Using AHP Method to Align and Integrate HR Metrics to Organisations' Balanced Scorecard

Dr Mohammed Tikrity

Alpha Training UK Limited

Working paper submitted to

"HR Metrics" Conference

Jordan, 11 – 14 June 2012

Using AHP Method to Align and Integrate HR Metrics to Organisations' Balanced Scorecard

Dr Mohammed Tikrity

Alpha Training UK Limited

Abstract

One of the most discussed topics in the HR industry today is metrics and measurement. There is a consensus that HR metrics are a vital way to quantify the cost and the impact of employee programs and HR processes and measure the success (or failure) of HR initiatives. HR Metrics has to be aligned and integrated with business objectives and operational capability to achieve the organisational strategy. One approach to achieve this alignment and Integration is the Balanced Scorecard (BSC) that matches business strategy against HR deliverables and objectives to provide statistical basis by which HR efficiency & contribution to strategy implementation can be measured. A balanced scorecard requires selecting the set of metrics for each of the four areas: customers, financial, internal business processes, and learning & growth. As BSC is essentially a frame for realisation of defined strategy in the organisation, its implementation requires an adequate choice of measures or indicators.

Ideally, BSC will measure the impact of all HR policies on their firm performance and capture the full impact of HR. But there are many challenges to achieve this. The first is that human capital is an intangible asset and HR's influence on firm performance is difficult to measure. Researchers agree that implementing effective measurement systems for intangible assets is a very difficult task and demands the existence of a unified framework to guide the HR managers. As Dave Ulrich put it "HR measurement is complex, difficult, and at times confusing, but it can and must be done."

The second challenge in building balanced scorecard and HR metrics is the alignment and Integration. If organisations were to improve the management of their intangible assets, they had to align and integrate them into their management systems.

Another challenge is that the formulation of an organisational strategy means making the correct decisions, selecting the best alternatives and optimising choices. The process of building BSC also requires a numerically weighted list of strategic process improvement priorities, measures and initiatives to help get the highest impact on improving performance. BSC as a model of balanced indicators gives a review of organisation activities within four perspectives (finance, users, business processes, learning and development) whereby necessary conditions for development and continual improvement are created. BSC implementation asks for an adequate choice of measures and indicators.

The purpose of this paper is to discuss these issues and proposes a framework to help the implementation, integration and optimisation of HR metrics to the organisation's BSC by using the AHP method. This framework is based on proper transformation of BSC strategy map to an AHP hierarchy.

The typical use of AHP in Balanced Scorecard reported in the literature is putting the vision and strategy at the top level of the AHP hierarchy as the overall objective, the four BSC perspectives, financial, customers and process and learning & growth, in the second levels as criteria (and third level if there are sub-criteria), and the operational metrics and indicators on the third or fourth level as alternatives. The logic of the structure of BSCs strategy map is different from that of AHP. The strategy map describes the causal relationships between strategic objectives in a sequential manner. Since the HR operation is part of the learning and growth perspective it should not be used in the same level of the other three perspectives. The three (remaining) BSC objectives (financial, customers and process in this case) should act as a filter (or conditioner) to optimise the "learning and growth" parameters (HR metrics for example). Because most of the outputs of the filter are lag indicators the optimisation process can only be achieved (manually) by experts or decision maker, i.e. the team who will choose the best metrics.

The paper will briefly review the concepts of the balanced scorecard (BSC), how to build the strategy map and how to integrate and align the HR metrics. Finally, the paper presents the concepts and applications of the Analytical Hierarchy Process (AHP) and explains how to apply it to a typical prioritisation and selection problems.

Introduction

The role of HR and the structure of the HR department have been changed significantly in recent years. They have been moved from purely administrative function into a strategic partner. Organisations are creating separate structures for HR and different roles for HR professionals. Dave Ulrich, the most influential person in HR pointed out that organization should move away with HR and apply four new strategic HR roles; Strategic partners, Administrative Experts, Employee Champions, and Change Agents.[1] The model is the process of aligning HR strategy with corporate strategy.

Research also confirms that there is a correlation between human capital and the creation of value. Watson Wyatt, a major consulting firm, released the results of a one-year study on human resource management practices for 405 publicly traded companies. The study concluded that there is a correlation between how human resources are managed and the amount of shareholder value.[2] According to Bruce Phau, head of Watson Wyatt's measurement division, if you can improve your human resource management in certain key areas, you can experience a 30% increase in shareholder value. The message is clear - measuring and managing human capital is a major part of creating value and it must be a key component of the Balanced Scorecard.

There is a consensus that HR metrics are a vital way to quantify the cost and the impact of employee programs and HR processes and measure the success (or failure) of HR initiatives. They enable an organisation to track year-to-year trends and changes in these critical variables. It is how organisations measure the value of the time and money spent on HR activities in their organisations. However, human capital is an intangible asset and HR's influence on firm performance is difficult to measure. Hence, in the current state of HR there is a clear rift between what is measured and what needs to be measured. If companies were to improve the management of their intangible assets, they had to integrate the measurement of intangible assets into their management systems. If you cannot measure it, you cannot improve it.[3]

According to Ulrich *(*1997*)* implementing effective measurement systems for intangible assets is a very difficult task and demands the existence of a unified framework to guide the HR managers. "HR measurement is complex, difficult, and at times confusing, but it can and must be done."[4]

The HR scorecard is a lever that enables HR measurement. The HR scorecard is a measurement as well as an evaluation system for redefining the role of HR as a strategic partner. It is based on the Balanced Scorecard framework developed by Kaplan and Norton (1996). The "Balanced Scorecard" framework has been identified as an effective methodology for deploying strategic direction, communicating expectations, and measuring progress towards agreed-to objectives. Today, over 70% of the Fortune 1,000 companies utilize the Balanced Scorecard to help manage performance. The Harvard Business Review, in 1997, cited the Balanced Scorecard as being one of the most important management concepts to have been introduced via articles in the magazine.[5]

But creating a Balanced Scorecard should not start with selecting metrics. Kaplan[6] stated:

> "We recognized that the weakest link in a strategy map and Balanced Scorecard was the learning and growth perspective. For many years, as one executive described it, the learning and growth perspective was "the black hole of the Balanced Scorecard." While companies had some generic measures for employees, such as employee satisfaction and morale, turnover, absenteeism and lateness (probably growing out of the stakeholder movement of the previous decade), none had metrics that linked their employee capabilities to the strategy."

In this paper we present a framework that applies an AHP model within the context of the BSC, to provide an integrated approach to decision making in developing the HR metrics. We begin with a discussion of the BSC, including its genesis, objectives, and basic components, followed by an overview of AHP. Having established the theoretical justification for the use of BSC and AHP in HR metrics decision, we describe the development of the model as well as the subsequent application of the model to the decision process.

Balanced Scorecard (BSC)

The Balanced Scorecard has emerged as a proven and effective tool in our quest to capture, describe, and translate intangible assets into real value for all of an organization's stakeholders. Developed by Robert Kaplan and David Norton in 1992[7], the Balanced Scorecard is the most commonly used framework for ensuring that organisations execute their strategies.

During the late 1980's, Robert Kaplan noticed that to make quality improvement in enterprise performance the measurement system should be expanded beyond financial indicators to include an array of quality metrics relating to customers, manufacturing processes, and employees.[8] This multi-dimensional approach is the basis of

the Balanced Scorecard (BSC). The BSC retains financial metrics as the ultimate outcome measures for company success, but supplements these with metrics from three additional perspectives – customer, internal process, and learning and growth – that was proposed as the drivers for creating long-term shareholder value.*

The Balanced Scorecard methodology typically communicates strategy across the four perspectives:

1. Financial: What financial returns are required by investors?
2. Customer: What do our customers want?
3. Internal Process: What do we need to do to deliver?
4. Learning and Growth. How do we sustain the business?

Figure 1: the four perspectives in the Balanced Scorecard

Figure 1 shows how the Balanced Scorecard provides a framework, through these four perspectives, for translating strategy into operational themes and thereby facilitating the role of management.

Each of the four perspectives has four critical components, as shown in figure 2, include:

- Objectives
- Measurements
- Targets
- Initiatives

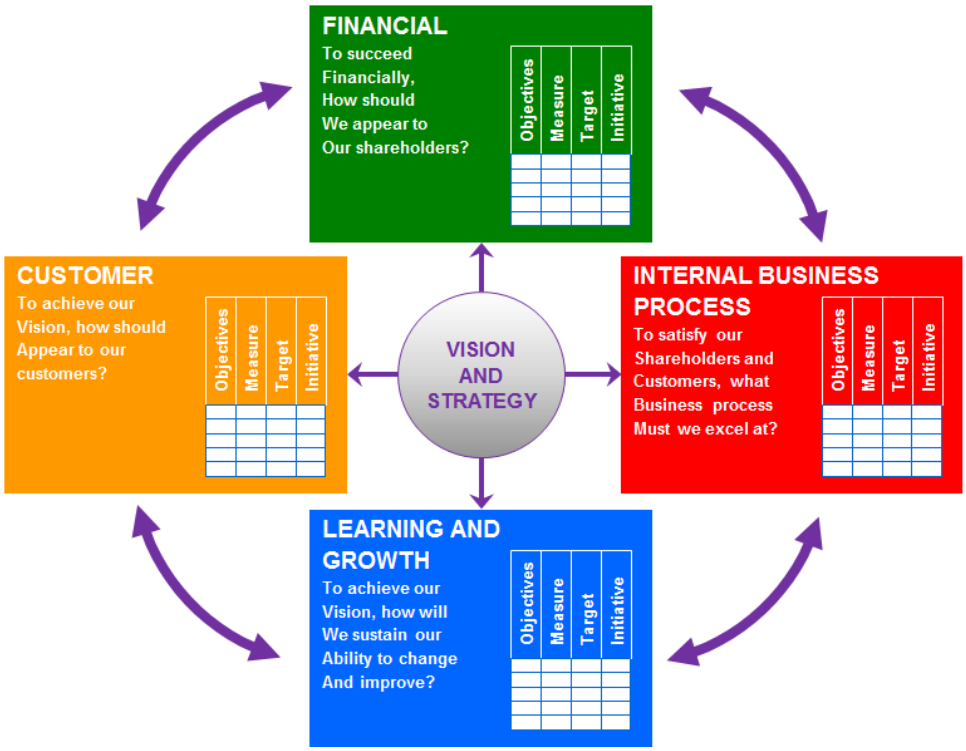

Figure 2

These four components are explained in an example in figure 3.

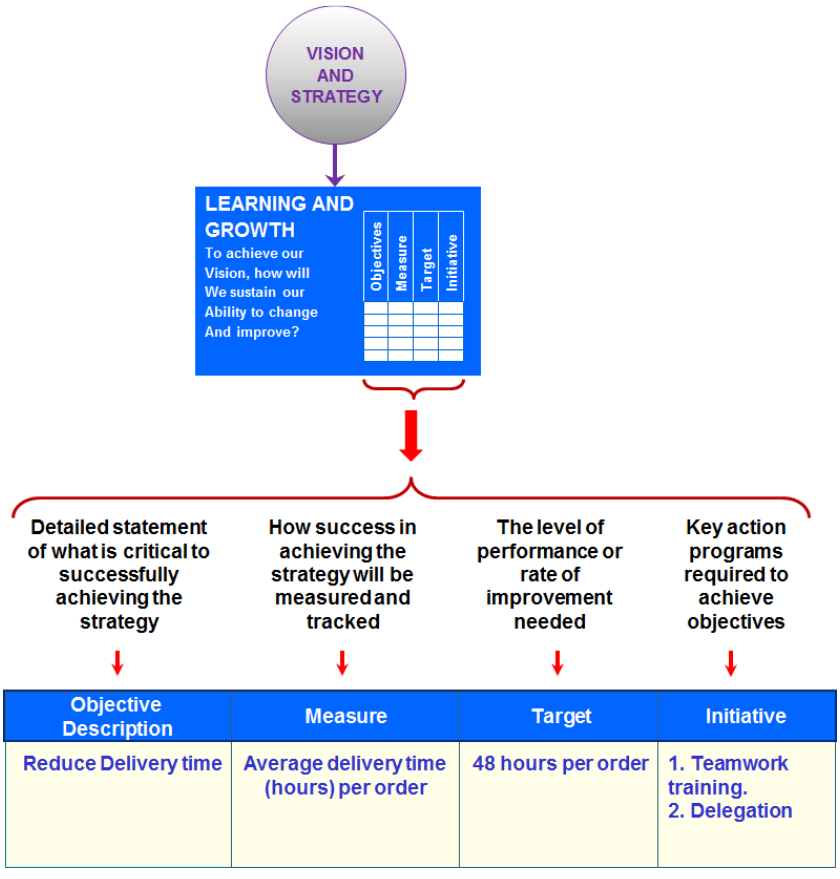

Figure 3: Outcomes (the "what") and performance enablers or drivers (the "how")

Balanced Scorecards shows the knowledge, skills and systems that the organisation's employees will need (learning and growth) to innovate and build the right strategic capabilities and efficiencies (internal processes) that deliver specific value to the market (customer) which will eventually lead to higher shareholder value (financial).[9]

The Balanced Scorecard process captures a cause and effect relationship based on having all parts linked together. Strategic goals link down to objectives, objectives link down to measurements. Measurements should be linked to targets. This requires a one-to-one relationship so that measurements are actionable to the organisation. A target without supporting initiatives is missing the "how" of meeting our performance goals. However, initiatives without targets do not signal whether the results we have achieved are what we expected or commensurate with any predetermined standards.

Cause-and-Effect Relationships

Identifiable cause-and-effect relationships are an important aspect of the Balanced Scorecard when choosing the appropriate indicators. It enables the translation of a financial aim, such as increasing revenue by x%, into operational factors which will lead to that increased revenue. Therefore, by evaluating the relevant factors in each segment of the Balanced Scorecard which may have an impact on a financial aim, the appropriate measures can be identified and the alignment of actions to the strategic goals is facilitated.

Figure 4 demonstrates how the financial aim of improving profitability was translated into operational factors for each of the Balanced Scorecard segments. It clearly demonstrates the hypothesised cause-and-effect links which can be tested using the Balanced Scorecard measurement process. The diagram also shows the emphasis on growth as a means of improving profitability.

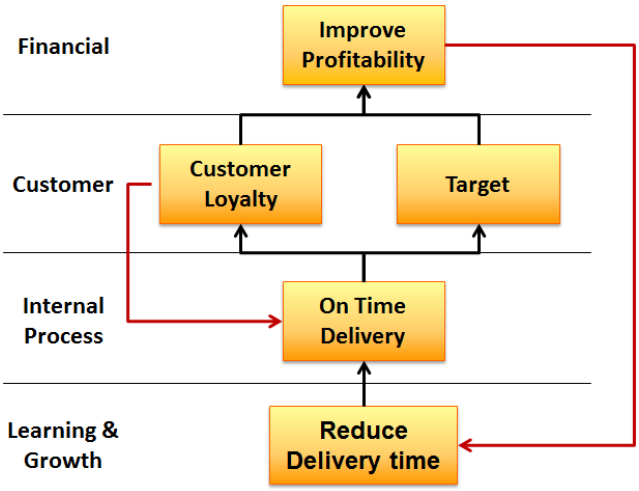

Figure 4: "Double-loop Feedback": Operational Control Loop and Strategic Learning Loop

So, the hypothesis of cause and effect is:

- If we improve our on time delivery
- Then the customer will come to depend on us and become a loyal customer.
- Customer loyalty will help improve our profitability.

The BSC incorporates feedback around internal business process OUTPUTS and a feedback loop around the OUTCOMES of business strategies. This creates "Double-loop Feedback": Operational Control Loop and Strategic Learning Loop.

Strategy Maps

Strategy Maps can be described as a series of cause and effect relationships. The Strategy Maps describe the causal relationships between strategic objectives. All the objectives are linked in cause-and-effect relationships, starting with employees, continuing through processes and customers, and culminating in higher financial performance. The strategy map links intangible assets and critical processes to the value proposition and customer and financial outcomes. Figure 5 shows the current structure for a strategy map.

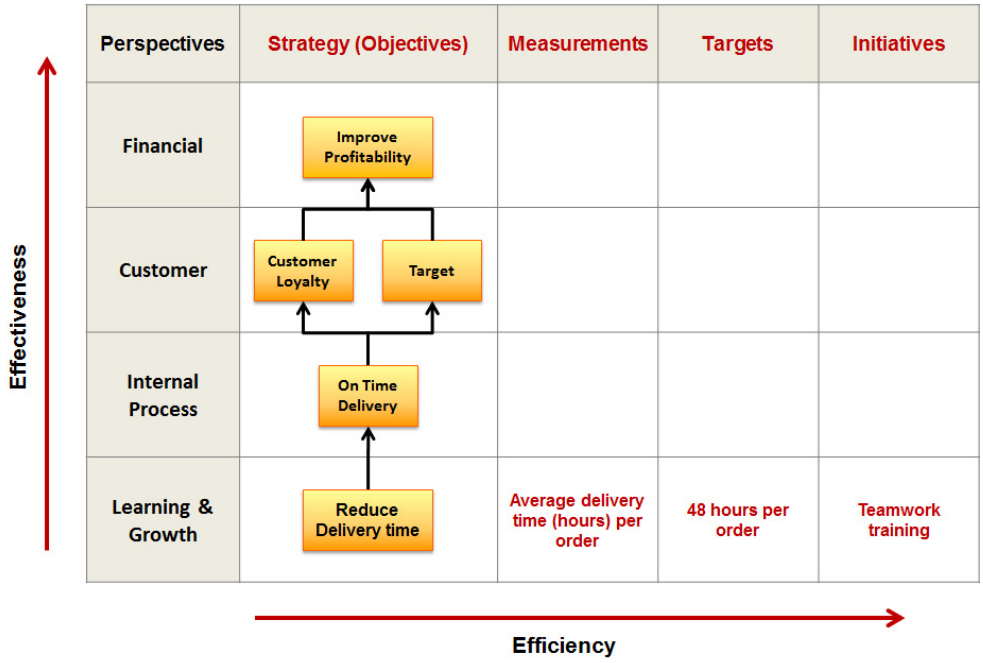

Figure 5: Strategy Map. Capture a Cause Effect Relationship from the Bottom Up.

Another point is that there are two types of indicators: Leading & Lagging Indicators. A "Lead Indicator" is a measure that "drives" or leads to the performance of lag measures; normally measuring intermediate processes and activities. Lead Indicator is an in-process measure - it is predictive. Examples:

- Average speed of answering enquiry
- Average delivery time
- Number of contacts

A "Lag Indicator" is a measure of results, outputs and outcomes - it provides an accurate snap-shot in time.

Examples:

- Total Customer Contacts
- Total Incidents
- Total Problems

HR Metrics and BSC

Kaplan stated that the Balanced Scorecard deliberately did not label its fourth perspective the "employees" or "people" perspective, choosing a more generic name, "learning and growth," to signal that we were not taking a pure stakeholder approach. He pointed out that "Under the BSC approach, employee objectives always appear (in the learning and growth perspective) but they get there because they are necessary for the strategy, not because someone has labelled them as a "stakeholder."[10] The key idea, Kaplan adds, was to have a more robust measurement and management system that included both operational metrics as leading indicators and financial metrics as lagging outcomes, along with several other metrics to measure a company's progress in driving future performance. Objectives in the learning and growth perspectives describe the goals for three components: employees, information systems, and organizational alignment. This means that the HR functions is embedded in the "Learning and Growth" section of the BSC model.

Dave Ulrich's (1997) view is that "the balanced scorecard is built on the logic that for a business to be considered successful, it must satisfy the requirements of three stakeholders: *investors*, *customers*, and *employees*. *Investors* require financial performance, measured in a variety of ways but focusing on economic profitability, market value, and cash flow. *Customers* who use products require quality and service, which can be measured through market share, customer commitment, customer retention, and other customer-focused issues. *Employees* of a firm want that firm to be a healthy place to work as measured by employee and organizational actions. Ulrich pointed out that employees are often the most difficult to measure specifically. Employee measures are often less accepted and less rigorous than are investor and customer measures.[11]

Therefore, the HR Metrics may be based on one of two main approaches[12]:

1. Embedded in the Corporate Scorecard, or
2. Based on HR Function.

It must be emphasised that creating a Balanced Scorecard should not start with selecting metrics. Before selecting metrics, organisations should describe what they were attempting to achieve with their strategies. Kaplan stressed the concept of Value Proposition**.** He stated that the value proposition, the unique combination of price, quality, availability, ease and speed of purchase, functionality, relationship and service, was the heart of the strategy.

Once the employee objectives had been aligned, selected and expressed, it was a simple task to select metrics that measured the performance for each of these strategic objectives. These metrics were more aligned to the strategy than generic metrics of employee morale and satisfaction.

HR Metrics Indicators

Dr. John Sullivan (2006), Head and Professor of Human Resource Management College of Business, San Francisco State University, published an article titled "Metrics - The Future of HR". He said that "HR is the last major business function to adapt the widespread use of metrics."[13] He mentioned 16 reasons to answer the question: Why Metrics Are Essential in HR? He recommended Strategic HR Metrics and he listed 27 individual HR metrics in 10 different categories including:

1. Overall workforce productivity
2. Recruiting
3. Retention
4. Manager satisfaction
5. Compensation and benefits
6. Employee relations
7. Training & Development

Cynthia Stotlar[14] proposed 5 key generic measures: Quantity - Time – Cost- Quality - Human Reaction, and to look to measure these 5 in each of the core HR disciplines. For example:

- In **recruiting** - measure cost per hire, length of time to hire and the quality of those hired.
- In **employee relations** - measure turnover, employee attitudes; absenteeism/tardiness, number of grievances and/or lawsuits filed.
- In **training** - determine the training investment factor, productivity increases, reaction and cost to train.
- In **compensation** - look at salary compression and/or internal equity.
- In **safety** - calculate your worker's comp costs, lost days cost and return to work numbers.
- In **benefits** - measure the number of employees participating, complaints and the costs of each benefit.

Ulrich proposed that HR services can be clustered into six domains: [15]

- Staffing
- Training/Development
- Appraisal
- Rewards
- Organization Governance
- Communication

For each domain four types of assessments may be made:

- Activity
- Customer Value
- Cost/Benefit
- Research

HRMetricsPro (an HR metrics tool) produces over 151 HR activities and processes classified in different categories. Example:

Recruiting - Recruiting metrics measure activities involved in the stages of attracting and selecting top talent. Decision makers frequently want to quantify variables such as: new hire performance, turnover rates of new hires, impact of a poor hire, and return on investment in a new hire, in order to measure the success of the recruiting process.

Retention - Retention metrics often measure important aspects of turnover. Management often wishes to quantify such variables as turnover rate, average tenure, the rate of a veteran worker, or the financial impact of employee turnover. Results often indicate how much each separating employee is costing the company and help the company create proactive plans to prevent the loss of top talent.

Training and Development - Training and development metrics quantify the learning processes of new employees, and includes activities such as: orientation, training process time and costs, and the time and cost of on-the-job learning. Results often demonstrate the success of professional development processes and how much they help the organization achieve its business goals.

Staffing - Staffing metrics quantify the return on investment in your employees. These measures include quantities such as: cost per hire, recruiting efficiency ratio, and the cost to replace an employee.

BSC Designer Balanced Scorecard software[16] "The most widely used HR metrics are typically concerned with employee attitudes, employee turnover, employee skill levels, as well as outsourcing costs, service centre operations, the number HR transactions processed, staffing process, training programs utilization and effectiveness, and promotions. These measurements are employed by 25 to 75% of all business organizations*".* Each metric contains 2 to 5 performance indicators. For example:

"Employee attitudes" metric includes the following indicators: Job Contentment (the percentage of employees satisfied with their job), and Manager Contentment (the percentage of employees satisfied with their manager).

"Employee turnover" metric generally include such indicators, as Cost per Hire (calculation of advertising, agency fees, employee referrals, relocation, recruiter pay and benefits costs and the number of hires), Turnover Cost (calculation of termination, new hire, vacancy and learning curve costs), Turnover Rate (rate of the employees leaving an organization), Time to Fill (the period from job requisition approval to new hire start date), Length of Employment (this indicator considers the job title, department, etc.).

"Recruiting" metric includes Vacant Period (number of overall days the positions were vacant), New Hires Performance Appraisal (average performance appraisal of new hires, compared to previous period), Manager Satisfaction (according to the survey of hiring managers, compared to previous period), Turnover Rates of New Hires (during a specified period), Financial Impact of Bad Hire (according to turnover cost and cost per hire).

"Retention" metric includes Overall Employee Turnover, especially in the key positions, Preventable Turnover (this indicator considers the reasons the employee left the organizations and what measures may be taken to prevent it), Diversity Turnover (turnover rate in professional, managerial, and technical positions), Financial Impact of Employee Turnover.

"Training and Development" metric includes Learning and Growth Opportunities (percentage of employees who are satisfied with the learning and growth opportunities in the organization), On-the-job learning Contentment (percentage of employees who are satisfied with on-the-job learning, project assignments for growth and development, and job rotations), Opportunities for New Hires (percentage of employees who report training opportunities among the top three reasons they accepted the job).

The **Society of Human Resource Management** (SHRM)[17] has identified ten key human capital measurements:

1. Revenue Factor = Revenue / Total Full Time Employees
2. Voluntary Separation Rate = Voluntary Separations / Headcount
3. Human Capital Value Added = (Revenue - Operating Expense - Compensation & Benefit Cost) / Total Full Time Employees
4. Human Capital Return on Investment = (Revenue - Operating Expenses - Compensation & Benefit Cost) / Compensation & Benefit Cost
5. Total Compensation Revenue Ratio = Compensation & Benefit Cost / Revenue
6. Labor Cost Revenue Ratio = (Compensation & Benefit Cost + Other Personnel Cost) / Revenue
7. Training Investment Factor = Total Training Cost / Headcount
8. Cost per Hire = (Advertising + Agency Fees + Recruiter's Salary/Benefits + Relocation + Other Expenses) / Operating Expenses

9. Health Care Costs per Employee = Total Health Care Costs / Total Employees
10. Turnover Costs = Termination Costs + Hiring Costs + Training Costs + Other Costs

Listed below are some critical questions that GTE used in their award winning HR Balanced Scorecard[18]:

Strategic Perspective

- Do we have the talent we need to be successful in the future?
- Are we investing in growing our HR capabilities?

Customer Perspective

- Are we viewed as a great place to work?
- Are we creating an environment that engages our people?

Operational Perspective

- Are our HR management processes and transactions efficient and effective?
- Are we using technology to improve HR efficiency?

Financial Perspective

- Is our return on investment in people competitive?
- Are we managing our cost of turnover?

Integrating HR Strategy

HR Metrics should be used primarily within the framework of the Balanced Scorecard, i.e. HR strategy should be linked to the business goals and objectives. When creating effective HR measurements, an organisational management should consider whether each set of HR metrics contributes to its business performance and provides an insight into productivity assessment and resources appraisal which lead to efficiency gains and customer experience improvement.

HR Metrics, like other measurements within the Balanced Scorecard, should have strong connections to the strategies of the company. This will help ensure that the evaluation of HR really matters to the organisation and we are working to make things happen.

To integrate HR into a business performance measurement system, managers must identify the points of intersection between the HR and the organisation's strategy implementation plan. These points are commonly called the HR deliverables. They are the outcomes of the HR architecture that serve to execute the firm's strategy.

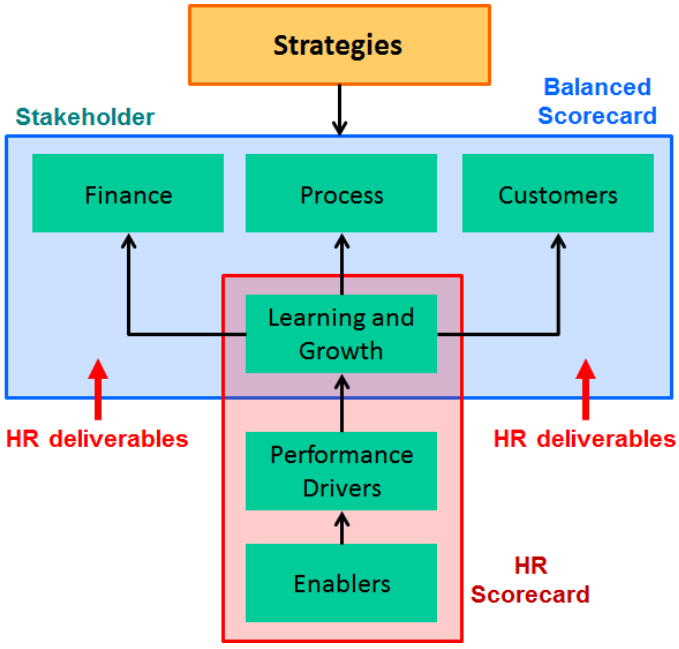

Figure 6

HR deliverables covers both HR Drivers and HR Enablers as shown below.

Drivers	Enablers
Motivation Troubleshooting skills Ability to think out-of-the-box Knowledge of sexual harassment legislation Ideas on further training Number of suggestions for improvement, Certifications Capacity for teamwork Employee satisfaction Productivity Company affiliation Low fluctuation rate Low incidence rate	Technology support Incentives Job expertise Appraisal process Recruitment Competency model Rewards and recognition Training and development Resourcing Performance management Training and development Employee relations Career development

BSC Implementation Using Analytic Hierarchy Process

AHP is widely used in many fields, such as planning, strategic analysis, finance, and medical applications, science, engineering; and in the field of management in general and Human resources in particular. See Bahurmoz & Al-Sharqi (2011)[19], Tikrity (2008)[20], Ehrhardt et al[21], Albayrak and Erensal (2004)[22], Bhagwata and Sharmab (2007)[23]. Reisinger, H. et al (2003)[24]. Alexandre, A. V. et al (2011)[25], Leung L. C. et al[26] (2006), Clinton B. D. et al (2002)[27], Theriou N. G. et al (2004)[28]and Searcy D. L. (2004)[29].

Searcy D. L. (2004) investigated the use of the AHP at the first level of the balanced scorecard hierarchy with data from six firms. Searcy found a couple of interesting points. First, the employee performance category is ranked last across all companies. When compared to the other performance categories, employee performance is just not as important. The second interesting point is the relative ranking of the customer performance category. A strong customer focus is at the heart of lean enterprises[30].

The typical use of AHP in Balanced Scorecard reported in the literature is putting the vision and strategy at the top level of the AHP hierarchy as the overall objective, the four BSC perspectives in the second levels as criteria (and third level if there are sub-criteria), and the operational metrics and indicators on the third or fourth level as alternatives. The logic of the BSCs strategy map is different from that of AHP. The strategy map describes the causal relationships between strategic objectives in a sequential manner. All the objectives are linked in cause-and-effect relationships, starting with employees, continuing through processes and customers, and culminating in higher financial performance.

The proposed transformation of HR metrics into an AHP structure is as follows:

First, consider one perspective at a time. Take, for example, the HR metrics in the "learning and growth". On the top level of the AHP hierarchy is the overall goal which is, in this case, the selection of the best HR metrics. On Level 2 are the three BSC (remaining) objectives: Financial, Customers and Process. Level 3 contains the elements of "learning and growth" such as "employees", HR functions and activities…etc. If any of these elements has sub-elements or sub-activities they go to the next level down. On the lowest level (level 4 or level 5) are the alternatives - the list of metrics.

The three (remaining) BSC objectives (Financial, Customers and Process in this case) act as filters (or conditioners) to optimise the "learning and growth" parameters (HR metrics for example). Because most of the outputs of the filter are lag indicators the optimisation process can only be achieved (manually) by experts or decision maker, i.e. the team who will choose the best metrics.

It is important that different personnel should be used in the metric identification process for each separate area. Participants initially should be encouraged to brainstorm and use their experiences and expertise to identify all possible metrics in each area. After they identify the set of possible metrics, the next step is to reduce the list to a smaller number of metrics by using some suitable tools such as Nominal Group Technique. After the list has been reduced, the AHP facilitator uses the reduced set of metrics and has participants respond to the AHP task.

Each participant is asked to fill in all comparison metrics. From the participants' responses, the AHP computes the priorities of the matric.

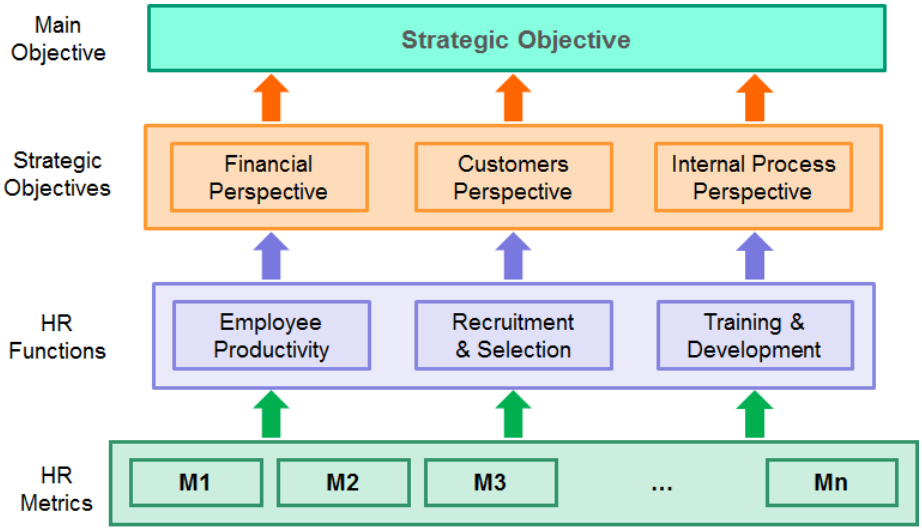

Figure 8

From the control system point of view the system looks like the following:

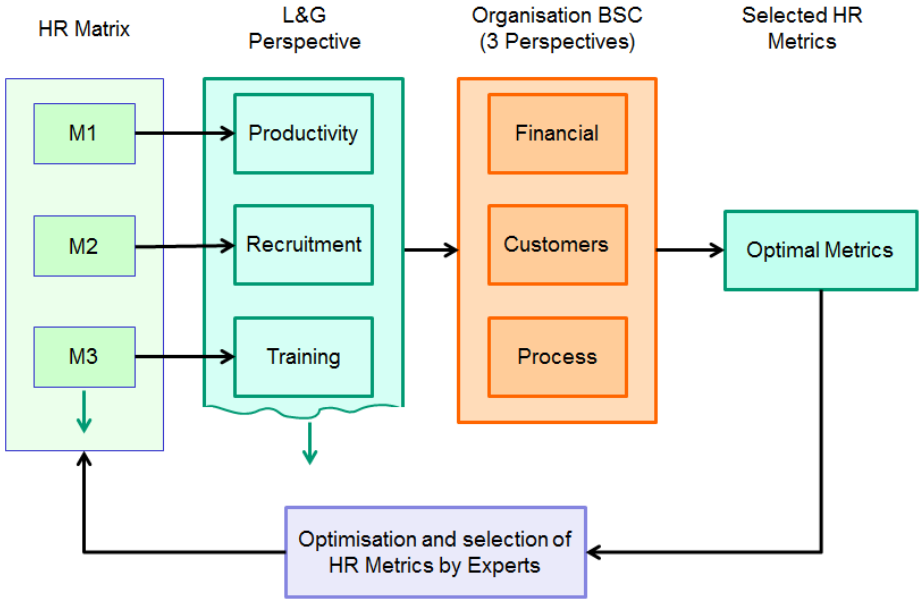

Figure 9

There are two perspectives in figure 9:

- Alignment between the HR system that produces the HR deliverables and the organisation's strategic implementation system.
- Alignment between the expectations of the HR functions and the individual competencies required to deliver.

The list of potential HR metrics is quite extensive, and the selection must be tailored to a specific business process and environment. Most scorecard practitioners and consultants have settled on a figure of 20 to 25 measures as being appropriate for the highest-level Balanced Scorecard.

The Analytical Hierarchy Process

The Analytic Hierarchy Process (AHP) is a powerful and comprehensive Multi Criteria Decision Making (MCDM) method developed in the 70s by Dr Thomas Saaty[31]. AHP provides groups and individuals with the ability to incorporate both qualitative and quantitative factors in the decision making process. The AHP uses a hierarchical model comprised of a goal, criteria, perhaps several levels of sub criteria and alternatives for each problem or decision.

The Analytic Hierarchy Process (AHP) is capable of combining qualitative and quantitative criterions in decision making processes. The AHP model is successful in practice and has numerous and diverse applications. AHP's capability of handling complex decision problems is well acknowledged. AHP can handle complex and poorly defined problems which rigorous mathematical models display difficulty in solving. It also helps create a consensus of scenarios or situations by converting qualitative decisions to quantitative data. AHP has the ability to handle both tangible and intangible attributes, define the structure of a scenario through its inherent hierarchical model and verify the consistency of end decisions.

AHP is a general method for structuring intricate or ill-defined problems and is built around three principles:

- The principle of constructing hierarchies.
- The principle of establishing priorities.
- The principle of logical consistency.

The AHP uses a hierarchical model comprised of a goal, criteria, perhaps several levels of sub criteria and alternatives for each problem or decision.

The simplest model of hierarchy consists of three levels:

- The main objective (goal),
- The criteria (attributes) and
- The options (alternatives)

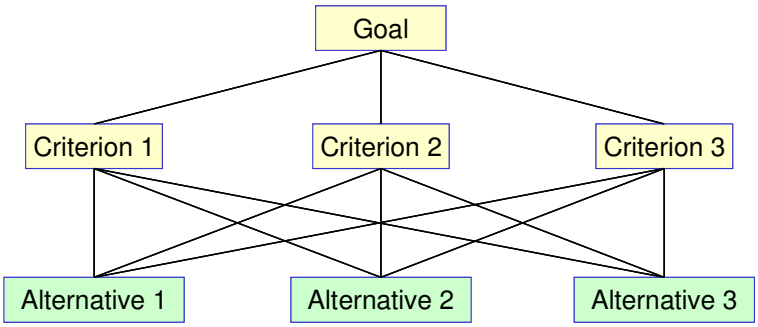

Figure 10

AHP procedure is based on 6 basic steps:

1. Definition of the problem and clearly set goal and possible alternatives (solutions) of the problem
2. Development of the hierarchical structure with defined criteria, sub-criteria and alternatives
3. Comparison of paired elements from the same level in relation to the element of a higher level
4. Determination of relative weight coefficients of hierarchical elements
5. Testing of evaluation consistency
6. Synthesis of relative weights of decision-making elements in order to get a complete evaluation of significance of alternatives (solutions)

The attributes in an AHP problem are generally not all measurable in the same units. In fact, some attributes may be impractical, impossible, or costly to measure at all. The car price is directly measured in dollars, the time required to complete a process is measured in hours or minutes, but company image or product's quality may not be practically measured in any unit. Generally speaking, there are two types of attributes, quantitative attributes

and qualitative attributes. Quantitative attributes such as prices, sizes, weights, time, and number of defects...etc. can be expressed in figures. Qualitative attributes, such as quality of life, reputation, customer status, leadership ability …etc., cannot be expressed directly in any unit. AHP problems involve analysis of a finite and generally small set of discrete and predetermined choices or alternatives. The term "choices" may be referred to as "alternatives", "options", "actions", "policies", strategies", "measures", "metrics" or "candidates".

The fundamental input to the AHP is the decision maker's answers to a series of questions of the general form, 'How important is criterion *A* relative to criterion *B*?' In other words AHP requires the decision maker to rate the importance of each attribute in pairs on a nine-point scale.

Paired comparison means focusing on only two decision elements at a time. This limited focus helps to maintain a cohesive thought pattern while simultaneously discussing all elements of the decision. This paired comparison focus also helps people understand each other and can bring consensus among divergent perspectives in an organisation. Easy-to-understand comparison screens allow you to weight each part of your decision on the basis of data and personal judgments. Paired comparisons involve the comparison of each attribute against every other attribute in pairs. The number of comparisons is given by:

$$n(n-1)/2$$

where n is the number of attributes/objectives. The rest of the matrix is defined by the reciprocal property. The following figure shows a pair comparison matrix.

R	E1	E2	E3	E4
E1	1			
E2		1		
E3			1	
E4				1

Figure 11

The elements E1, E2, … etc. represent a set of attributes or alternatives which requires to be compared in pairs, E1 with E2, E1 with E3 and so on for all combinations. Always, in any comparison matrix, the number of rows equals the number of columns. This type of matrix is called a "square matrix". The number of pairs in this matrix is 16 (4 x 4). Since comparing an element with itself doesn't mean anything, the number of comparable pairs is 12 (= 16 – 4). These 12 comparisons are shown in white cells in figure 11. The four shaded cells, with number "1" inside each of them, represent the comparison of each element with itself. The cell "R" in the left-upper corner shows the "Reference" which the comparison is made with respect to it. Any comparison, whether it is for attributes or alternatives, has to be made with respect to a certain reference attribute, goal or objective.

The nine-point comparison scale is based on experiments that tested how accurately people can assign numbers when comparing two objects, items, features or aspects. These comparisons are called absolute judgment[32]. The table below shows this 9-point scale.

How important (or preferable) is *A* relative to *B*?	Preference index
Equally important	1
Moderately more important	3
Strongly more important	5
Very strongly more important	7
Absolutely more important	9
Intermediate values	2, 4, 6 and 8

The 9-point scale

If the judgment is that *B* is more important than *A*, then the reciprocal of the relevant index value is assigned. For example, if *B* is felt to be very strongly more important as a criterion for the decision than *A*, then the value $^1/_7$ would be assigned to *A* relative to *B*. Because all parts of the hierarchy are interrelated, it is easy to see how a change in one factor will affect the other factors. By laying out decisions in this format, it is easy to incorporate many types of data, accommodate differences in levels of performance, and make trade-offs among things that look different.

In most cases, the stakeholders will apply weights to the objectives. Placing weights on attributes is, more or less, a technical task that is undertaken by experts or the decision analyst. In General situations, the most general objective is often stated as "Overall goal" or "Best choice". This is then divided into sub- criteria that have management, technical, economic, social and environmental aspects. An objectives hierarchy ensures that the attributes are appropriately related to an overall goal.

A judgment matrix is formed from the subjective pairwise comparisons. For each criterion C, an n x n matrix A of pairwise comparisons is constructed. The components a_{ij} (i, j = 1, 2… n) of the matrix A are numerical entries, which express (by the pairwise comparison scale) the relative importance of the element I over the element j with respect to the corresponding element in the next higher level. Thus the matrix A has the form:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix}$$

where: $a_{ii} = 1$, $a_{ji} = a_{ij}$, $a_{ij} \neq 0$

The elements of the matrix A become the subjective estimates of the pairwise comparisons.

Consistency

The assurance that a set of values satisfies prescribed conditions. For example, state consistency is maintained by invariants - expressions involving specified attribute values. Relation consistency can be maintained by cardinality constraints.

The estimates will not be perfectly consistent due to natural inconsistencies due to uncertainty inherent in human judgments. Hence, a mathematical procedure is required to estimate an underlying ratio scale based on an inconsistent judgment matrix.

In the AHP approach the maximum or principal eigenvalue of each matrix of pairwise comparisons is computed for checking the degree of inconsistency. If inconsistency is too high, it is necessary to review the judgments by means of new pairwise comparisons.

In order to measure the consistency of the evaluator's judgment through pairwise comparisons, the AHP model uses a consistency index (C.I.). The consistency index reflects the consistency of qualitative judgments of the importance of criteria and the impact of the degree (or strength) of importance on all comparisons.

$$C.I. = (\lambda_{max} - n) / (n - 1)$$

where λ_{max} is the maximum eigenvalue of the matrix.

AHP provides a table of different-order random matrices and their average consistencies. These random consistency numbers indicate on a random basis the numerical judgment, which can be used to compare with the C.I. The ratio of C.I. to the random consistency number of the same size matrix is called the consistency ratio (C.R.). C.R. is a measure of inconsistency. Inconsistency less than 0.1 is considered to be appropriate. If the inconsistency is more than 0.1, the evaluator should reassess the adequacy of his pairwise comparisons and make revisions.

The HR Metrics - AHP framework

The AHP can be used in two ways to implement HR metrics: (1) at the beginning of the process, to help choose metrics, and (2) after the metrics are chosen, to help understand their relative importance to a firm's managers and employees.

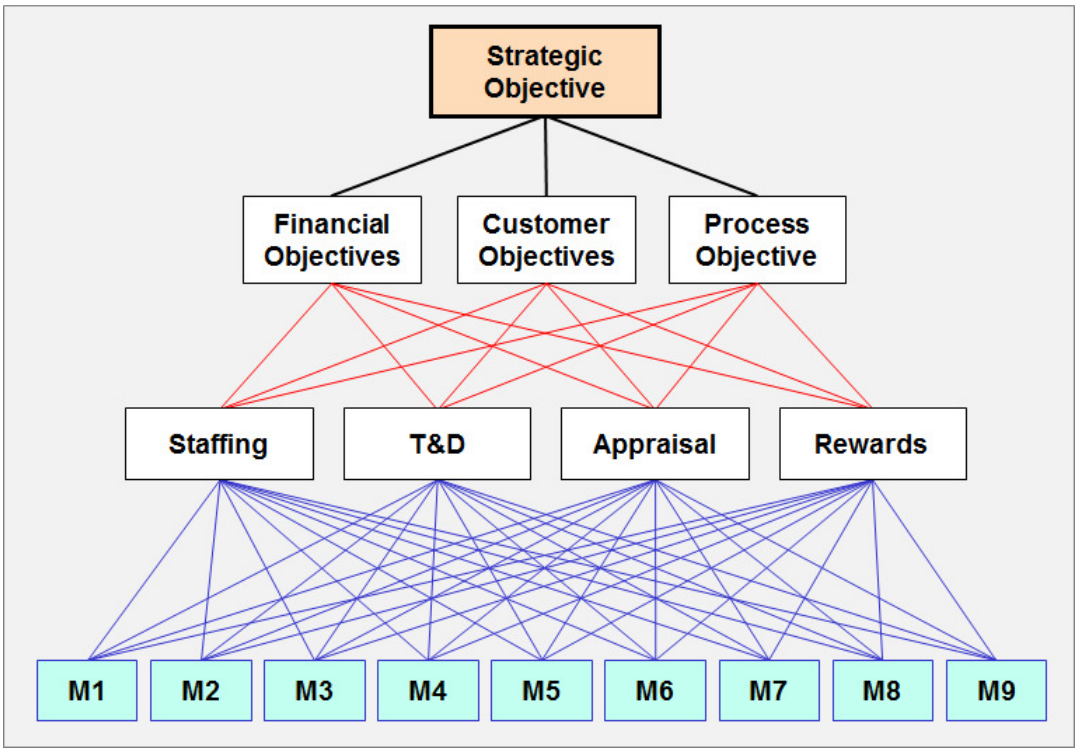

Figure 12: A hypothetical structure showing Integration of HR metrics into the organisation's Balanced Scorecard. M1, M2 … Mn stand for "Measures" or "Metrics"

Assigning weight to the metrics is based on *expert judgment*. It is *context dependent* and thus depends on the industry for which the trees are being used. When analysing the context one must understand the cultural background, employees' competence, resource availability and other relevant factors. After considering all these variables, the Analytic Hierarchy Process (AHP) can be used to determine the relative weight of the metrics.

Conclusion

In this paper we present a framework that applies an AHP model within the context of the BSC, to provide an integrated approach to decision making in developing the HR metrics. We begin with a discussion of the BSC, including its genesis, objectives, and basic components, followed by an overview of AHP and description of the role of AHP as a model for multi-criteria decision-making. Having established the theoretical justification for the use of BSC and AHP in HR metrics decision, we describe the development of the model as well as the subsequent application of the model to the decision process.

The paper proposed a method to transform HR metrics in the "learning and growth" into an AHP structure. The main idea is to consider the three BSC objectives (Financial, Customers and Process) as filters (or conditioners) to optimise the HR metrics. Because most of the outputs of the filter are lag indicators the optimisation process can only be achieved by experts or decision maker, i.e. the team who will choose the best metrics.

REFERENCES

[1] Ulrich, D. (1997). Human Resource Champions – The Next Agenda for Adding Value and Delivering Results. Boston: Harvard Business School Press.

[2] Sullivan J. (2006).Source: Metrics - The Future of HR and Strategic HR Metrics for a Global Organization, http://www.drjohnsullivan.com/newsletter-archives/40-metrics-the-future-of-hr, 2006

[3] Robert S. Kaplan: Conceptual Foundations of the Balanced Scorecard. Paper originally prepared for C. Chapman, A. Hopwood, and M. Shields (eds.), Handbook of Management Accounting Research: Volume 3 (Elsevier, 2009).

[4] Dave Ulrich: Measuring Human Resources: An Overview of Practice and a Prescription for Results. Human Resource Management, Fall 1997, Vol. 36, No. 3, Pp. 303–320

[5] Ian Cobbold and Gavin Lawrie, Classification of Balanced Scorecards Based on Their Intended Use, 2GC Active Management, http://www.2gc.co.uk/pdf/2GC-PMA02-3f.pdf (accessed April 19, 2008).

[6] Robert S. Kaplan: Conceptual Foundations of the Balanced Scorecard. Paper originally prepared for C. Chapman, A. Hopwood, and M. Shields (eds.), Handbook of Management Accounting Research: Volume 3 (Elsevier, 2009).

[7] R. S. Kaplan and D. P. Norton, "The Balanced Scorecard: Measures That Drive Performance," Harvard Business Review, January–February 1992, 71–79.

[8] Robert S. Kaplan: Conceptual Foundations of the Balanced Scorecard. Paper originally prepared for C. Chapman, A. Hopwood, and M. Shields (eds.), Handbook of Management Accounting Research: Volume 3 (Elsevier, 2009).

[9] "Having Trouble with Your Strategy? Then Map It" by Robert S. Kaplan and David P. Norton - Harvard Business Review

[10] Robert S. Kaplan: Conceptual Foundations of the Balanced Scorecard. Paper originally prepared for C. Chapman, A. Hopwood, and M. Shields (eds.), Handbook of Management Accounting Research: Volume 3 (Elsevier, 2009).

[11] Dave Ulrich: Measuring Human Resources: An Overview of Practice and a Prescription for Results. Human Resource Management, Fall 1997, Vol. 36, No. 3, Pp. 303–320

[12] Denis Mahoney (2004). The HR Scorecard. Inspiration to Power Success. www.development1st.com

[13] Sullivan J. (2006), 40-metrics-the-future-of-hr, http://www.drjohnsullivan.com/newsletter-archives/40-metrics-the-future-of-hr

[14] Stotlar Cynthia, M.Ed. 6 Steps to prove Your Worth: The Power of HR Metrics. www.SHRM.org

[15] Ulrich & Lake, 1990

[16] http://www.bscdesigner.com

[17] http://www.shrm.org/about/Pages/default.aspx

[18] Evans M. H. http://www.exinfm.com/board/metrics_for_hr_management.htm

[19] Bahurmoz A. M. & Al-Sharqi L. M. (2011). Implementing the Analytic Hierarchy Process to Recruit Females for The Ministry of Foreign Affairs in Saudi Arabia. http://204.202.238.22/isahp2011/dati/pdf/20_0161_Bahurmoz.pdf

[20] Tikrity, M. A. (2008). Application of Analytical Hierarchy Process (AHP) Model to Employee Selection, Promotion and Succession Planning. "Talent Management in the 21st Century" Conference Dubai, 20 – 22 April 2008.

[21] Richard Ehrhardt & William L. Tullar. Rating Recruiting Sources at Simtec Instruments Corporation: Applying Multiple-Criterion Decision Making in an HR Setting. http://business.troy.edu/jhre/Articles/PDF/2-1/13.pdf

[22] Esra Albayrak & Yasemin Claire Erensal (2004). Using analytic hierarchy process (AHP) to improve human performance: An application of multiple criteria decision making problem. Journal of Intelligent Manufacturing, Volume 15, Number 4, pp. 491-503.

[23] Bhagwata R. & Sharmab M. K. (2007). Performance measurement of supply chain management using the analytical hierarchy process. Production Planning & Control: The Management of Operations Volume 18, Issue 8, 2007. pp. 666-680.

[24] Reisinger, H. et al (2003). "Prioritizing Performance Measures within the Balanced Scorecard Framework" Management International Review, Vol. 43, No. 4 (2003 4th Quarter), pp. 429-43. Published by: Springer.

[25] Alexandre, A. V. et al (2011). "Multidimensional assessment of organizational performance: Integrating BSC and AHP" Original Research Article Journal of Business Research, Available online 23 November 2011.

[26] Leung L. C. et al (2006). Implementing the Balanced Scorecard Using the Analytic Hierarchy Process & the Analytic Network Process. The Journal of the Operational Research Society. Vol. 57, No. 6 (Jun., 2006), pp. 682-691. Published by: Palgrave Macmillan Journals. Article Stable URL: http://www.jstor.org/stable/4102352

[27] Clinton B. D. et al (2002).Implementing the Balanced Scorecard Using the Analytic Hierarchy Process. Management Accounting Quarterly, Spring 2002, Vol. 3, No. 3.

[28] Theriou N. G. et al (2004). A Proposed Framework for Integrating the Balanced Scorecard into The Strategic Management Process. http://abd.teikav.edu.gr/articles_th/framework.pdf

[29] Searcy D. L. (2004). Aligning the balanced scorecard and a firm's strategy using the Analytic Hierarchy Process. Summer, 2004 issue of Management Accounting Quarterly

[30] Niven, Paul R. (2002). Balanced Scorecard Step-by-step. John Wiley & Sons, Inc.

[31] Saaty, Thomas, The Analytic Hierarchy Process. New York: McGraw-Hill Book Co, 1980.

[32] Miller, G. A. (1956). "The magical number seven, plus or minus two: Some limits on our capacity for processing information". Psychological Review 63 (2): 81–97.