes that are part of any company ecosystem.

### **1.1 Problem Discussion**

The study is mostly concentrated on performance evaluation and enhancement, the methods that were utilized are Balanced Scorecard (BSC) performance measurement tool and multi-criteria decision-making methods (MCDM).

Senior managers utilize many organizational techniques for managing and accomplishing tasks; these tasks are organized, operated and controlled by performance tools which track activities and highlight mismanagements in the

system. For this reason, performance is a critical tool for any company which if used correctly can be used to avoid obstacles; these obstacles can be due to everlasting constraints in resources or financial issues. Because BSC considers all of the organizational aspects, it has an astounding popularity amongst industrial and business industries. (Kádárová, Durkáčová, & Kalafusová, 2014).

The KPIs are set of metrics that is chosen by the company executive board or brainstormed amongst appropriate members of the company. Although these indicators are of great significance, they should not be used as the primary source of decision-making by the senior managers. It is important that they only begin a discussion that otherwise didn't exist (Manyika, Woetzel, Dobbs, Remes, & Labaye, 2015).

## **1.2 Research Questions**

The study focuses business performance incorporating both management science and organizational performance tools and considers the below research questions,

- How can Balanced Scorecard (BSC) performance tool be utilized and measured?
- What are the differences between BSC and other organizational performance tools?
- Can the Balanced Scorecard (BSC) be incorporated with Multi-criteria decision-making (MCDM) to enhance productivity systematically?
- How do culture and commitment change the overall strategy?

BSC has integrated both financial and non-financial into one overall strategy. Bain & Company report for top 25 management tools & trends shows that BSC is in the 6th place outranking outsourcing and supply chain management (Rigby & Bilodeau, 2015). The objective of this study is to review BSC as a performance measurement tool and benchmarking techniques to prioritize its indicators and developing a model that measures productivity efficiently. Merging both Analytical Hierarchical Process (AHP) and BSC's four perspectives and benchmarking techniques will help to enhance company's strategical Perspectives. This method ensures a weight is given to each aspect and in the future real data at hand facilitates the decision-making

process. The underlying thinking of this research lays upon the assumption that BSC with MCDM integration leads to improved and enhanced performance.

### **1.3 Research Assumptions**

- Customer satisfaction is considered to be related to organizational performance.
- Gaining new customers is assumed to be related to organizational performance.
- Effectiveness and efficiency of internal processes are being thought to be related to organizational performance.
- Competence development through training is being assumed to be related to organizational performance.
- Decreasing unnecessary costs is believed to be related to improving performance.
- BSC and MCDM integration is expected to enhance performance.

### **1.4 Research Limitations**

A group of companies was surveyed, and the data was used accordingly for the research which is enhancing productivity. Limitations of the study are as follows;

- Lack of inside company's data (managerial data), mostly due to confidentiality of financial data which is vital in this research.
- Statistically, in order to have a representation of the entire population, we need a larger sample.
- Not able to find optimal measures suitable for all business cases.
- Time constraint, being unable to exceed the number of companies for the study.

## **1.5 Thesis Outline**

The thesis incorporates five chapters; each contributing to the strategic formation of the study. An initial definition is presented in the first chapter explaining strategy and the idea behind the thesis. Moreover, problem discussion and research limitations will elaborate on the thesis restrictions and purposeful outcomes. In the second chapter, balanced scorecard (BSC) and strategy maps are explained. Which are managerial tools for enhancing decision making. Furthermore, different performance measurement tools are mentioned in order to have a historical overview. Additionally, the data analyzing results are presented in chapter four of the study along with actionable strategy which will consequently make the organization more productive in achieving their goals. The chapter integrates all the values of the study and performs a market research analysis and elaborates on the research hypothesizes model and presents a model for consumers' purchase intention. Lastly, chapter five will encourage further analysis on the study and gives implications for the results of consumers' purchase intention.

## **2. LITERATURE REVIEW**

With the emergence of modern organizations, strategic management and performance measurement gained popularity. Even today, businesses all around the globe have an insatiable need to link these measuring models to their everyday processes (Couto, Vendrametto, Neto, Morais, & Brejão, 2016). To automate their operations and connect activities to other business sectors within their ecosystem.

Being solely dependent on financial performance may jeopardize the quality of the business program, measuring only profit and loss. Kaplan and Norton, “the balanced scorecard” publication in 1992, helped companies implement the framework in their workflow (Kaplan & Norton, 2008). Although this method was first highlighted by Art Schneiderman (Arthur M, 2006), Kaplan and Norton’s article made BSC popular, following the release of their book which made the framework accessible.

In his article named “When is a balanced scorecard a balanced scorecard?”, Soderberg examines the different characteristics of a BSC, and Non-BSC implemented organizations and finds that one category necessary for the functioning of the system in the BSC environment would be senior management involvement in the advancement of the goals (Soderberg, Kalagnanam, Sheehan, & Vaidyanathan, 2011). In this regard, other studies also examined the change principles applied and necessity of management authority overseeing the change (Agostino, 2011).

Within the strategic management ecosystem, a strategy map is an essential tool in BSC (Kaplan & Norton, 2000). The diagram gathers all the information necessary for creating an action plan which breaks down the objectives into manageable and actionable daily tasks (Kim and Mauborgne 2005), Overwhelming the objectives with lots of metrics can be an agonizing experience, slowing down productivity and making processes harder in respect (Wadugodapitiya & Sandanayake, 2010).

With its applied productive nature of considering each departmental section, BSC has the ability to restructure organizational goals and integrate into other tools, one of the tools is Total Quality Management (TQM), an older method that was

introduced thirty years before Balanced Scorecard. In contrast with BSC, TQM focuses more on system level and employee involvement and internal structure rather than focusing on the whole organization (Salem, Hasnan, & Osman, 2012).

Although there are many business performance tools out there, the Balanced Scorecard shows a better picture of corporate strategies based on BSC perspectives. In a study, Huang and Hao-Chen proposed a strategical knowledge-based web-based system of the framework that uses BSC to facilitate decision-making and implement a more intelligent approach to finding better solutions to any difficulty in the implementation of this method (Huang 2009). There are so many processes involved in a business setting that help in managing the organization, but without a growth plan and regular monitoring the productivity, there's no way of measuring success for the enterprise.

Every measuring tool has to be tested before it gains practicality in the corporate setting. These measuring tools have to be precise and globally articulated to generate as much impact as possible. These measuring tools should avoid being a one-sided phenomenon that only considers financial aspects (Taylor & Baines, 2012), although the current measurement methods are more integrated containing lag and lead indicators for long-term strategy, focusing on financial and non-financial metrics. A report on BSC effectiveness consolidates it with many applied studies, from aircraft design to manufacturing that links them to enterprise resource planning (Chand et al. 2005), and to other areas of operations such as logistics and supply chain management (Karpagam 2013).

BSC is not limited in private sector; its applications can be implemented in public sector, although in any implementation there are barriers to consider, which are as follows (Northcott & Ma'amora Taulapapa, 2012).

- Usage of other performance measurement system as an alternative solution to their short-term and long-term goals.
- Size and scalability of the system where these measurements are considered unnecessary in small settings.
- Lack of support from the system which the performance tool was implemented in.

- Lastly, support from the board of management is especially crucial to the smooth transition of the company.

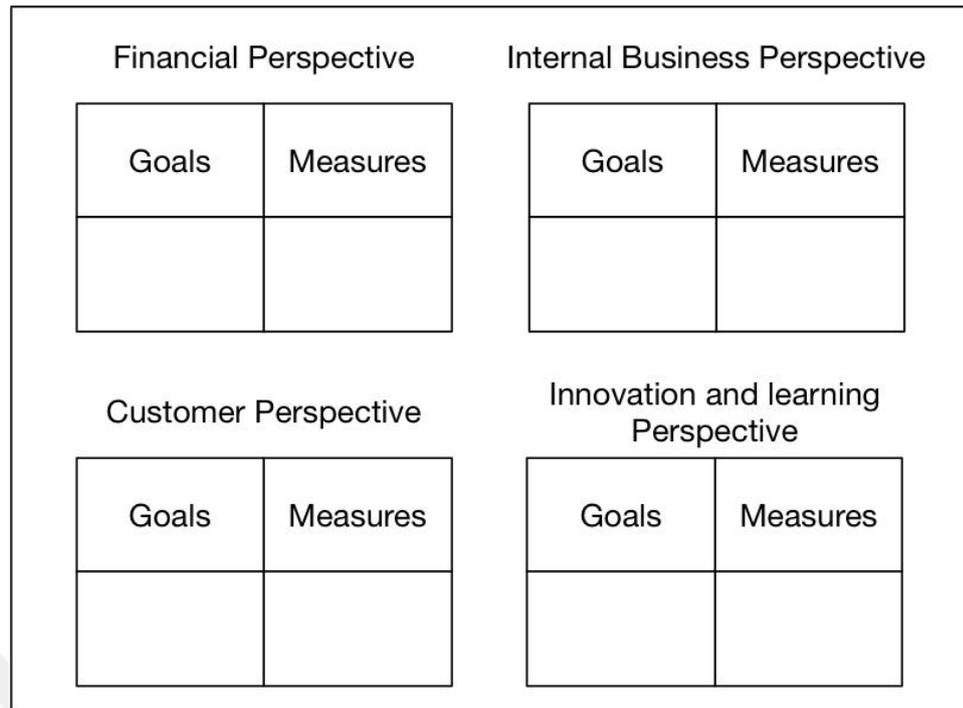
In a study by McKinsey group about productivity, they explained that productivity is not always achieved at the expense of employment (Manyika et al., 2015). There are many factors such as reduction of waste, investments in R&D, that will raise outputs in ways we couldn't imagine before. Productivity is the one accurate measure of efficiency. Whether we are dealing with learning organizations or SBA's or corporate organizations, it is necessary to have a base or benchmark that we can compare ourselves, to not only have a sustainable space but to differentiate ourselves from the competitors.

In all modern societies, one indicator that differentiates enterprises from others is productivity, even as technology advanced, this indicator also adapts itself and gives feedback accordingly. (Jagoda, Lonseth, & Lonseth, 2013)

The perspectives of BSC that are used in this research are: (Gary Dessler, 2016)

- Financial Perspective looks at top level financial objectives and measures to answer the question; "How do we look to our shareholders?" considering the following factors.
- Customer Perspective which focuses on customer satisfaction answering the question "How do our customers see us?" Considering the following factors.
- Internal Processes Perspective is concerned with assessing the processes quality and processes cycle time to identify "How well the business is running?" Considering the following factors
- Innovation and learning perspective determines the necessary skills and training modules required for the successful implementation of company processes.

Figure 2.1 table below shows an overview of the method which will be elaborated throughout the research.



**Figure 2.1:** The Balanced Scorecard

Without a doubt, BSC is one of the most well defined and comprehensive tools in performance measurement toolbox (Rigby & Bilodeau, 2015). Despite the popularity, not much was known about BSC’s practicality and usefulness (Intrafocus, 2015). While the BSC method focuses on outcomes, namely lag measures such as revenues and employee satisfaction, it also emphasizes on long-term strategy and leading performance measures such as time spent with customers which leads to their satisfaction. These two dimensions should be aligned with a defined set of key performance indicators (Taylor & Baines, 2012).

Organizational performance measurement (OPM) is not a new topic; many research has been done on this issue merging the Multi-criteria decision making (MCDM) techniques with business performance measurement (BPM) tools which some of the studies in this topic are mentioned in table 2.1. This research adds to that knowledge with using the performance benchmarking concepts. Moreover, the studies on these topics all have their limitations, an example of this is that senior management who are crucial to the success of the implementation. Concentrating more on the financial aspects of the process and as a result not focusing on employees and stakeholders contribution in the implementation process (Yaghoobi & Haddadi, 2016).

Constructing this framework with MCDM helps in better distinguishing the perspectives by allocating relative weights to the selected measures (Wadugodapitiya & Sandanayake, 2010). Although every organization has its specific indicators for the four aspects, mainly dealing with finance sector, customer section, internal processes held by the company and Learning and innovation which are concerned with employees satisfaction (Agostino & Arnaboldi, 2011). Especially growing their knowledge that they later can better perform and increase the firms' performance that was not possible with their current resources available.

This concept can systematically be applied to an organizational group, but it is necessary that the team employs the accurate Key performance indicators (KPI's) (Maharma, 2014). BPM's ability to monitor and analyze different measures with accuracy is the key to improved insight and as a result better and faster decisions.

**Table 2.1:** Combination of MCDM and BSC

Author	Years	Research topics
Tahere Yaghoobi and Firoozeh Haddadi	2016	Organizational performance measurement by a framework integrating BSC and AHP
Alexandre Veronese Bentes, Jorge Carneiro	2012	Multidimensional assessment of organizational performance: Integrating BSC and AHP
Ali Erbası and Raif Parlakkaya	2012	The use of analytic hierarchy process in the balanced scorecard: an approach in a hotel firm
Ahmad Hasan Maharma and Dr. Yahya Saleh	2014	Developing a business performance management model for PATEL group (using AHP method)
V.N. Sundharam and Vinay Sharma	2014	An integration of BSC and AHP for sustainable growth of manufacturing industries
Antônio André Cunha Callado	2014	Balanced scorecard metrics and specific supply chain roles

## 2.1 Strategy Maps

The dynamic visualized tool is practiced as a complement to the BSC method, and it helps in highlighting the power of measurements as a monitoring tool to better manage and control the systematic processes. With the help of their teams, they brainstorm and verbalize a set of objectives that they think contributes to their success. These goals then are presented in a graphical strategy map that assists them in better executing their strategy. These strategies will translate into actions that the company should communicate them to the team members for them to know what must be done in order to succeed. These actions consist of specific measures in each perspective. A strategic initiative should be defined in the process that aims at purposefully executing the objectives.

Every organization needs to define its vision appropriately, clearly stating its mission or purpose. Performing and creating strategy maps helps us identify and find the company's actionable goals and try to answer the question of "what makes the company different from the competitions?". In another word, "what is their competitive advantage?". Defining a vision will ensure long-term results with an organized framework with specified objectives. Objectives are measurable outcomes in the form of a statement that are simple enough for execution. The whole chain makes sure that value is created and offered to the customer.

Mauboussin from Columbia Business School also suggests starting with these questions. First, we should ask "what objectives you are seeking?", In this case, we want sales expansion and growth, the second question to ask is "what factors should you use for achieving those objectives?". The factors in this study are the balanced scorecard metrics which are selected throughout the process (Michael J. Mauboussin 2012).

Some factors that affect organizational performance include Investment of capital per worker, Research and development, Government regulation (for example setting of minimum wages and social securities or job securities), Energy costs, Employees stability and Environmental influences (N.s. Narahari, k.n. Subramanya, 2015).

Table 2.2 shows the objectives that can be linked to the strategy map which leads to the growth of the shareholders' value, as illustrated every part of the scorecard translates the strategies into objectives.

**Table 2.2:** Corporate Strategy Map

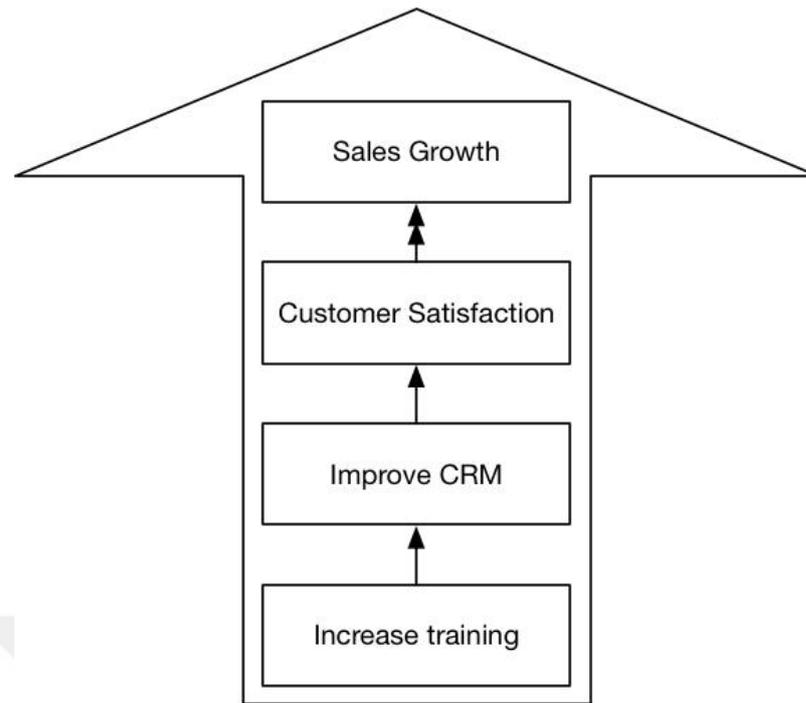
Perspectives	Objectives
Financial	Revenue growth, cost reduction, asset gaining improvement
Customer	Offering high-value solution, creating loyalty programs
Internal process	New products creation, monitoring and evaluating
Training and innovation	Ensuring healthy work environment, talent retention

## 2.2 Relational Effect

The measure and objectives have a causal relational impact; in the BSC case, this means that each criterion affects another essential criterion which leads to a logical mapping of the organization. This cause and effect bond will help to get to the desired outcome with high probability (Salem et al., 2012)

The selected factors in this study also follow these causal relationships which are shown in Figure 2.2. For growing the organization, we must have a growth strategy, in the financial perspective of BSC we consider sales as a strategic objective, we might hypothesize that more customer satisfaction in the customer perspective leads to more sales. In this case, when shifting towards internal processes, we might think of better customer service as a measure of processes or improving customer relationship management (CRM) as an alternative to that. Each of these relational factors leads to other measures that we would not consider if there's lack of perspective on it.

In 1989 through local governmental (LGOs) reforms, Performance management such as BSC was useful for the purpose. But because there were many outcomes, these casual relationships was just a guess. (Northcott & Ma'amora Taulapapa, 2012). This study suggests capturing measures that can be translated to qualitative outcomes. Being unable to build a cause and effect relationships narrows the ability of the selected apparatus and leads to failure of the system.



**Figure 2.2:** Causal Relationship

### **2.3 A Managerial Dashboard**

As dashboards control the efficiency of the operations, BSC focuses on achieving longer period perspectives by mapping strategically and ability to interpret data for better insights and execution in monthly basis. This performance management system is also referred to as PMS that helps management to take better decisions in dealing with everyday problems due to information crises or interpretation of data (Neely et al. 2005) this is the result of accurately selecting the indicators and this is the strategic part of the BSC model.

If we want to increase productivity in today's competitive world, we should use the resources efficiently, use fewer workforce, reduce wastes, decrease product cost, improve quality, increase customer satisfaction, increase motivation and finally increase employees interest in the work they do, which all of these eventually leads to organization expansion.

Organizations with these characteristics or qualities are called learning organizations, in these organizations, the workforce thinks intelligently, work with more creativity and adopt a more systematic attitude. In many organizations, managers are engaged more in routine work whereas they should put more time into planning, directing and

controlling the activities to achieve a more efficient productivity. Most prestigious organizations pay enormous attention to the productivity of human resources, and in return, the workforce plays a prominent role in the improvement of productivity.

In the Journey to improve human resource productivity, researchers believe one cannot provide only one factor. Instead, we should use a combination of causes and then by ranking the identified factors, management can give administrative guidelines for improvement of productivity. To summarize the difference between dashboard and BSC we use the following table 2.3;

Balanced Scorecard	Dashboard
Its purpose is to strategically execute the actions	The purpose is the operational effectiveness
Limited number of measures	Multiple viewpoints
Monthly review of the progress	Real-time intervention

**Table 2.3:** A Distinction Between BSC and Managerial Dashboards

## 2.4 Decision Making Concept

Advancement of organizations and adaptation of managerial practices in the corporate sector created a new field of management science which was used to ease the business problems. Linear programming models were helpful in determining a single objective being maximized or minimized, though companies have more than one objective.

We have an astonishing proximity to the cycle of making decisions, and most alarming characteristics of this process are the cognitive biases that surround it. These biases are the reason why we prefer to join and participate different groups (Kahneman, 2011) if confronted by a win-lose situation, we prefer the solution with lower rates of biases.

There are many techniques of multi-criteria decision techniques to consider, each having their advantages and limitations (shiwoei, 2013), this research focuses on performance benchmarking integrated with Analytical Hierarchical Process (AHP) for Balanced Scorecard (BSC) with the aim of minimizing the costs and increasing the performance.

## **2.5 Measuring Performance**

To make a logical decision, managers use various tools that boost speed and accuracy. Performance measurement needs a progressive system of metrics; that is a group of parameters each measuring one critical feature of our performance tool. Each company has its own creative way of defining the metrics; But it is essential to choose SMART performance objectives, these goals should be selected at the start of rating process (Pulakos & O'leary, 2011)

- The performance measures should be specific, and they should be synced with expectations.
- The performance metrics should be measurable, driving the employees to better results and toward better objectivity for the organization.
- The organization has to communicate attainable expectation to the employees to remove unfair subjectivity from the equation.
- The process in which we accomplish our goals should be itself result-oriented.
- Ensuring support for the system: objectives should be measured in deadlines or due dates (time-sensitive)

The SMART objectives ensure that the whole system should facilitate the organizational performance. The organization passionately adopts the practice of performance measurement, but this is not enough, the new management system should be implemented correctly, and it should integrate into the organization's culture.

The performance management systems that failed to establish a successful strategical process were either due to not having useful feedback or because of lack of devotion of attention from the managerial role to employees. These failures will result in an unsuccessful implementation of the system (Pulakos & O'leary, 2011). Other

obstacles also can be mentioned such as shortage of capital resources; this means if the system expects an implementation of a software platform concentrating on the system's needs, it should be also affordable for the SBA's. One more barrier is the misconception about the PMS that makes the advantages and flexibility become forsaken by the organization in favor of bureaucratization (Hvolby H-H, Thorstenson A 2000)

## **2.6 Features of Performance Measurement Systems**

It is the links between decision making and planning that result in action and leads to significant attentiveness to the organizational measurement (Pietro Micheli & Mari, 2014). Pietro suggests that PM does not follow a theoretical base that the measurement should be proportionate and has to contain a specified number of indicators. The system should have the following features (Stefano Biazzo & Patrizia Garengo, 2012);

- Aligned with the strategies, this ensures consistency of the organizational model with the performance measurement tool (Najam-ul-Arifteen, Kazmi, Mubin, & Latif, n.d.). This assures that the actions and strategies are not implemented in the opposite directions (Bourne M, 2001).
- Conceptual balance, this also was emphasized in earlier sections of the study, as a decision-making tool, the performance measurement tool has to incorporate both financial and non-financial perspectives.
- Putting stakeholders at the core, this means that focusing on organizations supporting and directly influencing the business. The companies taking part can outline the importance of sustainable ecosystem which aims at the satisfaction of the influencers (Funk K, 2003).
- The measures should be clear and approachable, with the advent of new organizational solutions, there is a significant amount of data being gathered, many of which are not useful and even unnecessary (Neely A, 1998). The data has to be also clearly defined from the empirical organizational activities that the team has accumulated throughout the everyday processes to gathering procedure that should be elaborated with care (Globerson S, 1985).

## **2.7 Comparing Traditional Performance Measurement Approaches**

The most critical procedure in the business life-cycle in any organization is the scaling of the business, and if not handled systematically, this growth could kill the business. Performance systems are designed to facilitate the business processes and make them more responsive.

One of the oldest models used in corporate settings is performance measurement Matrix proposed by Keegan, which is a balanced model known for simplicity (Keegan et al. 1989); although it lacks the casual relationship offered by newer performance measurement tools (e.g., Balanced Scorecard). This model is visualized in Figure 2.3 with some of our parameters embedded in its dimensions; it measures the multi-dimensional financial and non-financial aspects with the internal processes (e.g., design costs) and external processes (e.g., customer complaints).

	External	Internal
Non-financial	<ul style="list-style-type: none"> <li>• Customer Satisfaction</li> <li>• Market share</li> <li>• Customer complaints</li> </ul>	<ul style="list-style-type: none"> <li>• # of new service items</li> <li>• Employee stability</li> <li>• Product complexity</li> </ul>
Financial	<ul style="list-style-type: none"> <li>• Cost of labour</li> <li>• Sales</li> <li>• R&amp;D expense</li> </ul>	<ul style="list-style-type: none"> <li>• Cost of material</li> <li>• Cost of finished product</li> <li>• Distribution cost</li> </ul>

**Figure 2.3:** Performance Measurement Matrix

Systems all use some hierarchies within them that systematically guides the operations towards the strategic goals, the pyramid system designed in 1991 by Lynch & Cross is a representation of the organization's operations that indicates the objectives at each row of the pyramid. As with the performance measurement matrix, this model also discriminates between external and internal aspects concerning the stakeholders (Lynch R, Cross K, 1991).

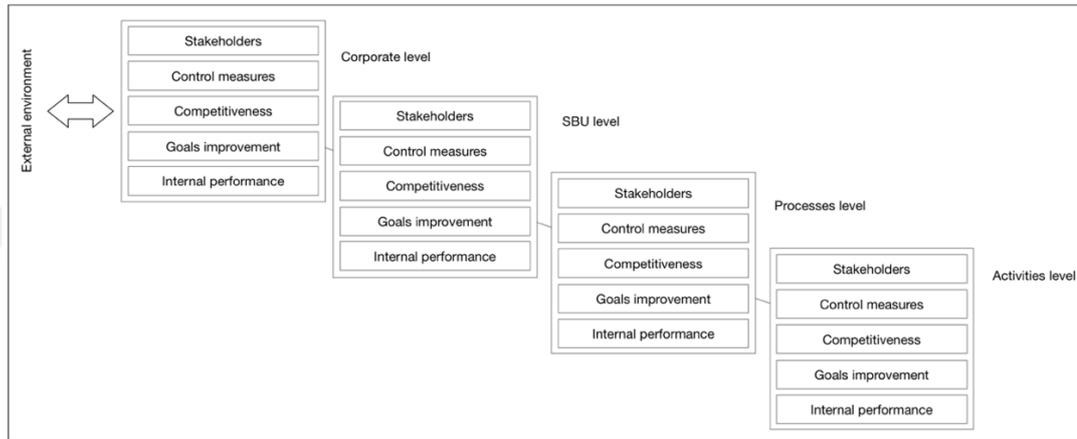


**Figure 2.4:** Pyramid System

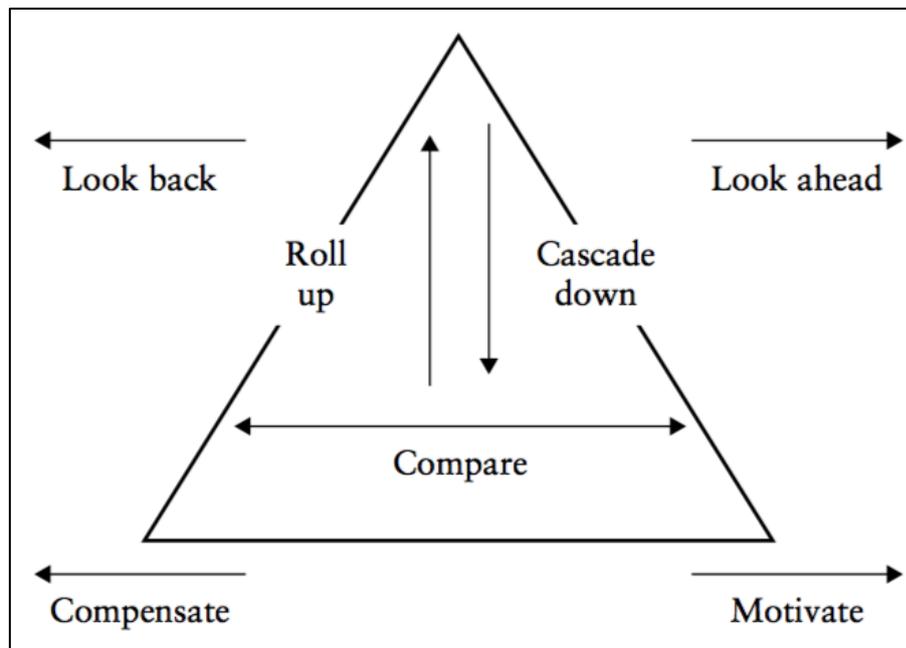
Between the first model and the pyramid system, there are similarities, the framework of a performance system ultimately links to the corporate strategy, in both models internal and external distinctions are considered, and the trade-offs between dimensions are explicitly defined (Chenget al. 2007). Most academicians categorize these systems as Contemporary Performance Measurement (CPM) systems which is a presentation of a system in which business strategies are translated into results that can be delivered instantaneously combining the operating business measures which get the organization closer to its specified goals (Hall, 2008)

Other models also exist such as Integrated Performance Measurement System shown in Figure 2.5 focus on making sure the performance management system functions. Accordingly, each level contains five factors for considering throughout the performance measurement process (Bititci, Carrie, & McDevitt, 1997). There is a tension between different performance view, performance, the act of performing and execution and accomplishment is different from the economic definition which focuses on future benefits resulting from the achievements. Performance measurement is a concept bridged between these two definitions. The measures

defined in the CPM's need to motivate, compensate, they should be able to forecast (envision) and also continuously look back for feedbacks of any gaps in the system (Meyer, 2003). In Figure 2.6 the envisioning and "looking back" steps are placed at the tip of the pyramid, this is because they apply to the entire organization and the compensation and motivation are placed in the lower part of the pyramid, this is because they define individual drives in the organization.



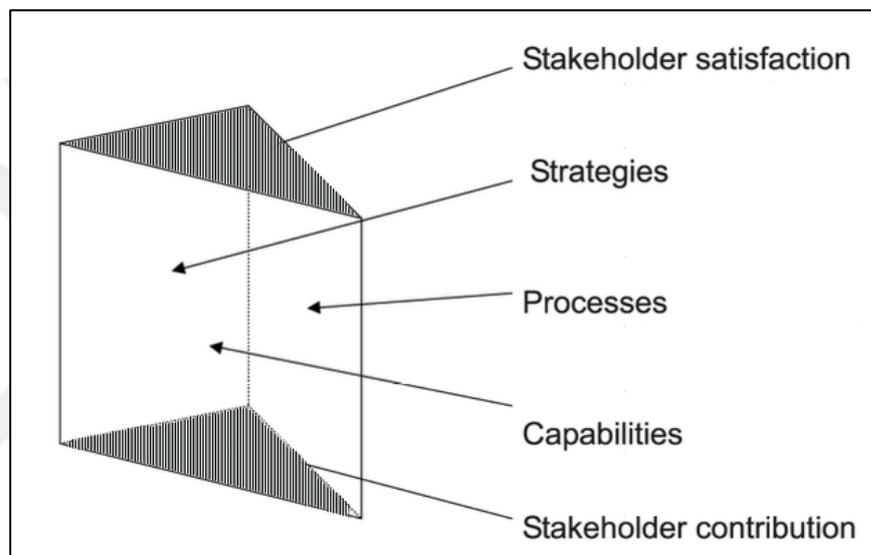
**Figure 2.5:** The Integrated Measurement System



**Figure 2.6:** The Purposes of Performance Measures (Bititci 1997)

Another model worth mentioning is the performance prism displayed in Figure 2.7 (Kurien & Qureshi, 2011; Tangen, 2004). This model is categorized by;

- Satisfying the stakeholder (employees, business environment)
- Strategies utilized to fulfill organizational needs (brand, product, service)
- Defining the processes within our strategies (generating demand, developing products)
- Required capabilities to operate the processes (technology, people, practices)
- Maintaining our capabilities through stakeholders' contribution.

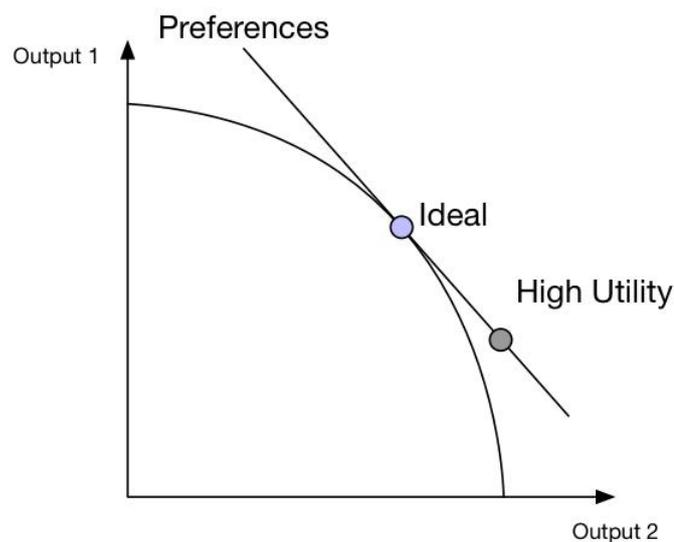


**Figure 2.7:** The Performance Prism

The concept of balanced scorecard as we see is relatively straightforward, but the execution of tasks that balance financial and non-financial objectives vary to a large extent. Although the application is inevitable in organizations productiveness, Callado argues that it is difficult to find commonality within the framework among different groups of competitors and only satisfying the customer has been considered a universal metric common between the distributors. (Cunha Callado & Jack, 2015)

### 3. RESEARCH METHODOLOGY

Between different tools that executives use for everyday decision making, benchmarking is among the top, alongside strategic planning and mission and vision statement (Rigby & Bilodeau, 2015). Conventional benchmarking uses key performance indicators (KPI) that show the prospects of success for the firm. Scorecards use it all the time for different perspectives but it was well-known purely for financial accounts (Taylor & Baines, 2012). The KPIs we used for financial analysis include Debt Ratio, Return on Assets (ROA), Return on Investment (ROI) and Earnings per Share (EPS). There is an implicit assumption that the differences in output between SBAs and large corporations legitimately have proportional inputs and outputs (Karpagam, 2013). In our research, we used survey data in a group of companies in Iran, and for that, we consider constant return to scale, this means, we assume income per asset does not necessarily depend on the firm's size. The purpose is to benchmark different indicators so that with real-time data generated by the business, we get to best ideal preferential utility; this concept is further shown in Figure 3.1 below;



**Figure 3.1:** Ideal Utility

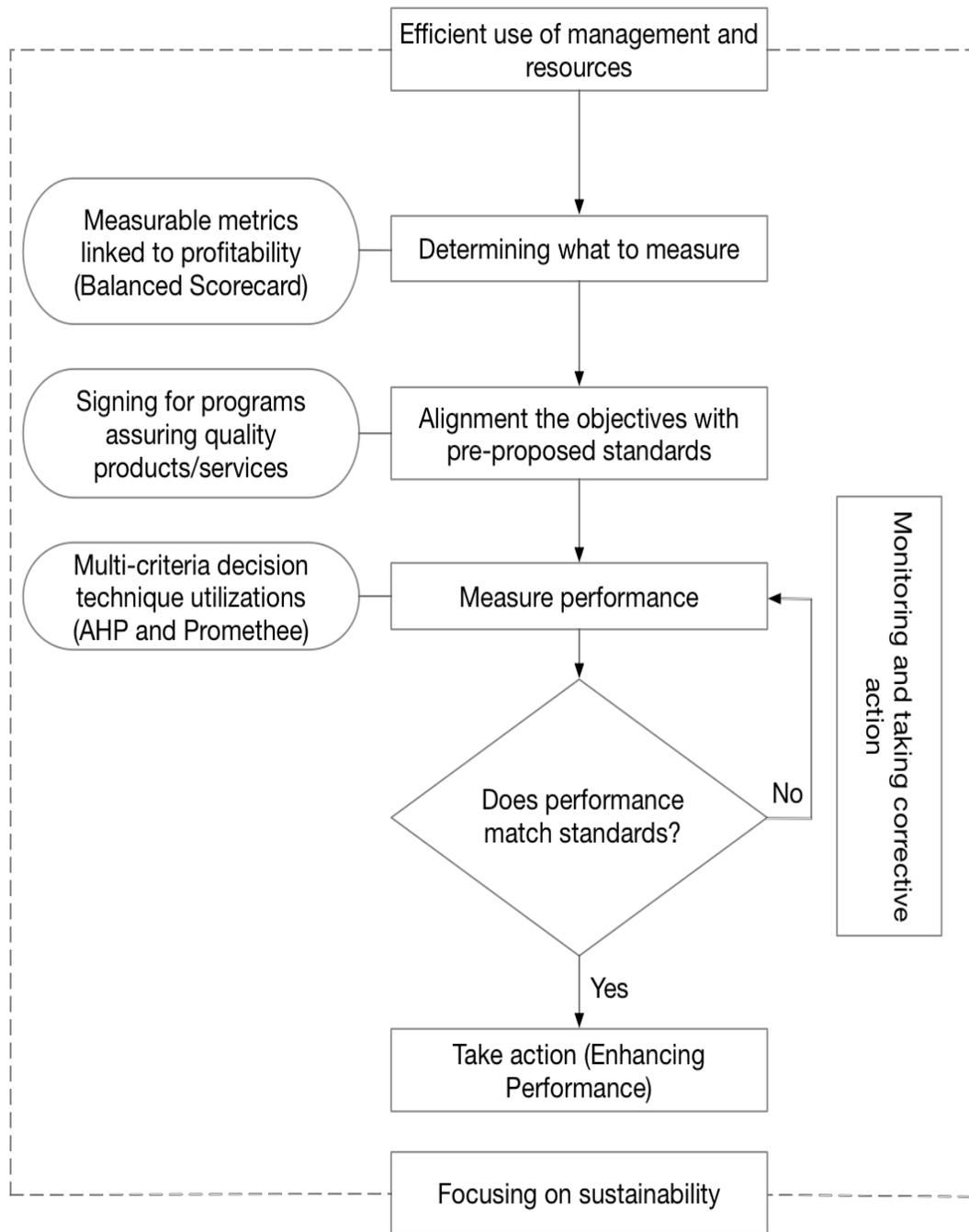
The ideal preference is the equal tradeoff between the two outputs, and the high utility is the tradeoff of one output exceeding the other. This shows that with high performance also we need tradeoffs that either is equally distributed or it is the case of one indicator having more utility than the other and as a result having more weight attached to it. As we see in Figure 3.1, all alternatives below our ideal curve are feasible.

Benchmarking as a concept of rank ordering is the comparison of two or more productive units. Organizations that have a stable benchmarking structure at place whether for the financial success or internal success, should not emphasize on monopolizing the firm nor they should cherish inefficiency in the system, and a stable ranking that benefits employees, as well as stakeholders, should be implemented.

Designing and implementing a strategy has been the fundamental managerial responsibility, the strategic plans need integration and commitment, this phase is critical because it ensures a sustainable procedure. After this the organization can focus on competitive advantage, this requires clean implementation and control which linked with benchmarking decision techniques and scorecards, it can be strengthened and correctly applied such that each business unit is aware of its drawbacks. The performance enhancement process of the research is elaborately illustrated in Figure 3.2. The process starts with brainstorming and exploiting measurement attributes, and then aligning them with control standards pre-proposed in the organization, creating a structure. The measuring attributes are afterward divided between the four perspectives of BSC for benchmarking using Multi-criteria decision-making techniques. The evaluation procedure will result in a collaboration of the benchmarked measures corresponding with the pre-determined standards. Benchmarking allows organizations to know their weaknesses and to recognize their robust qualities, not only it explains their position and objective but it also shows that to what extent their KPI's differ from each other. Market share was one of the KPI's used in the research which is the ratio of the firm's share in the market for specific accounting values. These measures evaluate the state of the organization which can be a crucial indicator to reference.

The below model helps to transform strategic planning into actionable steps and also monitor business performance, decreasing the errors within its processes. Ideally, a

firm's strength in the competition depends on its ability to use the resources effectivity to pursue its goals and preferences.



**Figure 3.2:** Conceptual Framework of Performance Enhancement

### **3.1 Measuring Organizational Productivity**

The whole model in Figure 3.2 emphasis on sustainability, stability and efficient use of resources which ultimately results in enhanced performance. Within the model, it's essential to determine the measurement criteria via team members insight or expert's opinions in the companies which were surveyed. Our chosen controls and measures following the BSC framework include sales, financial debt ratio, ROI, EPS, ROA for financial perspective.

In customer perspective, there is a particular indicator of customer satisfaction which itself lead to higher stock returns, profits per customer which is an essential factor in determining market share rate, customer retention rate which helps grow loyal customers and lastly customer acquisition rate.

Internal processes tend to have a systematic view of the firm in such a way that without an organized system, the objectives lose their guiding attribute. Furthermore, there should be monitoring measure for sales along internal processes ensuring better customer complaint procedure and other service-oriented ratios. Lastly, a sustainable organization guaranteeing efficiency throughout the chain needs well-trained employees with an organizational culture that encourages innovation. After determining the measures, the process will focus on making the outcomes purposeful and aligning them with organization's standards, whether it is health standard or system-oriented standard. The research's theoretical framework consists of finding measures, aligning them with the specified standards for ensuring quality, and the third stage is measuring the actual performance which displays the research usage of two Multi-criteria decision tools, each having a different purpose in developing a coherent framework. Many Multi-criteria decision-making tools exist each having unique characteristics and distinct goals in the realm of decision making.

### **3.2 MCDM Method Overview**

The first measuring tool, Simple Additive Weighting (SAW) method part of compensatory group family, is one the most straightforward methods among multi-criteria decision tools, in the purest form the model lacks accuracy and the results may not be logical (shiwoei, 2013). Because of lack of objectivity and the need for

pairwise comparison feature of Analytical Hierarchical Process, this method was not considered useful to the research.

The PROMETHEE ranking methods first developed by Professor Brans (1982), the technique introduced new profitable perspective to decision tools. In the procurement strategy, the method focuses on minimizing the price paid to suppliers while simplifying the buying decisions, and it uses the key performance indicators and location decision, all in one package for business decisions from sustainable development to environmental and social issues.

Other popular methods such as Technique for the Order of Prioritization by Similarity to Ideal Solution (TOPSIS) aim at simplicity and being structured but according to Velasquez and Hester lack consistency in the process (Abbasi, 2013).

Lastly, Analytical Hierarchical Process (AHP) due to ease of use and scalability is the subject of many articles, one of the usages of this method Is problems dealing with performance (Yaghoobi & Haddadi, 2016). One the features of this technique especially crucial for the survey-based research is the pairwise comparison, this feature enabled us to take a survey of our selected companies experts and compare different BSC measures against each other to benchmark them and track the HR performance efficiently and purposefully.

### **3.3 Enterprise Resource Planning Integration**

During the last decade of twentieth century the use of technology, especially in mass data interpretation had a significant impact on businesses. Integrating and automating the management processes across the departments had a drastic impact on their performance. This integration is extremely important for merging organizational measurement tools such as BSC with business process management tools such as enterprise resource planning (ERP) and organizational dashboards.

There are many ERP packages which are extremely expensive and have a high risk of implementation associated to them, for this reason, evaluation for choosing the right package is needed before investment (Ufuk Cebeci, 2009), Integrating the ERP and BSC can be beneficial since both aim at improving and measuring organizational performance (Shen, Y.-C., Chen, P.-S., & Wang, C.-H, 2016).

Managing the organizational changes resulted from deliberate implementation of the research framework will contribute to the overall decision-making process and the execution of the ERP system will reduce the levels of complexity and operational performance.



#### 4. DATA COLLECTION AND ANALYSIS

The goal of this section is to build a structured network of objectives (top level) and alternatives (sub-levels), using the Analytical Hierarchical Process we can assess the firm's performance focusing on as the name implies hierarchical level, the process is as follows;

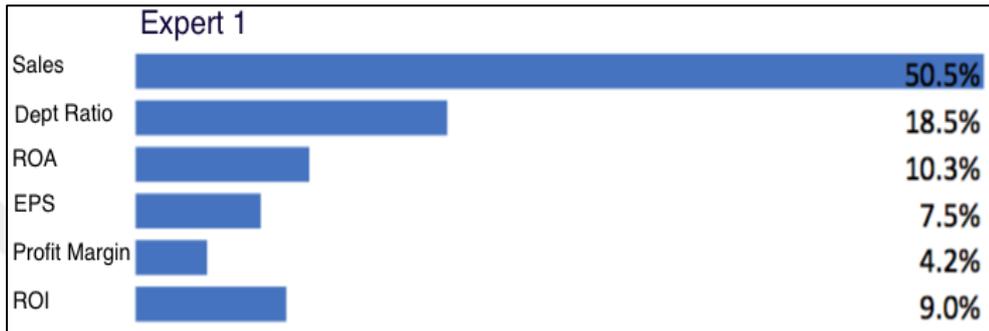
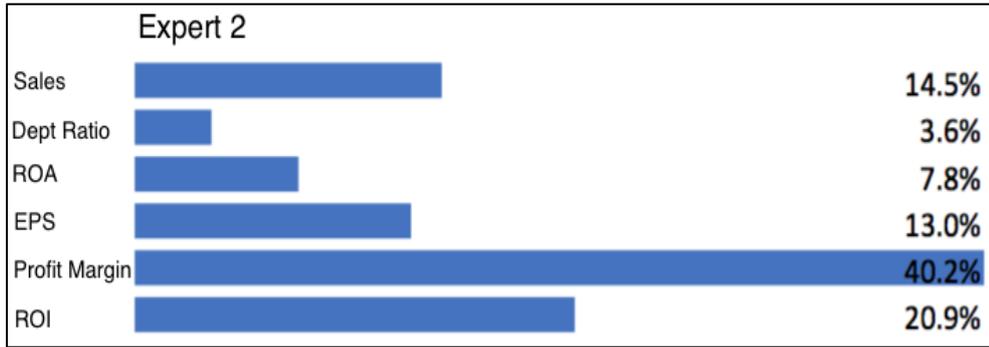
First the system comprises of four primary criteria which are related to the Balanced Scorecard (BSC), it compares the performance of customer, internal processes, financial and training and innovation. The objective is to create a platform for continuous growth and productive environment (Bentes, Carneiro, da Silva, & Kimura, 2012). In this case, sustainability is key to ensuring change throughout the organization, and this is why this paper focuses on a structured, systematic framework using both decision analytics and performance tools.

With a hierarchy system of ranking the most effective performance indicators, we can prioritize our objectives, especially this method weights the indicators ( $W_1$  to  $W_n$ ) using the opinions of team members within the chosen companies to assess the alternatives ( $X_1$  to  $X_n$ ) concerning the overall objective,

$$A = \{a_1, a_2, \dots, a_n\} \#(4.1)$$

$$W = \{w_1, w_2, \dots, w_n\}^T \#(4.2)$$

In the context of analytical hierarchy process, the priority of  $a_i$  over  $a_j$  depends on the weights given by individuals in the companies participated in the research, this means  $a_i$  is preferred to  $a_j$  only if  $w_i > w_j$ . Different individuals ideally have different perceptions; this is shown explicitly in the results of our survey which is illustrated in Figure 4.1, as you can see for the first company the notion of profitability is more important than other financial perspectives and for the second company, this change drastically with sales having the highest weight.



**Figure 4.1:** Two Company's Comparison of Financial Indicators of BSC

The process of breaking down these decision objectives and developing a model leads us to the next step, which is prioritizing the indicators for more proportionality and consistency. For this pairwise comparison is used to help to compare deferent alternatives concerning each other. At the core, AHP Is about proportional measurements; we are interested in knowing the relative comparison rather than exact measurement. The proportions are gathered in a relative pairwise comparison matrix which are displayed below,

$$A = (a_{ij})_{n \times n} = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix} \#(4.3)$$

Each alternative preferential degree is considered to be larger than zero in value and it is weighted relatively,

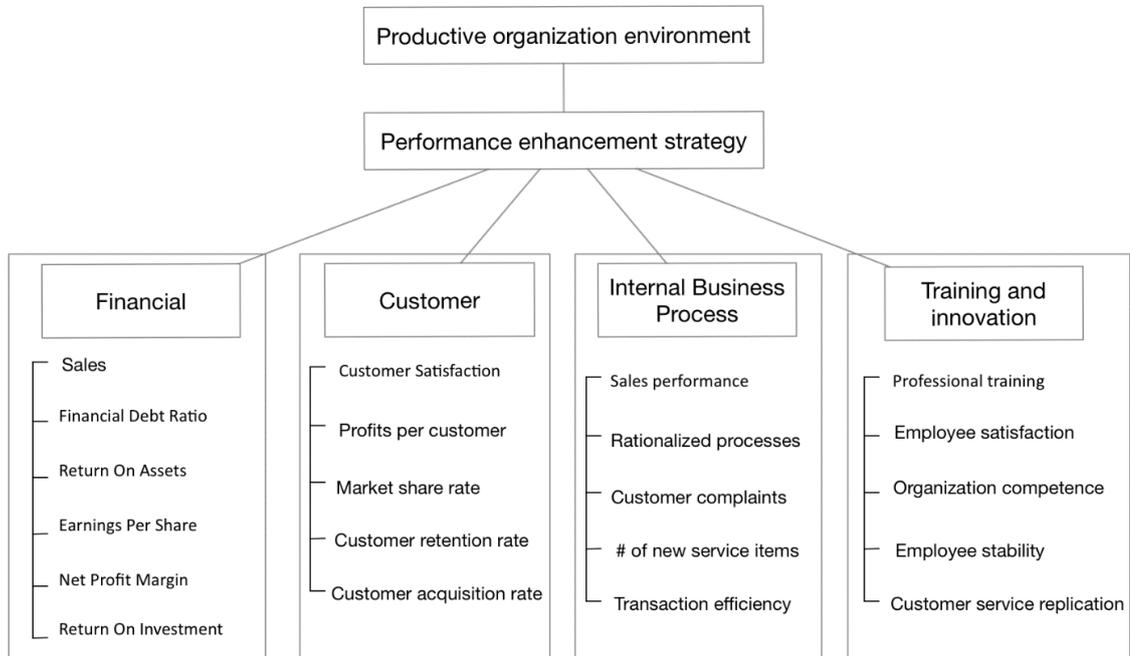
$$a_{ij} \approx \frac{w_i}{w_j} \quad \forall i, j \#(4.4)$$

$$a_{ij} = \frac{1}{a_{ji}} \#(4.5)$$

Therefore, the rewritten version will be,

$$A = (w_i/w_j)_{n \times n} = \begin{pmatrix} 1 & a_{12} & \cdots & a_{1n} \\ \frac{1}{a_{12}} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \frac{1}{a_{1n}} & \frac{1}{a_{2n}} & \cdots & 1 \end{pmatrix} \#(4.6)$$

elements of our decision matrix are constructed using survey data collection cited in the Appendix part of this research which is gathered from selected companies in Iran. The graphical representation of the hierarchy for the decision of performance evaluation is depicted in Figure 4.2 below which consists of 51 pair comparisons progressively evaluating the goal and objective. Each criterion in the graphical hierarchy model possess separate matrix, and therefore the alternatives are compared on the basis of criteria (Saaty 1977). The four criteria are shown with respect to their attributes which includes six measures in the financial perspective, five measures respectively in customer, internal business processes and training and innovation. (César Álvarez Pérez, Vicente Rodríguez Montequín, Francisco Ortega Fernández, Joaquín Villanueva Balsera, 2017)



**Figure 4.2:** Most Productive Performance Strategy

For determining the rate of relative comparison, reported in table 4.1 are nine scales associated to the verbal descriptions which were incorporated into the survey. In the research comparison between the sales performance and the number of new service items, in the case which one company was valued 5 for the Internal business process criterion. It is not necessary for the members to make a second comparison between the number of new service items and sales performance for the opposite comparison. Thus, in the method used if the preference value of sales performance for the number of new service items is valued 4, the preference for the number of new service items for sales performance will be valued 1/4 or 0.25.

**Table 4.1:** Preference Scale (Taylor, Bernard 2013)

<b>Verbal comparison</b>	<b>Associated value</b>
Equally important	1
Equal to moderately important	2
Moderately important	3
Moderately to strongly important	4
Strongly important	5
Strongly to very strongly preferred	6
Very strongly preferred	7
Very strong or demonstrated preference	8
Extreme preference	9

Members of each company evaluated the indicators, and the best strategy will be selected accordingly with regard to the ratings for a more sustainable decision. The next stage will be normalizing those matrices which are obtained by dividing the columns of each alternative by its corresponding sum of the column. The average value of the rows will give the priority vector between the indicators. The product of this vector and the matrix specify the Parron's eigenvector which in case of the first company experts for the consolidated weight (which is showed in the transpose form) of the balanced scorecard (BSC) is shown below which is more precisely displayed in the Appendix section of the research.

$$w = [0.06648, 0.21688, 0.40912, 0.30751]^T$$

Divided by the corresponding row weight will result in the preference vector which we use for developing the spectral radius  $\lambda_{max}$  of a criterion. The computed consistency index (CI) for the consolidated weighted mean of the balanced scorecard perspectives is approximately 0.09 which divided by the random index defined in Table 4.2 will be 0.0712, this level of consistency is lower than 0.10 which is satisfactory.

**Table 4.2:** Random Index (Taylor, Bernard 2013)

<i>n</i>	2	3	4	5	6	7	8	9
<i>RI</i>	0	0.5247	0.8816	1.1086	1.2479	1.3417	1.4057	1.4499

The Consistency Index (CI) and the calculated Consistency rate ensure more objectified results rather than subjective judgment for making decisions (Erbasi & Parlakkaya, 2012), the equation is as follows and the internal business perspective is applied in the formula.

$$CI = \frac{\lambda_{max} - n}{n - 1} \#(4.7)$$

$$Consistency\ rate = \frac{CI}{RI} = \frac{0.0874}{1.1086} = 0.0788 < 0.10 \#(4.8)$$

As mentioned the four perspectives of balanced scorecard surveyed from the participants of the companies were aggregated using the consolidated weighted mean, the geometric mean will result in a combined decision matrix consisting of all the weights given by experts in the companies participated in the research. The equation for the aggregation is as follows:

$$A_{ij} = \exp \left[ \frac{1}{N} \sum_{i \neq j}^N \ln(a_{ij}) \right] = \left( \prod_{i \neq j}^N a_{ij} \right)^{\frac{1}{N}} \#(4.9)$$

In the equation, N is the number of participants which are team members within three companies within the same industry and  $a_{ij}$  is decision indicators elements. The results of the aggregated pairwise comparison for BSC perspectives are shown in table 4.3 below,

**Table 4.3:** Aggregated Comparison of BSC

Indicators	Financial	Customer	Internal Business Process	Training and Innovation
Financial	1.00	0.17	0.16	0.35
Customer	5.77	1.00	0.52	0.36
Internal Business Process	6.32	1.91	1.00	1.59
Training and Innovation	2.88	2.77	0.63	1.00

The results are astonishingly relevant and significant; it shows that the same decision made by individual will be more accurate if aggregated by the members and group of people. The result of the BSC aggregated comparison indicates that although Financial wellbeing of the organization is essential, the emphasis always should be to better serve customer needs and wants. Training of the employees and sustainability of the company has a crucial role in the motivation of the employees and thus more productive behavior throughout the system.

The aggregated financial comparison chart is depicted in table 4.4, the table shows comparisons for the financial attributes which were surveyed from the selected companies in healthcare industry. Diagonally, all numbers in the matrix are one, meaning that the indicators are compared to each other. Between these indicators, the earning per share in relation to sales has higher preference; moreover, financial debt ratio in relation to sales has a higher preference.

**Table 4.4:** Aggregated Comparison of Financial Perspective

Indicators	Sales	Financial Debt Ratio	Return on Assets (ROA)	Earnings Per Share (EPS)	Net Profit Margin	Return on Investment (ROI)
Sales	1.00	5.85	4.12	6.07	2.11	1.64
Financial Debt Ratio	0.17	1.00	1.34	0.65	0.50	0.69
Return on Assets (ROA)	0.24	0.75	1.00	0.33	1.34	0.64
Earnings Per Share (EPS)	0.16	1.53	3.00	1.00	0.41	0.46
Net Profit Margin	0.47	2.00	0.75	2.47	1.00	0.69
Return on Investment	2.00	1.44	1.55	2.15	1.44	1.00

A company with high debt relative to equity shows that the company is overleveraged which can be extremely dangerous because there is no breathing room for mistakes and difficulties in the future. This chart also displays the vital nature of debt reduction and that it should be controlled but it can be inevitable due to competition and market risk features. Additionally, from the chart, it can be interpreted that profits from capital, encourage the performance and sales motivation towards sustainability. Return on assets is the ratio of earnings available for common stakeholders which is dividends on total assets generated from the company which is more emphasized than the return of investment which is defined by the ratio of the earnings to the total equity.

One indicator that is used most often in equity stocks is Earnings per share (EPS), this measures the earnings by the number of shares of outstanding stocks and it is shown that the importance is less highlighted with respect to sales and profit margin and ROI but more prominent than debt ratio and ROA and EPS respectively.

The following table (4.5) shows the aggregated comparison matrix for customer perspective; this perspective is included in almost all business models; the satisfaction of the customers is an essential function of marketing and business.

**Table 4.5:** Aggregated Comparison of Customer Perspective

Indicators	Customer Satisfaction	Profits Per Customer	Market Share Rate	Customer Retention Rate	Customer Acquisition Rate
Customer Satisfaction	1.00	7.32	6.95	2.00	2.60
Profits Per Customer	0.14	1.00	0.21	0.20	0.17
Market Share Rate	0.14	4.76	1.00	0.46	0.58
Customer Retention Rate	0.50	4.93	2.15	1.00	0.91
Customer Acquisition Rate	0.39	5.94	1.71	1.10	1.00

Table 4.5 illustrates the importance of customer and satisfying the customer is the most important indicator of all customer perspective measures.

Profits from the customers can be less important than the whole stock share rate and more budget should spend on acquiring new customers which ultimately increase the shares and customer satisfaction.

This cycle will be not possible without systematically designing and monitoring processes leading to creative thinking among the members which this requires sustainable organizational culture (Emerald Group, 2013). Without continuous innovation and innovative thinking, there is a big probability of being left out of the competition.

The aggregated business internal process is displayed in table 4.6. The table shows that in the aggregated comparison, number of new service items is preferred in relation to the sales performance.

**Table 4.6:** Aggregated Comparison of Internal Process

Indicators	Sales Performance	Rationalized Processes	Customer Complaint	Number of New Service Items	Transaction efficiency
Sales Performance	1.00	0.15	0.16	2.92	0.93
Rationalized Processes	6.54	1.00	1.59	3.27	6.00
Customer Complaints	6.35	0.63	1.00	7.27	6.65
Number of New Service Items	0.34	0.31	0.14	1.00	0.58
Transaction efficiency	1.08	0.17	0.15	1.71	1.00

Managers use different systems for evaluation and implementation of the processes; Table 4.6 suggests that the process of auditing the customer complaints is “strongly to very strongly” preferred to sales performance and very strong preference to the number of newly added service items. The chart also shows that the efficient use of transaction is also necessary in sales and new services added to the process but having rationalized processes in place and retaining and creating loyal customers through continuously having a system for feedbacks is also crucial in developing customer relationship.

Lastly training and innovation programs are preventive actions which is also part of ISO 9001 which is required because it ensures the competency of the individual who performs the action which is necessary for the processes.

The aggregated training and innovation is displayed in table 4.7, The table shows that in the aggregated comparison of training and innovation process organization competence is preferred in relation to professional training. Moreover, customer service replication is more preferred in relation to professional training.

**Table 4.7:** Aggregated Comparison of Training and Innovation Process

Indicators	Professional Training	Employee Satisfaction	Organization Competence	Employee Stability	Customer Service Replication
Professional Training	1.00	2.65	5.19	0.63	4.58
Employee Satisfaction	0.38	1.00	2.01	1.59	4.58
Organization Competence	0.19	0.50	1.00	1.71	1.71
Employee Stability	1.59	0.63	0.58	1.00	2.52
Customer Service Replication	0.22	0.22	0.58	0.40	1.00

#### 4.1 Consolidated Preferences of the Perspectives

After the normalization process which is evaluated by the equation (4.10), the weighted arithmetic mean was deduced, for the comparison matrix  $\hat{W} = [\hat{a}_{ij}]_{n \times n}$  and the consolidated vectors ranking the perspectives are displayed in following tables,

$$P_i = \frac{r_{ij}}{\sum_i^n r_i} \#(4.10)$$

The table 4.8 suggests that training the employees is worth the investment and the processes that are implemented contribute to the success of the company. Having

excellent customer service and building relationship and getting their feedback which ultimately results in higher profit margins. Although I can argue that investing in continuous development is crucial, but customer satisfaction is always the objective, aggregate consistency index to random Index of the balanced scorecard perspectives comparison is approximately 0.071 which is below the designated random index

**Table 4.8:** Consolidated Eigenvector of BSC

Balanced Scorecard	Weights	Preference
Financial	0.066	4
Customer	0.217	3
Internal business process	0.409	1
Training and innovation	0.308	2

The following table (4.9) also shows the weighted mean of Financial, customer, Internal business process and innovation and training respectively,

**Table 4.9:** Consolidated Eigenvector of Financial Perspective

Financial perspective	Weights	Preference
Sales	0.362	1
Financial Debt Ratio	0.083	6
Return on Assets (ROA)	0.092	5
Earnings Per Share (EPS)	0.108	4
Net Profit Margin	0.136	3
Return on Investment (ROI)	0.220	2

The highest weight is an indication of the most preferred indicator, the aggregate consistency index to random Index is approximately 0.14 and preference vector for the financial perspective is,

$$x_i \mid w_i \geq w_j, \forall i, j \# (4.11)$$

$$\widehat{W} = \{0.362, 0.220, 0.136, 0.108, 0.092, 0.083\}^T \#(4.12)$$

An important question to ask in SBA financial business models is “how to improve sales force productivity?”. The following table 4.10 of the customer perspective suggests that profit margin and EPS are at the nearly same level of importance.

**Table 4.10:** Consolidated Eigenvector of Customer Perspective

Customer Perspective	Weights	Preference
Customer Satisfaction	0.452	1
Profits Per Customer	0.039	5
Market Share Rate	0.111	4
Customer Retention Rate	0.200	2
Customer Acquisition Rate	0.198	3

Organizations and especially SBA’s must always move forward, innovating services and products and most importantly staying in touch with the customers. As also the table suggests their satisfaction with the products and services is an important key indicator of the wellbeing of the organization (Sundharam & Sharma, 2013). Companies try to meet customer needs, and they strive to reduce the cost of customer acquisition and on the other hand keeping them loyal for a longer period. The aggregate consistency index to random Index is approximately 0.036, and the preference vector for the customer perspective is,

$$\widehat{W} = \{0.452, 0.2, 0.198, 0.111, 0.039, \}^T \#(4.13)$$

The fundamental structure of a business consists of a collection of processes which are reliably repeated to generate a particular result. The processes should be optimized and rationalized so that the system is not only reliable, but it should be sustainable enough for the business to continue the deliverance of goods and services.

**Table 4.11:** Consolidated Eigenvector of Internal Processes

Internal processes	Weights	Preference
Sales Performance	0.085	3
Rationalized Processes	0.398	1
Customer Complaints	0.382	2
# of New Service Items	0.061	5
Transaction efficiency	0.073	4

The table 4.11 shows the explained concept, and the perspective has an aggregate consistency index to random index ratio of 0.07. Additionally, the customer complaints as displayed in the aggregated comparison is more preferred than sales performance thus ranked accordingly.

The preference vector for the internal processes is,

$$\hat{W} = \{0.398, 0.382, 0.085, 0.073, 0.061\}^T \#(4.14)$$

The consolidated eigenvector for the innovation and training perspective for the balanced scorecard is shown in table 4.12,

**Table 4.12:** Consolidated Eigenvector of Innovation and Training Perspective

Innovation and training	Weights	Preference
Professional Training	0.363	1
Employee Satisfaction	0.229	2
Organization Competence	0.141	4
Employee Stability	0.204	3
Customer Service Replication	0.063	5

This aspect is one of the most competitive priorities of companies, innovation, and delivery of quality products and services for a better competitive edge. Training and assigning the right jobs to the right people to develop a friendly environment and creates satisfied employees. The aggregate consistency index to random Index is approximately 0.13, and the preference vector for the innovation and training aspect is,

$$\widehat{W} = \{0.363, 0.229, 0.204, 0.141, 0.063\}^T \#(4.15)$$

The entries for weights for the matrix A was obtained from the group, and the priority vector for the perspectives was normalized and estimated with the following ratio,

$$W_i = \left( \prod_{i \neq j}^N a_{ij} \right)^{1/N} / \sum_{i=1}^N \left( \prod_{i \neq j}^N a_{ij} \right)^{1/N} \#(4.16)$$

The equation 4.16 was used to normalize the aggregated pairwise comparison, for the consistency of the balanced scorecard the previously mentioned geometric consistency index was used which was given in the context of the tables.

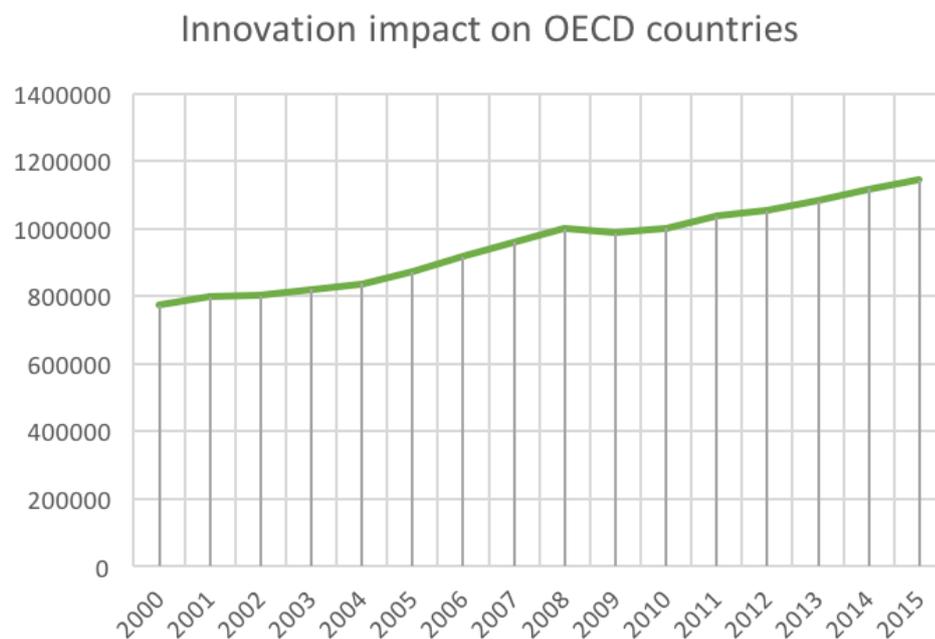
## 4.2 BSC Benchmarking and Overall Weighting

The managerial dashboard mentioned in chapter 2 of the research, is the core model for strategy maps and also explaining the idea of controlling the performance systematically.

Before an implicit examination of the indicators, we should ask,

- What is our success factors or performance key indicators (KPI's)?
- Do the factors align with the strategic business goals?
- How can we achieve a competitive advantage?

The focus and attention should be stripped away from the disposable measures and centered on the specific goals; innovation is one the indicators that nowadays companies are investing in it for a competitive edge. Shown in the Figure below is the profound impact that innovation has in OECD countries in recent years (OECD 2017),



**Figure 4.3:** OECD Countries Investment on R&D

To evaluate and control the flow of information and to monitor the key performance indicators, we should have a systematic view of financial and non-financial indicators. The managerial dashboard has an enormous impact on day to day work processes. It illuminates new dimensions by easing the tension for long-term

financial goals, balancing the objectives of the organization with goals of the employees.

The performance dashboard is shown in Table 4.13; the rationalized processes have the highest priority outperforming customer complaints the deliberately impacts customer satisfaction.

**Table 4.13:** BSC Preference Dashboard

BSC perspectives	Global Weight	Rank	Symbol	Indicators	Local Weight	Absolute Weight
Financial indicators	6.65%	14	F <sub>1</sub>	Sales	0.362	0.024
		21	F <sub>2</sub>	Financial Debt Ratio	0.083	0.005
		20	F <sub>3</sub>	Return On Assets (ROA)	0.092	0.006
		19	F <sub>4</sub>	Earnings Per Share (EPS)	0.108	0.007
		17	F <sub>5</sub>	Net Profit Margin	0.136	0.009
		16	F <sub>6</sub>	Return On Investment (ROI)	0.220	0.015
Customer indicators	21.7%	4	C <sub>1</sub>	Customer Satisfaction	0.452	0.098
		18	C <sub>2</sub>	Profits Per Customer	0.039	0.009
		13	C <sub>3</sub>	Market Share Rate	0.111	0.024
		7	C <sub>4</sub>	Customer Retention Rate	0.200	0.043
		9	C <sub>5</sub>	Customer Acquisition Rate	0.198	0.043
Training and innovation indicators	40.9%	3	T <sub>1</sub>	Professional Training	0.363	0.112
		5	T <sub>2</sub>	Employee Satisfaction Organization	0.229	0.070
		8	T <sub>3</sub>	Competence	0.141	0.043
		6	T <sub>4</sub>	Employee Stability	0.204	0.063
		15	T <sub>5</sub>	Customer Service Replication	0.063	0.019
Internal business process indicators	30.8%	10	P <sub>1</sub>	Sales Performance	0.085	0.035
		1	P <sub>2</sub>	Rationalized Processes	0.398	0.163
		2	P <sub>3</sub>	Customer Complaints	0.382	0.156
		12	P <sub>4</sub>	Number of New Service Items	0.061	0.025
		11	P <sub>5</sub>	Transaction efficiency	0.073	0.030

The implications of the balanced scorecard integrated dashboard for managers are that decision making has to be reliable enough that the organization can take advantages of it. This KPI's in each perspective help create actionable metrics that can be used to enhance performance and productivity in the organization. Developing a system that fundamentally aligns the goals and objectives and helps create new ways of changing customer behavior for the purpose of increasing customer acquisition metric.

The companies that were surveyed for the research all have a common objective, these are increasing sales, creating a process and controlling them and striving to satisfy customers with services which will grow the organization's competence and thus its share in the marketplace. Sales have an absolute weight of 0.024, and it is ranked 14. While controlling and evaluating the sales (sales performance) is ranked 10 with an absolute weight of 0.035 which implicates that these two indicators have correlation and are connected to each other.

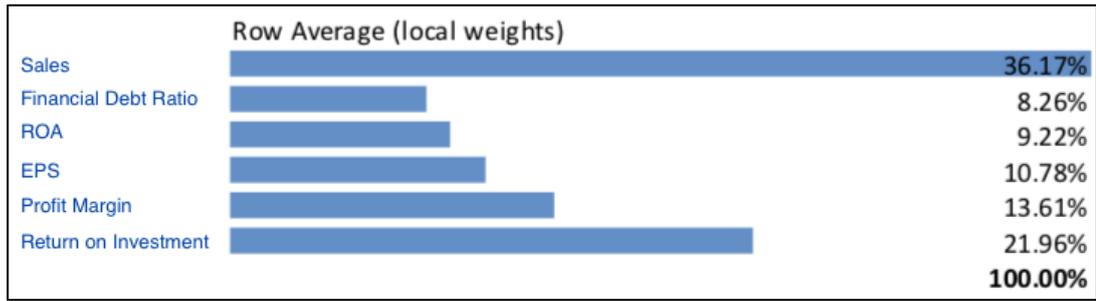
Consequently, each of the four BSC perspectives can be visualized in charts for better interpretation. Following is the standardization of the BSC perspectives and the chart shows the relationship of its indicators. The standardization process ensures that the values are in the ranges of zero and one which can help in easing the analysis and eigenvalue calculation. The consequent tables show the calculation process of AHP method and the charts help in interpreting those values. For example, for the financial perspective, the chart shows that Sales indicator is highly preferred in comparison to other indicators in this perspective. Moreover, the Return of investment indicator is also more preferred to other indicators excluding the sales indicator. However, these measurements are relative and are weighted according to expert's comparison of the indicators and therefore the extent of effectiveness of the indicators cannot be recognized.

Table 4.14 shows the financial perspective of BSC which shows the standardization of pairwise comparison of aggregated expert's opinions.

**Table 4.14:** Financial Perspective Standardization

Indicators	Sales	Financial Debt Ratio	Return on Assets (ROA)	Earnings Per Share (EPS)	Net Profit Margin	Return on Investment (ROI)
Sales	0.2467	0.4652	0.3504	0.4790	0.3100	0.3188
Financial Debt Ratio	0.0422	0.0796	0.1138	0.0515	0.0736	0.1352
Return on Assets (ROA)	0.0599	0.0594	0.0850	0.0263	0.1971	0.1255
Earnings Per Share (EPS)	0.0406	0.1219	0.2551	0.0789	0.0597	0.0905
Net Profit Margin	0.1172	0.1591	0.0635	0.1945	0.1472	0.1352
Return on Investment	0.4934	0.1147	0.1321	0.1699	0.2123	0.1949

Figure 4.4 illustrates the comparison of the indicators associated with the financial perspective of BSC which shows that sales indicator has higher preference than other indicators. Furthermore, return on investment which shows the investment performance of the organization has second highest preference and profit margin with almost 14% has the third highest preference which this shows an indication that the surveyed companies had higher priority for customer satisfaction. Moreover, return on assets which is calculated by the sum of Net income and interest expense divided by book value of assets has a preference value of 9% which is almost equal to the preference of debt ration which is calculated by total debt divided by the book value of equity.



**Figure 4.4:** Financial Indicator’s Comparison

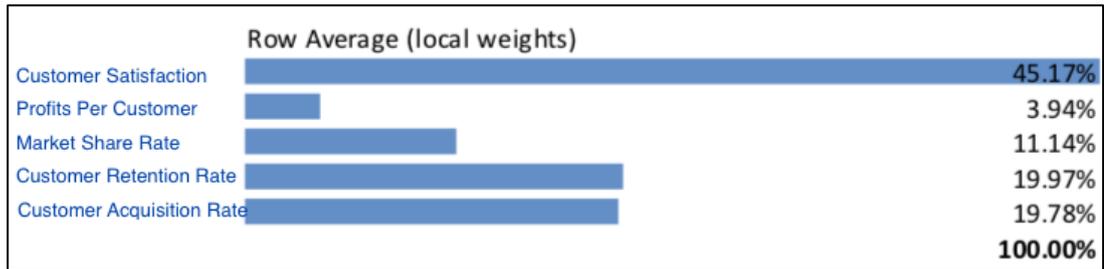
Table 4.15 shows the customer’s perspective of BSC which shows the standardization of pairwise comparison of aggregated expert’s opinions.

**Table 4.15:** Customer’s Perspective Standardization

Indicators	Customer Satisfaction	Profits Per Customer	Market Share Rate	Customer Retention Rate	Customer Acquisition Rate
Customer Satisfaction	0.4618	0.3055	0.5781	0.4195	0.4938
Profits Per Customer	0.0631	0.0417	0.0175	0.0425	0.0320
Market Share Rate	0.0664	0.1988	0.0832	0.0974	0.1112
Customer Retention Rate	0.2309	0.2059	0.1791	0.2098	0.1728
Customer Acquisition Rate	0.1779	0.2481	0.1422	0.2309	0.1902

Figure 4.5 illustrates the comparison of the indicators associated with the customer’s perspective of BSC which shows that customer satisfaction indicator has higher preference than other indicators. Furthermore, customer retention and acquisition rate are at the same rate of almost 20% for each of the indicators. Moreover, market share rate which is calculated by dividing total company’s debt and book value of equity. Lastly profits per customer which is associated with profit margin the company makes from products and services per customer is the lowest, this shows that these

companies focus more on best deliverance of their services to maximize customer satisfaction which is the first priority in this BSC preference.



**Figure 4.5:** Customer Indicator’s Comparison

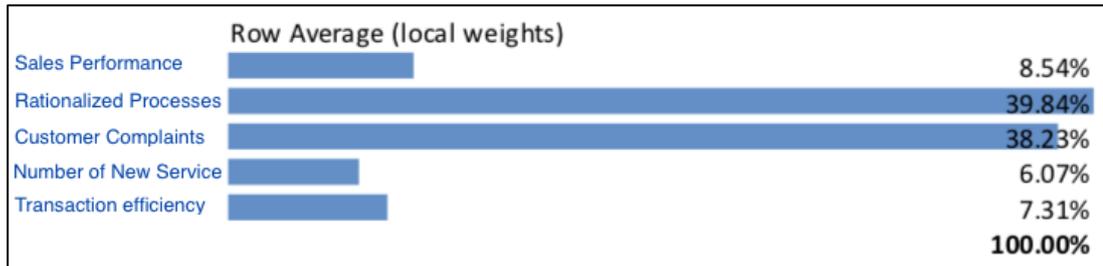
Table 4.16 shows the internal process perspective of BSC which shows the standardization of pairwise comparison of aggregated expert’s opinions.

**Table 4.16:** Internal Process Perspective Standardization

Indicators	Sales Performance	Rationalized Processes	Customer Complaints	Number of New Service Items	Transaction efficiency
Sales Performance	0.0653	0.0678	0.0519	0.1808	0.0612
Rationalized Processes	0.4273	0.4434	0.5234	0.2022	0.3957
Customer Complaints	0.4147	0.2793	0.3297	0.4494	0.4385
Number of New Service Items	0.0223	0.1356	0.0454	0.0618	0.0386
Transaction efficiency	0.0704	0.0739	0.0496	0.1057	0.0660

Figure 4.6 illustrates the comparison of the indicators associated with the Internal perspective of BSC which shows that the highest preference is equally distributed between rationalized processes in organizations which is the systematic construction of processes and customer complaints which is acquired by the feedback the customers provide using social networks or company’s website. Furthermore, sales

performance, number of new services and transaction efficiency are at the 9% average.



**Figure 4.6:** Internal Process Indicator’s Comparison

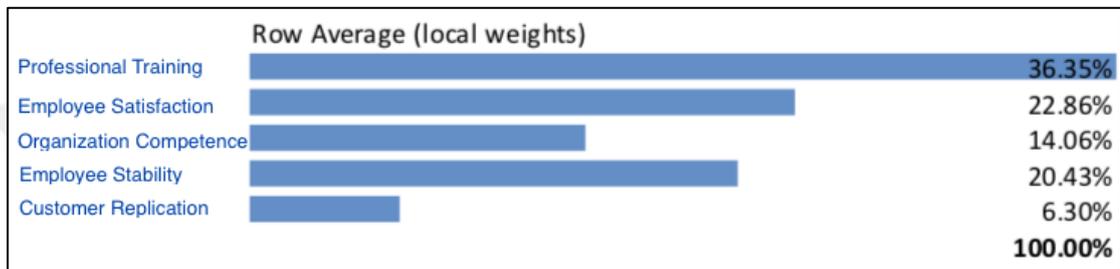
Table 4.17 shows the Training and innovation perspective of BSC which shows the standardization of pairwise comparison of aggregated expert’s opinions.

**Table 4.17:** Training and Innovation Perspective Standardization

Indicators	Professional Training	Employee Satisfaction	Organization Competence	Employee Stability	Customer Service Replication
Professional Training	0.2963	0.5308	0.5538	0.1183	0.3183
Employee Satisfaction	0.1117	0.2001	0.2148	0.2981	0.3183
Organization Competence	0.0571	0.0994	0.1067	0.3212	0.1189
Employee Stability	0.4703	0.1261	0.0624	0.1878	0.1751
Customer Service Replication	0.0647	0.0437	0.0624	0.0745	0.0695

Figure 4.7 demonstrates the comparison of the indicators associated with the training and innovation perspective of BSC which shows that professional training indicator has higher preference than other indicators. With the advent of internet and the breakthrough of technologies, more and more companies rely on training the employees to enhance productivity which has high return on investment in the long

run. Furthermore, employee satisfaction which shows the degree of job fulfillment the employees feel at the workplace, this measure is becoming more important nowadays. Third preferred indicator is employee stability in the company, level of security they feel which can be linked to organizational culture. This indicator has a high relationship with productivity increase in the company (Dobre Ovidiu-Iliuta, 2014). Moreover, employee satisfaction has a preference value of almost 23% which is significant and by having better organizational culture and better job conditions productivity enhances and flourishes. Lastly customer replication and acquisition which shows what is the organizational commitment to their business environment.



**Figure 4.7:** Training and Innovation Indicator's Comparison

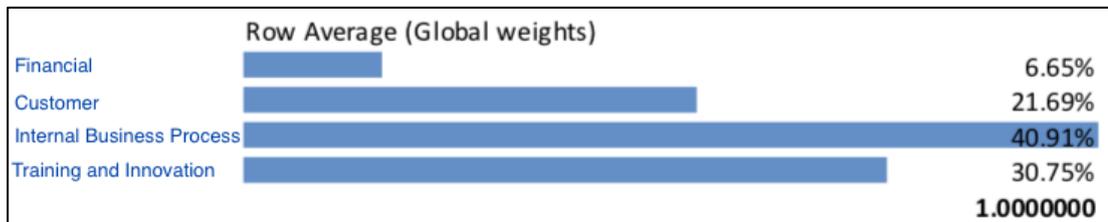
Table 4.18 shows the BSC's perspective the standardization of pairwise comparison of aggregated expert's opinions.

**Table 4.18:** BSC's Perspective Standardization

Indicators	Financial	Customer	Internal Business Process	Training and Innovation
Financial	0.0626	0.0296	0.0685	0.1052
Customer	0.3612	0.1707	0.2262	0.1094
Internal Business Process	0.3955	0.3265	0.4327	0.4818
Training and Innovation	0.1806	0.4733	0.2726	0.3035

Figure 4.8 demonstrates the comparison of the indicators associated with BSC core perspectives which clearly identifies internal business processes as the highest preferred perspective, these processes are implemented for the organization's continuous effort for productivity maximization. Additionally, training and innovation is second preferred indicator which supports the idea that after the

organizational processes are implemented, focus on continuous improvement is key to enhanced organizational culture and improved productivity. As the internal business environment is established, the organization should commit to sustainable relationship with customers. Lastly financial measures should be inaugurated which promotes the company's growth ecosystem.



**Figure 4.8:** BSC's Indicator's Comparison

In summary the analysis of the relative comparisons helps the companies visualize which indicators they should focus on and which indicator they should more contemplate on. For example, in the training and innovation perspective, the professional training of the employees should be one the first priorities of the company. Moreover, in the internal business processes perspective, the organization and rational systems should be one of the main objectives of the organization. Therefore, this analytical process can help companies make better decisions and utilizing the resources more efficiently, this ensures sustainability in the long-term for the organization.

### 4.3 Actionable Strategy Using PROMETHEE

An alternative multi-criteria decision analysis method is PROMETHEE; this method complements AHP on deciding on implementing the best strategy. The name stands for “Preference ranking organization method for enrichment of evaluation” which was proposed by professor Jean-Pierre Brans (Brans, Vincke, & Mareschal, 1986). This decision tool takes the distances of alternatives into account which outperforms its competitors concerning the extent of effectiveness of the indicators.<sup>1</sup> The weights were previously calculated and designated to the criteria using AHP which were given by a group of experts in selected companies. The criteria in the case of the research are the four perspectives of balanced scorecard; the following formula defines the function of the PROMETHEE method,

$$\pi(a, b) = \sum_{j=2}^k W_j \times P_j(a, b) \#(4.17)$$

The PROMETHEE outranking method is different from AHP which an aggregation method is, PROMETHEE method has preference degrees which help to give meaning to each alternative through defining the conditions in which the perspectives can be aligned with alternatives.

The preference degrees  $P_j(a, b)$  help understand which measure can be preferred to another measure, if there is no preference the preference degree is zero otherwise if it is preferred, the extent of the preference can be somewhere between 0 and 1. Thus the limitations of the relations are as follows (Tomić, Marinković, universitatis-series, 2011, n.d.),

$$0 \leq P_j(a, b) \leq 1 \#(4.18)$$

$$P_j(a, b) \neq P_j(b, a) \#(4.19)$$

This method can be used in many industries and it is not limited to management settings, it can be used in product and service ranking based on different categorical criteria.

The preference is considered zero in the central diagonal because they cannot be preferred to itself. The PROMETHEE outranking method is just to complement the research; the technique is just explained so that the companies can practically use the

data collected from the AHP method and they can get functionally applicable to the organization.

PROMETHEE 1 uses the idea of preordering the alternatives, this means alternative  $a$  is highly preferred to alternative  $b$ , if alternative  $a$  has a larger positive flow  $\varphi^+$  than alternative  $b$  and  $a$  smaller negative flow  $\varphi^-$  than the negative flow of alternative  $b$  (Balali, Zahraie, & Roozbahani, 2014). In the case of  $a$  being preferred to  $b$ , the preordering positive and negative flows follow the following relationship,

$$\varphi^+(a) > \varphi^-(b) \#(4.20)$$

$$\varphi^+(a) < \varphi^-(b) \#(4.21)$$

The two alternatives are indifferent  $aIb$  with the following relations,

$$\varphi^+(a) = \varphi^-(b) \#(4.22)$$

$$\varphi^+(a) = \varphi^-(b) \#(4.23)$$

The preference of the action compared to others on a specific criterion can be calculated by the following equations, the positive flow is the summation of deviations, and the preference of the action to itself is also taken into account.

$$\varphi^+ = \frac{1}{n-1} \sum_{x \in A} \pi(a, x) \#(4.24)$$

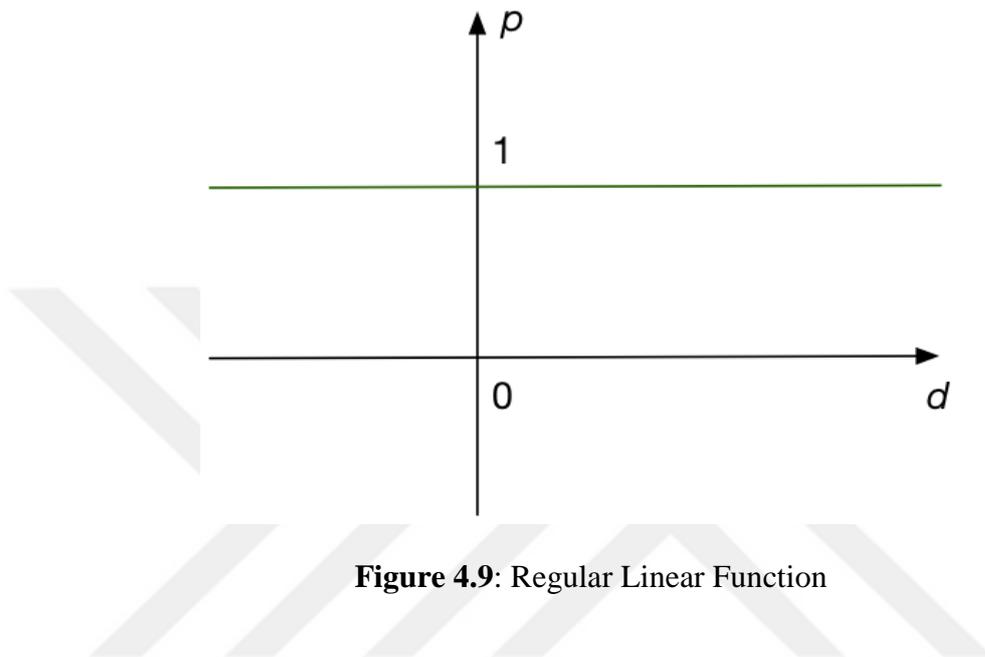
$$\varphi^- = \frac{1}{n-1} \sum_{x \in A} \pi(x, a) \#(4.25)$$

Lastly, the PROMETHEE ranking method takes the negative and positive measures and calculates the overall flows which are a subtraction of the positive flow  $\varphi^+$  and  $\varphi^-$ , this balance is between -1 and 1 which is an indication of the strength of the measures.

$$\varphi(a) = \varphi^+(a) - \varphi^-(a) \#(4.26)$$

The preference function for the balanced scorecard strategy selection for performance enhancement should have four preference functions linking to each of the BSC perspectives. The indifference threshold  $q$  should be defined as to the lower end preference indicator alongside the preference threshold  $P$  in the higher end (Zhaoxu & Min, 2010). The preference for the research can be a staircase function for the financial indicators or a regular criterion for the customer perspective and

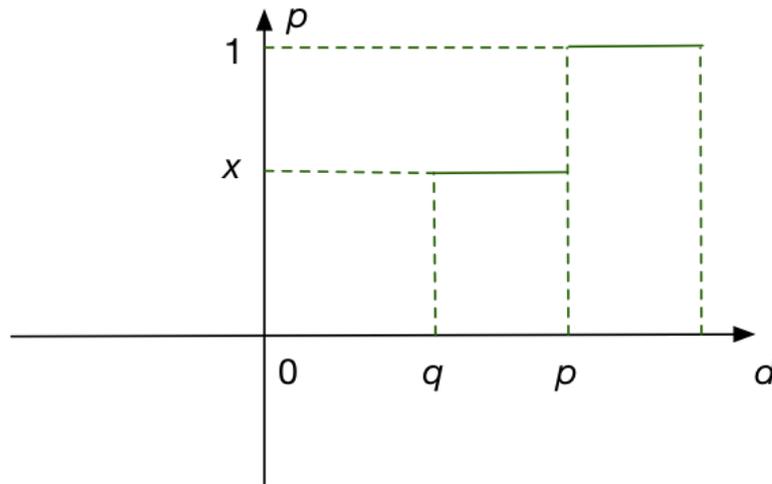
internal business processes (Jafari & Esmaeildoust, 2013). The three linear types of preferences functions used in PROMETHEE are shown below where  $p$  and  $q$  are preference and indifference thresholds respectively. Figure 4.9 shows the regular linear function for the preference degree and the equation (4.27) displays the preference function.



**Figure 4.9:** Regular Linear Function

$$P(d) = \begin{cases} 0, & |d| \leq 0 \\ 1, & |d| > 0 \end{cases} \#(4.27)$$

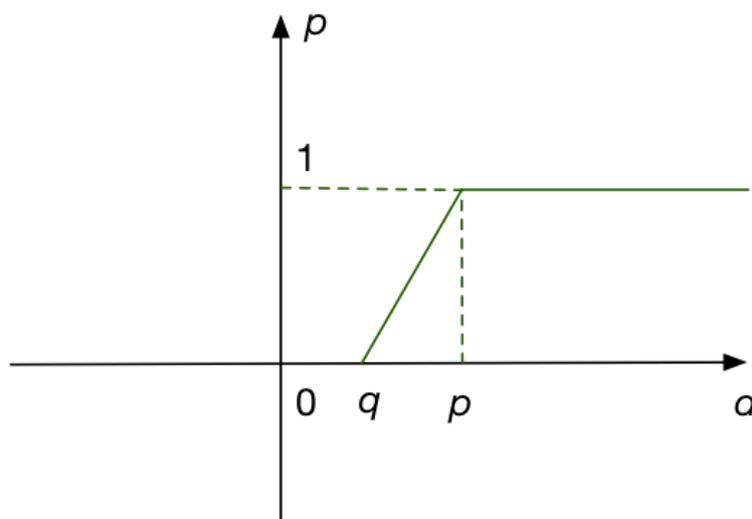
Figure 4.10 illustrates the staircase linear function and the equation (4.28) shows the preference function. This graph shows three distinctive points which is separated by two constraints and thresholds of  $p$  and  $q$ , these points can distinguish the limitation in the model and gives us a better view. The difference between this function and the previous function is that, the staircase function is not bound to agreement with a specific preference and can add limitations in the model. However, in the regular function, the measure will be measured as soon as the action takes place.



**Figure 4.10:** Staircase Linear Function

$$P(d) = \begin{cases} 0, & |d| \leq q \\ x, & q \leq |d| \leq p \text{ (4.28)} \\ 1, & |d| \geq p \end{cases}$$

Figure 4.11 shows the linear criterion function and the equation (4.29) shows the preference function. This model is a regular function containing limitation and thresholds  $p$  and  $q$  which can be especially influential in business problems with constraints and quick decision making. For example, in business setting, the sales can be on a range threshold.



**Figure 4.11:** Linear Criterion Function

$$P(d) = \begin{cases} 0, & |d| \leq q \\ \frac{|d| - q}{p - q}, & q \leq |d| \leq p \\ 1, & |d| \geq p \end{cases} \quad (4.29)$$

Based on these assumptions, the selected strategies are accordingly in each area, these areas follow the chosen performance functions, and are deliberately ranked, and this evaluation is visualized in Table 4.19,

**Table 4.19:** PROMETHEE Evaluation Table

	Financial	Customer	Internal processes	Learning and innovation
Weight	0.167	0.200	0.200	0.200
Function	MAX	MAX	MAX	MAX
A <sub>1</sub>	a <sub>1</sub>	a <sub>1</sub>	a <sub>1</sub>	a <sub>1</sub>
A <sub>2</sub>	a <sub>2</sub>	a <sub>2</sub>	a <sub>2</sub>	a <sub>2</sub>
A <sub>3</sub>	a <sub>3</sub>	a <sub>3</sub>	a <sub>3</sub>	a <sub>3</sub>
p	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>
q	q <sub>1</sub>	q <sub>2</sub>	q <sub>3</sub>	q <sub>4</sub>

Table 4.20 displays PROMETHEE overall flow where alternatives and prioritized accordingly with respect to the chosen parameters.

**Table 4.20:** PROMETHEE Overall Flow

	$\varphi^+$	$\varphi^-$	$\varphi$
A <sub>1</sub>	$\varphi_1^+$	$\varphi_1^-$	$\varphi_1$
A <sub>2</sub>	$\varphi_2^+$	$\varphi_2^-$	$\varphi_2$
A <sub>3</sub>	$\varphi_3^+$	$\varphi_3^-$	$\varphi_3$

This is a template of PROMETHEE that utilizes the AHP weights. Each strategy is formulated by the performance functions and the positive flows and negative flows are analyzed after the ranking of the strategies. The evaluation of the PROMETHEE is finally carried out by the calculation of the overall flows in which the strategy will be ranked against each other.

The PROMETHEE outranking method is a complement to the research as explained in the text. The strategies being selected should be compatible with current company goals and the weights are given to the strategies should be consistent with the weights of the AHP method. Furthermore, the implementation of the strategies can be carried out by different departments within the company.

In the next chapter we discuss further about departmental functions and strength of organizational commitment to strategy and the extent of the impact strategy has on organizations.

## 5. CONCLUSION AND FURTHER DISCUSSION

Managing workers' competence is one of the essential functions of any business, in other words, how to create a friendly environment for employees that motivates and inspires them to work effectively and efficiently? And how can the organization systematically evaluate their performance in the future?

Functional work, which is the idea of work being organized objectively and tasks should be distributed to different departments and the system creates a hierarchy of stakeholders in the company's future, from the supervisor who is in charge of the departments to the arrangement of departments being controlled by the administration.

For enhancing and improving HR productivity, the underlying questions were,

- How can Balanced Scorecard (BSC) performance tool be utilized and measured?
- What are the differences between BSC and other organizational performance tools?
- Can the Balanced Scorecard (BSC) be incorporated with Multi-criteria decision-making (MCDM) to enhance productivity systematically?
- How do culture and commitment change the overall strategy?

The inquiry regarding the performance evaluation was analyzed throughout the research; the conceptual framework was presented that looked at enhancing the organization's performance using Balanced Scorecard (BSC), a highly systematic performance management tool and Analytical Hierarchy Process (AHP) and PROMETHEE, both associated to the Multi-Criteria Decision Methods (MCDM). The following is a brief overview of organization's cultural impact and best practices of HR in any organization.

## **5.1 Organizational Commitment**

As the competition grows, the organizations should also follow extending their capabilities, for this, they should create a system in which strategies are formulated, performances are monitored and plans are executed. Each step contributes to the overall strategy.

Commitment is the key to a sustainable strategy, not only to the company's future but also to employees' personal growth through training. Commitment and continuously improving is the key to a sustainable organization.

## **5.2 Organization's Cultural Impact**

One of the ways to make the outcomes of an unpredictable business prospect foreseeable is to cherish organizational culture; this is the shared experiences, beliefs and customized narratives within the company that helps in characterizing the organization. Organizational culture, therefore, has a strong impact on employees' performance (Kotter and Heskett, 2011), this relationship not only has a direct positive impact, through organizational commitment indirectly helps to improve organizational performance. (Amin Nikpour, 2017).

A study by Ovidiu-Iliuta also linked these two dimensions and observed that the relationship between the business culture and performance management, the cultural traits that were analyzed by the researcher were (Dobre Ovidiu-Iliuta, 2014),

- Adaptability, building an environment in which new ideas can prosper, adapting to different customer needs distinguishes the organization from the competition.
- Mission, prioritizing the objectives and setting new goals and motivating employees, all need a clearly defined mission in which every stakeholder is involved in the big picture.
- Consistency, consistent decisions are made when companies set explicit values and support the employees in their vision. Being consistent is a challenges trait and accomplishing it needs a strong uninterrupted culture.
- Involvement, the success of the organization rests upon its ecosystem of commitment, a responsible environment that encourages teamwork and involving employees in the future of the business

### **5.3 Strategy Formation**

Strategies are plans or set of guidelines that assist in future decision making and there are different assumptions for a strategy perspective. According to Mintzberg, the formation of the strategy can be either deliberate or emergent (Mintzberg 1978), which in business context means that, the control over the implementation process is an intended strategical framework, on the contrary, a feedback loop of intuition-based implementation can not only improve the performance but also can create a culture of learning within the company.

A strategical model consists of the interplay of five areas, namely productivity, culture, innovation, organizational flexibility, execution (Ole Friis, Jens Holmgren, Jacob Kjær Eskildsen, (2016), these areas are highly correlated, but innovation and execution are two areas that challenge the organizations the most.

### **5.4 Conclusion and Future Study**

The study of performance management helps organizations realize the benefits of a sustainable, flexible environment. An efficient trustable system incorporates the traits of, Innovation which is a key competitive advantage in the competition. The trait of customer awareness and satisfaction which emphasizes on knowing the potential customer base. The trait of financial health which is the idea of sustainable support of the organization and the trait of internal processes which systematically helps in creating better outcomes. All of these were the traits of BSC, an organizational tool that helps companies better manage their workflow and engage and efficiently invest in the future of the organization. The research strengthened the BSC framework by incorporating two Multi-criteria decision tools, the first method being used was AHP, a full aggregation approach which helps in prioritizing the perspectives and determining the factor of success and the and PROMETHEE outranking method which assists the team in purposefully determining the outstanding strategy.

For the AHP evaluation, the study surveyed a group of companies in the healthcare industry in Iran. The purpose of the thesis was to enhance productivity utilizing the BSC method, and the research results show that rationalized processes have the highest rank of 16% and customer complaints have the second highest rank of 15%, followed by the training indicator with 11% and so on. The implications of the thesis from the manager's point of view are that managers continuously are balancing the

financial and non-financial aspects of the organization and the performance tools play a pivotal role in the company. Utilizing the managerial performance tools produces a growth mechanism and commitment within the company.

Lastly, one of the unintended outcomes of these metric systems is that the organizations tend to fixate their incentive systems on the individual progressive performance. This can be harmful in the long term due to organization's displacement of values which may have negative effects on the business environment.

Furthermore, supplementary discussion on the subject of rank ordering the strategies should be made; the PROMETHEE method was explained briefly as a complement to the research, more experiments and research on the incorporation of MCDM methods and performance management tools is also advisable.

## **5.5 Summary**

The study proposed a managerial framework for enhancement of human resource productivity. The framework illustrates a path in which the key performance indicators are selected and measured and weighted against each other using multi-criteria decision methods. Moreover, the indicators were benchmarked and aligned with business standards. This process ensures sustainability for the business and makes the company more focused and organized.

## REFERENCES

- Abbasi, R. (2013).** Performance Evaluation of Social Security Branches by using BSC and MADM techniques, 1–6.
- Agostino, D., & Arnaboldi, M. (2011).** How the BSC implementation process shapes its outcome. *International Journal of Productivity and Performance Management*, 60, 99–114.
- Amin Nikpour, (2017)** The impact of organizational culture on organizational performance: The mediating role of employee's organizational commitment, *International Journal of Organizational Leadership* 6(2017) 65-72.
- Balali, V., Zahraie, B., & Roozbahani, A. (2014).** A Comparison of AHP and PROMETHEE Family Decision Making Methods for Selection of Building Structural System. *American Journal of Civil Engineering and Architecture*, 2, 149–159.
- Bentes, A. V., Carneiro, J., da Silva, J. F., & Kimura, H. (2012).** Multidimensional assessment of organizational performance: Integrating BSC and AHP, 65, 1790–1799.
- Berry A J, Broadbent J, and Otley D T,** Management Control: Theories, Issues and Performance (2nd edition, 2005), Palgrave Macmillan.
- Bititci, U. S., Carrie, A. S., & McDevitt, L. (1997).** Integrated performance measurement systems: a development guide. *International Journal of Operations & Production Management*, 17, 522–534.
- Bourne M (2001)** Implementation issues. Hand book of performance measurement. GEE Publishing, London
- Brans, J. P., Vincke, P., & Mareschal, B. (1986).** How to select and how to rank projects: The Promethee method. *Mathematical Programming Multiple Criteria Decision Making*, 24, 228–238.
- César Álvarez Pérez, Vicente Rodríguez Montequín, Francisco Ortega Fernández, Joaquín Villanueva Balsera. (2017).** Integration of Balanced Scorecard (BSC), Strategy Map, and Fuzzy Analytic Hierarchy Process (FAHP) for a Sustainability Business Framework: A Case Study of a Spanish Software Factory in the Financial Sector. *Sustainability*, 9, 527–23.
- Chand, D., Hachey, G., Hunton, J., Owhoso, V. and Vasudevan, S. (2005)** 'A balanced scorecard based framework for assessing the strategic impacts of ERP systems', *Computers in Industry*, Vol. 56, No. 6, pp.558–572.
- Couto, C. A., Vendrametto, O., Neto, P. L. O. C., Morais, M. de O., & Brejão, A. S. (2016).** ERP Systems and BSC in the Operations Management: An Analysis of Results by Companies. *Advances in Production Management Systems*.
- Creating a culture of innovation: How can small and medium-sized enterprises (SME) compete?" (2013),** Development and Learning in Organizations: An International Journal, Vol. 27 Issue: 2, pp.26-29.
- Cunha Callado, A. A., & Jack, L. (2015).** Balanced scorecard metrics and specific supply chain roles. *International Journal of Productivity and Performance Management*, 64, 288–300.

- David Norton, Randall H. Russell (2011)** Balanced Scorecard Report the strategy execution source vol 13 no 1.
- Dessler, G. (2016).** Human Resource Management, Global Edition. Pearson Higher Ed.
- Dobre Ovidiu-Iliuta,** The link between organizational culture and performance management practices (2014)
- Erbasi, A., & Parlakkaya, R. (2012).** The use of analytic hierarchy process in the balanced scorecard: an approach in a hotel firm. *Business and Management*.
- Funk K (2003)** Sustainability and performance. *Sloan Manage Rev* 44:65–71
- Globerson S (1985)** Issues in developing a performance criteria system for an organization. *Int J Prod Res* 23:639–646
- Hall, M. (2008).** The effect of comprehensive performance measurement systems on role clarity, psychological empowerment and managerial performance. *Accounting, Organizations and Society*, 33, 141–163.
- Henry Mintzberg (2007),** Tracking Strategies: Towards a General Theory, Oxford University Press.
- Huang, Hao-Chen (2000)** , A balance scorecard perspective ,Expert system with application, Designing a knowledge-based system for strategic planning , VOL,36, 2009, p. 204-218.
- Hvolby H-H, Thorstenson A (2000)** Performance measurement in small and medium-sized enterprises. In: Proceedings of the international conference on stimulating manufacturing excellence in SMEs, Coventry, 17–19 Apr 2000
- Intrafocus (2016).** Balanced Scorecard Usage Survey 2016 Summary of Findings
- Jafari, H., & Esmaeildoust, M. (2013).** Integrating the Balanced Scorecard and PROMETHEE Methods for Seaport’s Performance Evaluation. *American Journal of Marine Science*, 1, 38–43.
- Jagoda, K., Lonseth, R., & Lonseth, A. (2013).** A bottom-up approach for productivity measurement and improvement. *International Journal of Productivity and Performance Management*, 62, 387–406.
- Kaplan, R. S., & Norton, D. P. (2008).** The Execution Premium. Grupo Planeta (GBS).
- Kaplan, Robert S., and David P. Norton (2000).** Putting the Balanced Scorecard to Work. Harvard Business Review.
- Kahneman, D. (2011).** Thinking Fast and Slow. N.Y: Farrar, Straus and Giroux.
- Karpagam, P. U. (2013).** Performance measurement of organisations: a review of balanced scorecard technique. *International Journal of business performance management*.
- Kádárová, J., Durkáčová, M., & Kalafusová, L. (2014).** Balanced Scorecard as an Issue Taught in the Field of Industrial Engineering. *Procedia - Social and Behavioral Sciences*, 143, 174–179.
- Keegan DP, Eiler RG, Jones CR (1989)** Are your performance measures obsolete? *Manage Account* 70:45–50
- Kim WC, Mauborgne R (2005)** Blue ocean strategy. Harvard Business School Press, Boston
- Kotter, J. P., & Heskett, J. L. (2011).** Corporate culture and performance. New York: Free Press.
- Kurien, G., & Qureshi, M. (2011).** Study of performance measurement practices in supply chain management (Vol. 2, pp. 19–34).
- Lynch R, Cross K (1991)** Measure up! Yardsticks for continuous improvement. Blackwell, Cambridge

- Maharma, A. H.** (2014). Developing A Business Performance Management Model For Paltel Group-Palestine.
- Manyika, J., Woetzel, J., Dobbs, R., Remes, J., & Labaye, E.** (2015). Global growth: Can productivity save the day in an aging world. New York: McKinsey Global ....
- Meyer, M. W.** (2003). Rethinking Performance Measurement: Beyond the Balanced Scorecard (pp. 1–202).
- Mintzberg, H.** (1978) 'Patterns in Strategy Formation.' Management Science.
- Michael J. Mauboussin**, "The True Measures of Success," Harvard Business Review (October 2012)
- N.s. Narahari, k.n. Subramanya, m.n. Vijayakumar, and v. Prashant.** (2015). Productivity improvement studies in a process industry, a case study
- Najam-ul-Arifeen, M. H., Kazmi, S., Mubin, M., & Latif, S.** (n.d.). Measuring Business Performance: Comparison of Financial, Non Financial and Qualitative Indicators. *Academia.Edu*.
- Neely A, Gregory M, Platts K** (2005) Performance measurement system design: A literature review and research agenda.
- Neely A** (1998) Measuring business performance, The economist in association with profile books. Profile Books, London
- Niven, P. R.** (2014). Balanced Scorecard Evolution. John Wiley & Sons.
- Northcott, D., & Ma'amora Taulapapa, T.** (2012). Using the balanced scorecard to manage performance in public sector organizations. *International Journal of Public Sector Management*, 25, 166–191.
- OECD** (2017), Gross domestic spending on R&D (indicator). Accessed on 12 December 2017.
- Ole Friis, Jens Holmgren, Jacob Kjær Eskildsen,** (2016) "A strategy model – better performance through improved strategy work", *Journal of Modelling in Management*, Vol. 11 Issue: 3, pp.742-762
- Pietro Micheli, & Mari, L.** (2014). The theory and practice of performance measurement. *Management Accounting Research*, 25, 147–156.
- Pulakos, E. D., & O'leary, R. S.** (2011). Why Is Performance Management Broken? *Industrial and Organizational Psychology*, 4, 146–164.
- Rigby, D., & Bilodeau, B.** (2015). Management tools & trends 2015. Bain & Company; 2015.
- Salem, M. A., Hasnan, N., & Osman, N. H.** (2012). Balanced scorecard: Weaknesses, strengths, and its ability as performance management system versus other performance management systems. *Journal of Environment and ...*, 60, 493–511.
- Schneiderman, Arthur M.** (2006). "Analog Devices: 1986–1992, The First Balanced Scorecard".
- Shen, Y.-C., Chen, P.-S., & Wang, C.-H.** (2016). A study of enterprise resource planning (ERP) system performance measurement using the quantitative balanced scorecard approach. *Computers in Industry*, 75, 127–139.
- shiwoei.** (2013). An Analysis of Multi-Criteria Decision-Making Methods, 1–11.
- Soderberg, M., Kalagnanam, S., Sheehan, N. T., & Vaidyanathan, G.** (2011). When is a balanced scorecard a balanced scorecard? *International Journal of Productivity and Performance Management*, 60, 688–708.
- Stefano Biazzo I Patrizia Garengo** (2012) Models for Measuring Performances. P53
- Sundharam, V. N., & Sharma, V.** (2013). An integration of BSC and AHP for

- sustainable growth of manufacturing industries. ... *Journal of Business* ..., 6, 77.
- Tangen, S.** (2004). Performance measurement: from philosophy to practice. *International Journal of Productivity and Performance Management*, 53, 726–737.
- Taylor, J., & Baines, C.** (2012). Performance management in UK universities: implementing the Balanced Scorecard. *Journal of Higher Education Policy and Management*, 34, 111–124.
- Tomić, V., Marinković, Z., universitatis-series, D. J. F.,** 2011. (n.d.). PROMETHEE method implementation with multi-criteria decisions. *Scindeks.Ceon.Rs*.
- Ufuk Cebeci.** (2009). Fuzzy AHP-based decision support system for selecting ERP systems in textile industry by using balanced scorecard. *Expert Systems with Applications*, 36, 8900–8909.
- Wadugodapitiya, R., & Sandanayake, Y. G.** (2010). Building project performance evaluation model. Presented at the Proceedings of CIB 2010 ....
- Wheelen, Thomas L.** Strategic Management and Business Policy: Globalization, Innovation and Sustainability. Pearson, 2011.
- Yaghoobi, T., & Haddadi, F.** (2016). Organizational performance measurement by a framework integrating BSC and AHP. *International Journal of Productivity and Performance Management*, 65, 959–976.
- Zhaoxu, S., & Min, H.** (2010). Multi-criteria Decision Making Based on PROMETHEE Method (pp. 416–418). Presented at the 2010 International Conference on Computing, Control and Industrial Engineering, IEEE.

## APPENDICES

### Appendix A: Survey Approval Form

Evrak Tarih ve Sayısı: 28/06/2017-3952



T.C.  
İSTANBUL AYDIN ÜNİVERSİTESİ REKTÖRLÜĞÜ  
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Hk.

28/06/2017

Sayın HAMİDREZA MOHEBBİ

Enstitümüz Y1312.130057 numaralı İşletme Anabilim Dalı İşletme Yönetimi (İngilizce) Tezli Yüksek Lisans programı öğrencilerinden HAMİDREZA MOHEBBİ'nin "A FRAMEWORK FOR ENHANCEMENT OF HUMAN RESOURCE PRODUCTIVITY BY USING BALANCED SCORECARDS: A DECISION BASED APPROACH" adlı tez çalışması gereği "İnsan Kaynakları Verimliliği" ile ilgili anketi 12.06.2017 tarih ve 2017/12 İstanbul Aydın Üniversitesi Etik Komisyon Kararı ile etik olarak uygun olduğuna karar verilmiştir. Bilgilerinize rica ederim.

Prof. Dr. Özet KANBUROĞLU



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## Appendix B: Pairwise Comparison for Customer Perspective

The following pairwise comparison survey results which were gathered from three companies in healthcare industry. The aim of the survey is to benchmark the key performance indicators (KPI's) to maximize and enhance the company's performance and minimize future risks.

**Table B.1:** Consolidated Weighted Mean

	1	2	3	4	5
1	1	7.32	6.95	2.00	2.60
2	0.14	1	0.21	0.20	0.17
3	0.14	4.76	1	0.46	0.58
4	0.50	4.93	2.15	1	0.91
5	0.39	5.94	1.71	1.10	1

**Table B.2:** Company 1 Expert's Response Matrix

	1	2	3	4	5
1	1	8	8	8	5
2	1/8	1	1/6	1/6	1/7
3	1/8	6	1	1	1
4	1/8	6	1	1	3
5	1/5	7	1	1/3	1

**Table B.3:** Company 2 Expert's Response Matrix

---

	1	2	3	4	5
1	1	7	7	7	7
2	1/7	1	1/3	1/4	1/5
3	1/7	3	1	1/5	1/5
4	1/7	4	5	1	1/2
5	1/7	5	5	2	1

---

**Table B.4:** Company 3 Expert's Response Matrix

---

	1	2	3	4	5
1	1	7	6	1/7	1/2
2	1/7	1	1/6	1/5	1/6
3	1/6	6	1	1/2	1
4	7	5	2	1	1/2
5	2	6	1	2	1

---

### Appendix C: Pairwise Comparison for Financial Perspective

This section is the financial perspective's pairwise comparison which was surveyed from three companies in healthcare industry.

**Table C.1:** Consolidated Weighted Mean

	1	2	3	4	5	6
1	1	5.85	4.12	6.07	2.11	1.64
2	0.17	1	1.34	0.65	0.50	0.69
3	0.24	0.75	1	0.33	1.34	0.64
4	0.16	1.53	3.00	1	0.41	0.46
5	0.47	2.00	0.75	2.47	1	0.69
6	2.00	1.44	1.55	2.15	1.44	1

**Table C.2:** Company 1 Expert's Response Matrix

	1	2	3	4	5	6
1	1	5	2	4	1/6	1/8
2	1/5	1	1/5	1/6	1/8	1/2
3	1/2	5	1	1/3	1/5	1/3
4	1/4	6	3	1	1/3	1/2
5	6	8	5	3	1	4
6	8	2	3	2	1/4	1

**Table C.3:** Company 2 Expert's Response Matrix

	1	2	3	4	5	6
1	1	8	7	8	7	7
2	1/8	1	4	5	3	4
3	1/7	1/4	1	1/3	4	4
4	1/8	1/5	3	1	1	1
5	1/7	1/3	1/4	1	1	1/4
6	1/3	1/4	1/4	1	4	1

**Table C.4:** Company 3 Expert's Response Matrix

	1	2	3	4	5	6
1	1	5	5	7	8	5
2	1/5	1	3	1/3	1/3	1/6
3	1/5	1/3	1	1/3	3	1/5
4	1/7	3	3	1	1/5	1/5
5	1/8	3	1/3	5	1	1/3
6	3	6	5	5	3	1

**Appendix D: Pairwise Comparison for Internal Business Process Perspective**

This section is the internal business process perspective’s pairwise comparison which was surveyed from three companies in healthcare industry.

**Table D.3:** Consolidated Weighted Mean

	1	2	3	4	5
1	1	0.15	0.16	2.92	0.93
2	6.54	1	1.59	3.27	6.00
3	6.35	0.63	1	7.27	6.65
4	0.34	0.31	0.14	1	0.58
5	1.08	0.17	0.15	1.71	1

**Table D.2:** Company 1 Expert’s Response Matrix

	1	2	3	4	5
1	1	1/8	1/8	5	4
2	8	1	7	7	6
3	8	1/7	1	8	7
4	1/5	1/7	1/8	1	1/4
5	1/4	1/6	1/7	4	1

**Table D.3:** Company 2 Expert's Response Matrix

	1	2	3	4	5
1	1	1/5	1/4	1	1
2	5	1	4	1	6
3	4	1/4	1	8	7
4	1	1	1/8	1	4
5	1	1/6	1/7	1/4	1

**Table D.4:** Company 3 Expert's Response Matrix

	1	2	3	4	5
1	1	1/7	1/8	5	1/5
2	7	1	1/7	5	6
3	8	7	1	6	6
4	1/5	1/5	1/6	1	1/5
5	5	1/6	1/6	5	1

## Appendix E: Pairwise Comparison for Training and Innovation Perspective

This section is the internal business process perspective's pairwise comparison which was surveyed from three companies in healthcare industry.

**Table E.4:** Consolidated Weighted Mean

	1	2	3	4	5
1	1	2.65	5.19	0.63	4.58
2	0.38	1	2.01	1.59	4.58
3	0.19	0.50	1	1.71	1.71
4	1.59	0.63	0.58	1	2.52
5	0.22	0.22	0.58	0.40	1

**Table E.2:** Company 1 Expert's Response Matrix

	1	2	3	4	5
1	1	8	7	1/7	8
2	1/8	1	7	1/6	8
3	1/7	1/7	1	1	1
4	7	6	1	1	8
5	1/8	1/8	1	1/8	1

**Table E.3:** Company 2 Expert's Response Matrix

---

	1	2	3	4	5
1	1	1/3	4	1/4	2
2	3	1	7	4	3
3	1/4	1/7	1	1	1
4	4	1/4	1	1	8
5	1/2	1/3	1	1/8	1

---

**Table E.4:** Company 3 Expert's Response Matrix

---

	1	2	3	4	5
1	1	7	5	7	6
2	1/7	1	1/6	6	4
3	1/5	6	1	5	5
4	1/7	1/6	1/5	1	1/4
5	1/6	1/4	1/5	4	1

---

## Appendix F: Pairwise Comparison for BSC Perspective

This section is the internal business process perspective's pairwise comparison which was surveyed from three companies in healthcare industry.

**Table F.5:** Consolidated Weighted Mean

	1	2	3	4
1	1	0.17	0.16	0.35
2	5.77	1	0.52	0.36
3	6.32	1.91	1	1.59
4	2.88	2.77	0.63	1

**Table F.2:** Company 1 Expert's Response Matrix

	1	2	3	4
1	1	1/8	1/9	1/9
2	8	1	1	1/8
3	9	1	1	3
4	9	8	1/3	1

**Table F.3:** Company 2 Expert's Response Matrix

	1	2	3	4
1	1	1/3	1/4	3
2	3	1	1	3
3	4	1	1	4
4	1/3	1/3	1/4	1

**Table F.4:** Company 3 Expert's Response Matrix

	1	2	3	4
1	1	1/8	1/7	1/8
2	8	1	1/7	1/8
3	7	7	1	1/3
4	8	8	3	1

## RESUME



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