HOW ASSESSING INTELLECTUAL CAPITAL IN ICT COMPANIES: A NEW MODEL AND AN EMPIRICAL STUDY FROM JORDAN

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Abstract: The cornerstone of intellectual capital (IC) management, measurement and assessment attracts greater attention from both academics and professionals.

This paper presents the Hierarchical Assessment Index (H.A.I.), which is a new IC assessment model, based on the Analytic Hierarchy Process (A.H.P.) approach, to obtain a global index expressing the aggregated results achieved by the organizational strategies. The HAI considers the strategic assets of a company and its competitive context, to assess intellectual capital characteristics and the generated economic value. Furthermore, the model is empirically applied to three Jordanian ICT companies to provide a validation of its peculiarity.

Keywords: Intellectual Capital; Assessment Model; Analytic Hierarchy Process.

1. Introduction

From the industrial age to the present there has been a great shift in the world of business. Nowadays, information, Intellectual Capital (IC), and technology play a major role in making business organizations successful. Unfortunately, most firms still do not understand the importance of intangible assets (Collins et al., 1997). With this regard, Kim and Kumar (2009) refer to the lack of the right evaluation methods and the lack of prioritization of performance indicators which contribute to identifying IC influence on business value. Moreover, Lev (2001) highlights the need for an innovative approach towards a more efficient evaluation of the R&D activities within the aforementioned organizations, far from the traditional accounting and cost-based methods that over-estimate the risk perception on the R&D investments.

The Arab region’s situation is not far away from this scenario. This is evident from two reports released by the UNDP in 2003 and 2009: the Arab Human Development Report 2003: Building a Knowledge Society (UNDP, 2003) and the Arab Knowledge Report 2009 (UNDP, 2009). Both of them deemed it necessary for the Arab nations to move towards a knowledge-based economy in the future,
or to risk being left behind and stay in the past (UNDP 2003). The Arab region followed these recommendations with increased vigor and began the transition towards a knowledge-based economy. Therefore the UNDP report (2009) laid the foundations of the future knowledge-based societies “through the generation of future public and private sector leaders” (UNDP, 2009), and setting up a new conventional principles for the new knowledge adoption and engagement, to cut down the knowledge-gap among the Arab regions and states currently classified as knowledge-intensive (UNDP, 2009).

IC has become an attractive force of great interest for many states of the Arab region; especially after recognizing IC as a basic economic factor in giving organizations the competitive edge to face market competition (UNDP 2009, Bontis, 2004, Huang and Liu, 2005). In particular, Jordan has been ranked as the second highest IC index in the Arab state (Bontis and Fitz-enz, 2002). This is referable to the fact that Jordanian IT sector is considered as a knowledge-intensive with strong flow rate of IC. However, despite this, Jordanian managers still do not have the right evaluation methods to asses IC and are not able to recognize the IC’s added value to business performance.

The paper presents a model to assess the IC and provides an answer to the following research questions. Firstly, it aims at studying how assessing the organizational IC by considering the context, the sector and the company’s environment; Secondly, it aims at analyzing how supporting managers of IT sector in understanding the value of the IC and in determining the appropriate indicators to be used in the assessment process?

This paper contributes to the literature by proposing an innovative measurement method, which is called Hierarchical Assessment Index (H.A.I.). In addition, the H.A.I aims to support the managers in understanding the value of their IC and the best ways to evaluate and measure IC.

The paper is presented as follows. Section 2 discusses the IC’s evaluation methods in the literature. Section 3 illustrates the H.A.I model. Section 4 describes the model’s assessment process. Section 5 presents an empirical study in which the H.A.I is applied to data from three Jordanian ICT firms and reports and discusses the results of the aforementioned study. Section 6 concludes the paper.

2. Intellectual capital overview

The business world still lacks the right tools to evaluate IC and many researchers and academics agreed on the need to move forward in shaping the definition of IC (Bontis, 1999; Edvinsson and Malone, 1997, Roos et al., 1997; Stewart, 1997; Sveiby, 1997). The majority of these definitions was mostly spin and emerged from the term of intangible assets. The IC classification found in the literature refers to taxonomy, which encompasses three kinds of capital: Relational, Structural, and Human. This classification has been adopted and will be explained in the third paragraph.
Although CEOs from different sectors consider IC as an important strategic asset, constituting the source of competitive advantages, financial performance, and market value, IC assessment is still under exploration and a general and recognized methodology has not yet been defined. With regard to the IC, numerous evaluation models have been proposed. However, the wide variety of these models is instantly clear. Most of them rely on different techniques and approaches for solving different problems related to IC assessment. The Technology Factor (Khoury, 1994), Holistic Value approach (Pike and Roos, 2000), Intellectual Capital Benchmarking Systems (Viedma, 2001) and the IC Audit (Brooking, 1996) had the main purpose to improve the internal management. In addition to this, the part of improving the External Reporting has been handled by the intangible Capital model (Gu and Lev, 2001), Value Chain Scoreboard (Lev, 2001) and the Skandia Navigator (Edvinsson and Malone, 1997). Thus, it becomes a necessity for companies to find a suitable and flexible approach to meet their needs to move forward with IC evaluation, so as not to have to rely on differing approaches for every problem that may arise in future.

Furthermore, experience has demonstrated that, in addition to listing and classifying companies’ intangible assets, it is necessary to determine the characteristics which influence companies’ performance and their positive and negative trends.

Since a firm’s intangible asset development is strictly related to its competitive strategy, Zack (1999) recognized the importance of adopting a strategy reflecting the management’s decision on how to respond to external reality. To do this, managerial perceptions should shape the way knowledge resources are used and it should be valued as an intangible asset to the organization. Thus, managers’ opinions and experiences should be taken into account for the achievement of the desired performance not only with regard to the actual state of the company’s performance, but also with regard to its development over time. Reasonably, the choice of intangible assets to be developed by an organization is strictly dependant on its capability to make this choice fit for the business strategy of the company (Johansson et al., 2001); not secondarily, it is relevant to understand on what specific areas the organization needs to focus and what knowledge assets of human resources need to be leveraged within each specific area (Andreou et al., 2007).

Additionally, four scenarios have been discussed earlier by Andriessen (2003), regarding the differences between the financial valuation, value measurement, value assessment and measurement as follows:

- First Scenario is the IC measurement: a numerical scale reflects the usefulness or desirability, with observed characteristics variables at hand.
- Second Scenario is the IC financial valuation: a numerical scale reflects the usefulness or desirability, and the money unit used on this value scale.
- Third Scenario is the IC value measurement: a numerical scale reflects the usefulness or desirability, but without any money units used on the value
scale, but the value can translate into observed criteria.
- Fourth Scenario is the IC value assessment: a scale reflects the usefulness or desirability, but without any money units on the value scale, and without any observable criteria.

The proposed model considers the third scenario as the most suitable to support managers with a unique method for their IC assessment, by reflecting usefulness and desirability, without monetary and financial indicators, but through qualitative and subjective perspectives. In the specific, the proposed model aims to consider the components that contribute to economic performance in the process of mutual sharing, promotion and growth. To do this, it refers to the ‘Intellectual Capital Index’ (Roos et al., 1998; Pike and Roos, 2001), which gives an index of the intangible assets measured in a holistic way, and to its extension by Chu et al. (2006), which deals with an association of components of the intellectual capital with the value and the performance of the firm and shows their considerable influence in the direction of the value creation process.

3. The HAI Model Structure

The “Hierarchical Assessment Index” (HAI) model is based on the previous study held by Grimaldi and Cricelli (2009). The HAI classifies all the intangible assets in successive levels so that each of them directly influences the performance measurement (Figure 1). The model has the capability to show a balanced image of the intangible assets of the firm, as each asset can be allotted a priority that gives the measure of the influence on the performance. The definition of these priorities is based on a process that assembles managers’ thoughts and experiences through the Analytic Hierarchy Process (Saaty, 1980).

The Analytic Hierarchy Process (AHP), as introduced by Saaty (1980), is a flexible, structured technique for dealing with complex decisions which seeks to break the problem down into a hierarchical structure consisting of goal, criteria, sub-criteria and alternatives.

The element placed at the top of the hierarchy represents the goal the decision maker wants to reach or achieve. The alternatives or activities are placed at the bottom level of the hierarchy. The criteria and their attributes are presented in the middle levels of the hierarchy for the evaluating process. Figure 1 shows the goal element (IC), criteria (Value drivers), attributes (Sub value driver) and alternatives (Measurement Indicators).
3.1 HAI Taxonomy: The Value drivers

The first level of the hierarchical structure encompasses the organization’s goals and, therefore, holds the highest degree of significance. This global value includes all of the second level elements (value drivers), which specify contents and meaning of the company’s goal; the tangible and intangible assets referring to each element of the second level are grouped into the elements of the third
level (characteristics); at the last level, the measurement indicators are provided.

The Human, Structural, and Relational Capital have been introduced in literature as part of IC structural taxonomy (Youndt and Snell, 2004; Edvinsson and Sullivan, 1996; Wiig, 1997; walsh et al., 2008; Sharabati et al., 2010).

3.1.1 The Human capital (HC)

This term has been discussed by many researchers. Some of them refer to it as the human capital’s contributions to IC (Fletcher et al., 2003) under the term human resources. Sveiby (1997) and Tamayo et al., (2001) refer to it as the individual contributions of knowledge, ideas, innovations, patents, and much more by employees within the organization thus bringing added value to organizations’ intangible assets.

There was also unanimity among many researchers that Human capital encompassed individual contributions of knowledge, ideas, innovations, know-how, and problem solving skills and promoted better organizational productivity (Sharabati et al., 2010; Reed et al., 2006). In addition, personal values and organizational culture are to be considered in human capital as important and difficult imitate or replace individual contribution for the organizational context (Edvinsson and Malone, 1997; Walsh et al., 2008).

3.1.2 The Structural Capital (SC)

This term concerns all the organizational processes, polices, functions, procedures, technology and organizational structure (Edvinsson and Malone, 1997; Stewart, 1997; Roos et al., 1998; Allee, 1999; Saint-Onge, 1999; Fletcher et al., 2003). Furthermore, it is considered as an important concept within the IC taxonomy; people joining an organization for a certain period of time, and then leaving or moving to another organization take with them their knowledge, competencies, know how, and experience. People contribute with their knowledge during their employment and this knowledge will become part of the organization’s IC. As a result, the lack of strong structural capital denotes a lack of better integration for the employee’s knowledge and skills inside organizations (Bontis, 1998). With this regard, Ferreira and Martinez, (2011) promote human interactions inside the organization with the aim of capturing knowledge and managing it as a fundamental part of the organizational capital.

3.1.3 The Relational Capital (RC)

This term refers to the knowledge available to organizations through the relational structure with external parties such as customers, suppliers, partners, joint ventures and business affiliations (Stewart, 1997). In this sense, Youndt et al (2004) and Alder and Kwon (2002) introduced the Relational Capital and refer
to it as the External Structure or External Social Capital. These aspects refer to the employee’s interaction within the organizations with external parties and environments. This kind of relational issue enhances knowledge and experiences of employees and leads them to better contributions to IC. Moreover, Keller (2003) highlights that organizations should focus on improving the relationships with customers to attract new of them and retain the current ones.

3.2 HAI Taxonomy: The Characteristics

Stability, Efficiency, and Growth: these characteristics refer to specific aspects of each value driver by means of properly defined performance indicators.

3.2.1 Stability

Stability represents the endowment of the company in terms of material and immaterial talents and capabilities examined at a precise time (“As Is” condition).

3.2.2 Efficiency

Efficiency is intended as the capacity of obtaining the desired performance by means of the available tangible and intangible assets.

3.2.3 Growth

Growth answers the demand for controlling company development and the positive trend of its continuous improvement. The analysis of growth studies the “To Be” condition of the variables.

3.3 HAI Taxonomy: The Measurement Indicators

Measurement indicators vary from an organization to another and depend on the typology of industry and on the dimension of the firm. The measurement indicators have been identified by reviewing the literature (Tables, 2, 3, 4), moreover the selected measurement indicators have been discussed with the managers in the chosen companies, where it has been customized according to their needs.
<table>
<thead>
<tr>
<th>Human Capital</th>
<th>Literature Background</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stability</strong></td>
<td></td>
</tr>
<tr>
<td>Satisfaction of employees</td>
<td>Bontis and Serenko, 2009; Shih el at., 2010; Moon and Kym 2006; Walsh 2008</td>
</tr>
<tr>
<td>Education</td>
<td>Choong, 2008; Youndt and Snell, 2004; Kong and Prior, 2008; Kong, 2008</td>
</tr>
<tr>
<td>Competencies of employees</td>
<td>Kim et al., 2010; Choong, 2008; Bontis and Serenko, 2009; Shih el at., 2010; Moon and Kym 2006; Walsh 2008</td>
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<tr>
<td><strong>Efficiency</strong></td>
<td></td>
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<tr>
<td>Employee Turn Over</td>
<td>Bontis and Serenko, 2009; Shih el at., 2010; Moon and Kym 2006; Walsh 2008</td>
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<tr>
<td>Employee awareness/ motivations</td>
<td>Kim et al., 2010; Choong, 2008; Bontis and Serenko, 2009; Shih el at., 2010; Moon and Kym 2006; Walsh 2008</td>
</tr>
<tr>
<td>Savings from implemented employee suggestions</td>
<td>Kim et al., 2010; Choong, 2008; Bontis and Serenko, 2009; Shih el at., 2010; Moon and Kym 2006; Walsh 2008</td>
</tr>
<tr>
<td><strong>Growth</strong></td>
<td></td>
</tr>
<tr>
<td>Investment in Training and Formation</td>
<td>Castilla and Ruiz, 2008; Tan, 2008; Campos and Pomeda, 2007; Bontis et al., 2000; Bontis,2001; Ferreira and Martinez., 2011</td>
</tr>
<tr>
<td>New Idea and Innovation from employee</td>
<td>Kim et al., 2010; Choong, 2008; Bontis and Serenko, 2009; Shih el at., 2010; Moon and Kym 2006; Walsh 2008</td>
</tr>
<tr>
<td>New skills, experience of employees</td>
<td>Castilla and Ruiz, 2008; Tan, 2008; Campos and Pomeda, 2007; Bontis et al., 2000; Bontis,2001; Ferreira and Martinez., 2011</td>
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Table 1. Human capital Measurement indicators literature review screening

<table>
<thead>
<tr>
<th>Structural Capital</th>
<th>Literature Background</th>
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<tr>
<td><strong>Stability</strong></td>
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<tr>
<td>Internal cooperation and sharing</td>
<td>Joia and matherios, 2009 ; Swart, 2006; Luo el at., 2009; Vergauwe,2009; Campos and Pomeda, 2007; Bontis et al., 2000; Bontis,2001; Ferreira and Martinez., 2011</td>
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<tr>
<td>Process technology and IT penetration</td>
<td>Bontis et al, 1999; Petty &amp; Guthrie, 2000; Klock &amp; Megna, 2000; ACS, 2002; BOZBURA, 2004; Carlucci et al, 2004; Qureshi el at., 2006</td>
</tr>
<tr>
<td>Corporate culture and philosophy</td>
<td>Edvinsson and Malone, 1997; Stewart, 1997; Roos et al., 1998; Allee, 1999; Saint-Onge, 1999; Fletcher et al., 2003</td>
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<tr>
<td><strong>Efficiency</strong></td>
<td></td>
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<tr>
<td>Number of best practice identified</td>
<td>Bontis et al, 1999; Petty &amp; Guthrie, 2000; Klock &amp; Megna, 2000; ACS, 2002; Bozbura, 2004; Carlucci et al, 2004</td>
</tr>
<tr>
<td>Number of innovative ideas and number of implemented innovative ideas.</td>
<td>Carlucci et al, 2004; Lee, Lee, &amp; Kang, 2005; Capello &amp; Faggian, 2005; Marr, 2005; Yang and Lin, 2009; Youndt and Snell, 2004;</td>
</tr>
<tr>
<td>Returns on assets</td>
<td>Youndt and Snell, 2004; Dorweilr and Yakhou, 2005; Bozbura &amp; Beskese, 2007; Carlucci &amp; Schiuma, 2007; Unger et al, 2009; Nevine &amp; Tony, 2010; CMA, 1999</td>
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</table>
### Table 2. Structural capital Measurement indicators literature review screening

<table>
<thead>
<tr>
<th>Growth</th>
<th>Entrepreneurship and innovation</th>
<th>Revenue from new product and product development.</th>
<th>IT and KMS Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campos and Pomeda, 2007; Lee, &amp; Kang, 2005; Kang and Snell, 2008; St-Pierre &amp; audit, 2011; Grant, 1996; Grant, 2009; Luo el al., 2009</td>
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<tr>
<td>Haeussler el at., 2010; Chang el at., 2008; Campos and Pomeda, 2007; Eric, 2008; Joia and malherios, 2009; Luo el at., 2009; Hsu and fang 2009</td>
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<tr>
<td>Bontis et al, 1999; Petty &amp; Guthrie, 2000; Klock &amp; Megna, 2000; ACS, 2002; Bozbura, 2004; Carlucci et al, 2004; Hsu and fang 2009; Qureshi el al., 2006</td>
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### Table 3. Relational capital Measurement indicators literature review screening

<table>
<thead>
<tr>
<th>Relational capital</th>
<th>Literature Background</th>
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<tbody>
<tr>
<td>Stability</td>
<td></td>
</tr>
<tr>
<td>Cooperation with customers</td>
<td>Stewart, 1997; Bontis el al., 2000; Bontis,2001;Chen and Zhu 2004; Mouritsen and Larsen, 2001; Roos, 1997</td>
</tr>
<tr>
<td>Joint venture</td>
<td>Clercq and Dimov, 2004; Kang and Snell, 2008; Chang el at., 2008; Clercq and Dimov, 2008</td>
</tr>
<tr>
<td>Relationship with suppliers</td>
<td>Sharabati el at., 2010; Bontis, 2001; Chen and Zhu 2004; Mouritsen and Larsen, 2001; Roos, 1997; Johnson, 1999; Bontis, 1999</td>
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<tr>
<td>Efficiency</td>
<td></td>
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<tr>
<td>Revenue per Customers</td>
<td>Sharabati el at., 2010; Kong and Prior, 2008; Bontis el al., 2000; Bontis,2001; Choong, 2008; Liew, 2008</td>
</tr>
<tr>
<td>Partnership and strategic alliances</td>
<td>Lin el at., 2009; Haeussler el at., 2010; Joia and malherios, 2009; Luo, 2009; Sambasivan, el al., 2011; Vergauwe, 2009</td>
</tr>
<tr>
<td>Competitive advantage in the market</td>
<td>Kang and Snell, 2008; Kong and Prior, 2008; Lee, Lee, &amp; Kang, 2005; Capello &amp; Faggian, 2005; Castilla and Ruiz, 2008; Tan, 2008</td>
</tr>
<tr>
<td>Growth</td>
<td></td>
</tr>
<tr>
<td>New customers and new markets</td>
<td>Joia and malherios, 2009 ; Kong and Prior, 2008; Walsh el at., 2008; Castro and Szé 2008; Lee and Guthrie, 2010</td>
</tr>
<tr>
<td>Investment in stakeholder relationship</td>
<td>Chen el at., 2005; Swart, 2006; Díez el at., 2010; Bontis el al., 2000; Kang and Snell, 2008; Kang and Prior, 2008</td>
</tr>
<tr>
<td>Patents and product development</td>
<td>Haeussler el at., 2010; Chang el at., 2008; Campos and Pomeda, 2007; Eric, 2008; Joia and malherios, 2009; Luo el at., 2009; Hsu and fang 2009</td>
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</table>
4. The HAI process

The process of assessing the IC is made of four steps:
1. Determination of quantitative measures.
2. Determination of qualitative measures.
3. Accounting of the temporal variations of measures.
4. Combination of measures in an index

4.1 Determination of qualitative measures

The assessment process begins with the determination of the numerical value of each of the selected measurement indicators, placed at the last level of the hierarchy.

A quantitative value, which expresses the measure of its performance ($m_{ijk}$), is associated with every measurement indicator, where:
- $i$ value refers to the value driver and runs from 1 to 3 (Human Capital, Organizational Capital, Relational Capital);
- $j$ value refers to the 3 characteristics of each value driver; it runs from 1 to 3 (Stability, Efficiency, and Growth);
- $k$ value refers to the measurement indicators that relates to each value driver and to each characteristic; it runs from 1 to the total number of the selected indicators.

In this way, a value expressing the measure of its performance is associated with every measurement indicators.

4.2 Determination of qualitative measures

In the following step of the process, a qualitative value, which expresses its degree of importance (priority) with regard to the totality of the assets in achieving the company prefixed goals, is associated with every measurement indicator: $m_{ijk}$. To do this, the AHP is used to determine the degree of importance of each element of the hierarchical structure and to calculate its overall priority. In order to establish the priorities of the elements in the hierarchy, the elements are pair-wise compared against the forefather element. This comparison is performed using the AHP comparison scale (Saaty, 1980), which expresses comparisons verbally, and these verbal comparisons are then represented numerically. In particular, the pair-wise comparison process starts at the top of the hierarchy to select the value driver with the highest priority. Then, at the level immediately below, the priorities of the value drivers are divided by the weighting process among their descendant, and so on. To obtain the set of overall priorities of the hierarchy elements all the results of the pair-wise comparison need to be synthesized. The overall priority of an element is the degree of importance of that element with
regard to all the other elements in the hierarchical structure and represents its significance with respect to the whole of the company performance.

Therefore, the overall priority of every measurement indicator is expressed by \( x_{ijk} \), where the indexes \( i, j, \) and \( k \) are the same as for the value range and connotation of the quantitative value \( m_{ijk} \).

Regarding the qualitative value of measurement indicators \( (x_{ijk}) \), it is worth reminding that each value is expressed by a percentage value and their total sum is unitary.

4.3 Accounting of the temporal variations of measures

In the process of calculating the H.A.I., which is based on the combination of all the measures of indicators \( (m_{ijk}) \) with their overall priorities \( (x_{ijk}) \), it is necessary to take into account both the temporal variations of \( m_{ijk} \) and the expectations by managers for its improvement. To fulfil this objective, it is necessary to make use again of the A.H.P., but in a different application from that previously implemented. A pair-wise comparison is performed among three elements for each measurement indicator:

- The value of the performance calculated for the time period “T” \( (P_T) \);
- The value of the performance calculated for the time period immediately preceding the time period “T”, that is “T-1” \( (P_{T-1}) \);
- The desired performance \( (P_{\text{Desired}}) \).

The three element matrix of the pair-wise comparison is represented in Figure 2. The three values are derived as it follows: \( P_{(T-1; T)} \) is the numerical ratio between the value of the performance of the indicator calculated for the time period “T” \( (P_T) \) and that calculated for the time period “T-1”; \( P_{(T-1; \text{Desired})} \) is inferred from the opinion of the manager about his expectation for the value of that indicator \( (P_{\text{Desired}}) \); \( P_{(T; \text{Desired})} \) is determined by simply substituting one relation into the other, so obtaining a numerical value. This particular procedure helps to avoid the inconsistency that could emerge from the fact that one of the three terms of comparison derives from subjective considerations \( (P_{\text{Desired}}) \) and, also, that some measurement indicators derive from qualitative data.

<table>
<thead>
<tr>
<th></th>
<th>( P_{T-1} )</th>
<th>( P_T )</th>
<th>( P_{\text{Desired}} )</th>
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<tbody>
<tr>
<td>( P_{T-1} )</td>
<td>1</td>
<td>( P_{(T-1; T)} )</td>
<td>( P_{(T-1; \text{Desired})} )</td>
</tr>
<tr>
<td>( P_T )</td>
<td></td>
<td>1</td>
<td>( P_{(T; \text{Desired})} )</td>
</tr>
<tr>
<td>( P_{\text{Desired}} )</td>
<td></td>
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<td>1</td>
</tr>
</tbody>
</table>

Figure 2. The pair-wise comparison matrix of each measurement indicator

By means of the same procedure as the one used to find the priorities of the pair-wise comparison matrix, the normalized values of the priorities for each of \( P_T \), \( P_{T-1} \) and \( P_{\text{Desired}} \) are obtained. The priority of \( P_T \) is the weight of the performance
of the measurement indicator, calculated for the time period “T” with respect to its correspondent value for “T-1” and to its desired performance.

Reiterating the aforementioned procedure for each of the indicators supplies an evaluation of performance (p_{ijk}), where the indexes i, j, and k are the same as for the value range and connotation of the quantitative value x_{ijk}.

For each indicator, the value of p_{ijk} is comprised between 0 and 0.5. This follows from the fact that the sum of the three weights of P_T, P_{T-1}, and P_{Desired} must be unitary and that the value of P_{Desired} must be higher than those of P_T and P_{T-1}, in consequence of managers’ expectations. It is demonstrable that the weights of P_T and P_{T-1} cannot assume values either negative or higher than 0.5.

4.4. Combination of measures in an index

At this point, for each indicator, it is possible to combine the weights of the performance (p_{ijk}) with their overall priorities (x_{ijk}). The sum of the products of p_{ijk} and x_{ijk} of each measurement indicator results in a unique index, the H.A.I.:

$$\text{H.A.I.} = \sum_i \sum_j \sum_k x_{ijk} \cdot p_{ijk}$$

The value of H.A.I. is comprised between 0 and 0.5, in consequence of the fact that every p_{ijk} cannot assume a value which is either negative or higher than 0.5 and that every x_{ijk} cannot assume a value either negative or higher than 1. Indeed, the closer value of the H.A.I. to 0.5, which is the maximum value that H.A.I. can assume, the more advantageous the utilization of the available assets by the company. On the other hand, the margin of divergence from 0.5 will indicate the measure of the relevance of corrective strategies.

In addition, a sectional analysis can be performed on successful or unsuccessful actions at every level of the structure. It is possible, in fact, to focus the attention on the performance and on the weights of the indicators for each value driver, separately.

5. The Empirical Study

The paper presents an empirical study from Jordan, whereby the HAI model has been applied on three ICT Companies, which have been named as A, B and C to provide anonymity.

5.1. Organizations Involved in the empirical study

5.1.1 Company A

A regional early-stage fund, targeting early stage companies in ICT industry and to transform ideas into viable businesses, by concentrating on the transformation of ICT, mobile and digital media ventures.
5.1.2 Company B:

A pioneering ICT organization in Jordan on the area of creating e-content, elearning systems, knowledge management solutions, e-government solutions and decision support applications.

5.1.3 Company C:

One of the oriented ICT companies in Jordan on e-content production for entertainment and education systems, and it has been ranked as one of the leading companies in their area.

5.2 Data Collection

The researchers used an AHP-based questionnaire (Figure 3) to collect data. The analysis of the data was carried out using the Expert Choice v.11 (EC) software package, which allows the synthesis of values.

The questionnaire was sent by e-mail, along with a cover letter explaining the nature of the research and its purpose. The cover letter also asked respondents to return the completed questionnaire (Data file) by e-mail. A total of three questionnaires were distributed to Chief Executive Officers (CEO), working in ICT sector. Participants in study were given 10 days to complete and return the questionnaires. Follow upped with calls during the survey days to support the participants with answers to any inquiries about the questionnaire.

5.3 Results and Discussion

This paragraph screens the results obtained by the implementation of the HAI method on three ICT Jordanian Companies (Figure 4) the following paragraphs explain the maximum values and motivation of the three companies.
5.3.1. Company A

The researchers found that “Employee Turnover” provided the highest contribution to HAI for Company A. This indicates that the company pays great attention to their HC, especially as a consequence of the reduction of turnover. Moreover, the “Satisfaction of Employee” offered the second highest contribution to HAI. This indicates that employee satisfaction is indisputably essential to provide good customer services and satisfaction, long-term external relationships and high financial performance. The third and fourth contributions to HAI were the “Returns on assets”, and “Revenue from new product and product development”. This indicates the high recognized value of SC. It is important to consider that the priority of these aspects is very high, but the performance is not so adequately recognized. The RC, SC, and HC have a global contribution of 0.0259, 0.1095, and 0.2596, respectively. This means that the RC generated the lowest performance indicators among the three value drivers. This can be explained by the fact that Company A focuses on start-up ICT projects and companies. As a consequence, these phases require a strong investment on HC and SC, rather than on RC. The global value of the HAI (0.3950) condenses both high performance results and satisfaction by managers.

5.3.2 Company B

Based on the results obtained from Company B, it is evident that the company focused on generating profits through investing in IC; this aspect has been proven by the high contribution of “Returns on Assets”, and supported with the equally high contribution of the “Employee Awareness & Motivations”, that indicates the important role of management awareness of HC in the creation of IC.

In addition, the impact of “New Idea and innovation from employee”, and “Number of innovative ideas and number of implemented innovative ideas”, made the third and fourth highest contributions respectively to the HAI Index. This indicates company’s recognition of the importance of IC in the organization B. RC, SC, and HC have a global contribution of 0.0489, 0.0645 and 0.0667, respectively. These low and distributed values represent a low and diffuse performance of the measurement indicators. This can be explained by the fact that the company deals with a lot of main costly activity, such as business application, design and implementation of new innovative application, decision support, e-system and platforms, and at the same time has customers, which are condensed into small groups of users, such as government institutions and international organizations. The global HAI result has a medium value (0.1802). It condenses low performance values for the majority of the measurement indicators and, what is worst, it combines the few high values of performance with low priority by managers.
5.3.3 Company C

The third company in the study was balanced judged on its results, among the three value drivers. A high contribution to the HAI derived from the “Competencies of employees”, which supports the company’s interest in the HC. Not far away from the “Cooperation with customers” which indicates the second highest contribution to HAI and represents the recognized satisfaction about RC. The third was indicated by the “New Idea and innovation from employee” showing a great interest to this aspect of the HC. The forth high contribution was represented by the “Returns on assets” referring to SC.

RC, SC, and HC have a global contribution of 0.1048, 0.1030, and 0.1810, respectively. The result of company C shows a balanced performance results on the three value drivers. This can be explained by the fact that Company C focuses on programming projects, e-content production, system integration, programs, software, and application design, which involve all the three IC components. The global HAI result (0.3888) condenses high values for those measurement indicators with high recognized priority by managers.

<table>
<thead>
<tr>
<th>NAME OF THE MEASUREMENT INDICATORS</th>
<th>X_{ijk}^{PA_B}</th>
<th>X_{ijk}^{PA_C}</th>
<th>X_{ijk}^{PA_D}</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human Capital</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee Turn Over</td>
<td>0.1695</td>
<td>0.0045</td>
<td>0.0107</td>
</tr>
<tr>
<td>Employee awareness / motivations</td>
<td>0.0016</td>
<td>0.0149</td>
<td>0.0012</td>
</tr>
<tr>
<td>Saving from implemented employee’s suggestions</td>
<td>0.0014</td>
<td>0.0017</td>
<td>0.0015</td>
</tr>
<tr>
<td>Investment in training and formation</td>
<td>0.0015</td>
<td>0.0100</td>
<td>0.0058</td>
</tr>
<tr>
<td>New Idea and innovation from employee</td>
<td>0.0064</td>
<td>0.0084</td>
<td>0.0059</td>
</tr>
<tr>
<td>New skills, experience of employees</td>
<td>0.0032</td>
<td>0.0118</td>
<td>0.0572</td>
</tr>
<tr>
<td>Satisfaction of employee</td>
<td>0.0522</td>
<td>0.0041</td>
<td>0.0065</td>
</tr>
<tr>
<td>Education</td>
<td>0.0057</td>
<td>0.0029</td>
<td>0.0131</td>
</tr>
<tr>
<td>Competencies of employees</td>
<td>0.0182</td>
<td>0.0084</td>
<td>0.0791</td>
</tr>
<tr>
<td><strong>Total of HC Value</strong></td>
<td>0.2596</td>
<td>0.0667</td>
<td>0.1810</td>
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<tr>
<td><strong>Relational Capital</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue per Customers</td>
<td>0.0005</td>
<td>0.0081</td>
<td>0.0017</td>
</tr>
<tr>
<td>Partnership and strategic alliances</td>
<td>0.0002</td>
<td>0.0011</td>
<td>0.0020</td>
</tr>
<tr>
<td>Competitive advantage in the market</td>
<td>0.0019</td>
<td>0.0059</td>
<td>0.0066</td>
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<tr>
<td>New customers and new markets</td>
<td>0.0027</td>
<td>0.0067</td>
<td>0.0036</td>
</tr>
<tr>
<td>Investment in stakeholder relationship</td>
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<td>0.0017</td>
<td>0.0005</td>
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<tr>
<td>Patents and product development</td>
<td>0.0009</td>
<td>0.0079</td>
<td>0.0019</td>
</tr>
<tr>
<td>Cooperation with customers</td>
<td>0.0138</td>
<td>0.0094</td>
<td>0.0697</td>
</tr>
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<td>Joint venture</td>
<td>0.0041</td>
<td>0.0024</td>
<td>0.0019</td>
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<tr>
<td>Relationship with suppliers</td>
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<tr>
<td><strong>Total of RC Value</strong></td>
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<td>0.0489</td>
<td>0.1048</td>
</tr>
<tr>
<td><strong>Structural Capital</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Number of innovative ideas and number of implemented innovative ideas</td>
<td>0.0050</td>
<td>0.0109</td>
<td>0.0070</td>
</tr>
<tr>
<td>Number of best practice identified</td>
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<td>0.0021</td>
<td>0.0086</td>
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<td>Returns on assets</td>
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</tr>
<tr>
<td>Entrepreneurship and innovation</td>
<td>0.0167</td>
<td>0.0039</td>
<td>0.0032</td>
</tr>
<tr>
<td>Revenue from new product and product development</td>
<td>0.0182</td>
<td>0.0094</td>
<td>0.0189</td>
</tr>
<tr>
<td>IT and KMS Expenditure</td>
<td>0.0032</td>
<td>0.0022</td>
<td>0.0006</td>
</tr>
<tr>
<td>Internal cooperation and sharing</td>
<td>0.0023</td>
<td>0.0047</td>
<td>0.0051</td>
</tr>
<tr>
<td>Corporate culture and philosophy</td>
<td>0.0166</td>
<td>0.0094</td>
<td>0.0082</td>
</tr>
<tr>
<td>Process technology and IT penetration</td>
<td>0.0117</td>
<td>0.0057</td>
<td>0.0147</td>
</tr>
<tr>
<td><strong>Total of SC Value</strong></td>
<td>0.1095</td>
<td>0.0645</td>
<td>0.1030</td>
</tr>
<tr>
<td><strong>H.AI.</strong></td>
<td><strong>0.3950</strong></td>
<td><strong>0.1802</strong></td>
<td><strong>0.3888</strong></td>
</tr>
</tbody>
</table>

Figure 4 Measurement Indicators classified according IC taxonomy
6. Analysis of results and conclusions

Results from the empirical study show that Companies A, B, and C report a HAI value of 0.3950, 0.1802, and 0.388, respectively. Although Company A gets high performance in HAI value, the management should give more attention to RC and in particular to the “Patents and product development” through establishing new “Partnerships and Strategic alliances”, to guarantee more “Revenue per Customer” and strong stakeholder relationships.

The lowest HAI value performance was for Company B, which should invest in RC to improve especially on the following low performance area of “Joint venture”, “Partnership and strategic alliances”. Moreover, it should invest in the measurement indicators with the highest priority, such as “Stakeholder relationships”, “Satisfaction of employee” and “Education”.

Company C gets high performance in HAI value, with balanced contributions from the three IC components. It demonstrates that the company’s management understands the value of intangible assets. However, the company should give more attention on some low performance aspects, such as “Employee awareness and motivations”, “Joint venture”, “Patents and Product development”.

In the proposed model, the H.A.I. identifies the sources of added value and competitive advantage in each business context and singles out those assets which can improve the performance. Firstly, it supports the assessment of IC, starting by a global sight of the obtained results. Secondly, it analyzes and measures each single value driver quantitatively. Lastly, the model enables the management to check the behavior of a particular indicator, and whether the company’s performance is affected, positively or negatively, by it. In this way, the management is solicited to identify and promptly adopt corrective strategies. Finally, by means of the empirical studies, the HAI model has been tested and validated, since the obtained results confirm the expectations of the interviewed manager.

In the empirical study presented here, 27 indicators have been suggested. These measurement indicators can constitute a possible generalizable modality to measure the performance of ICT companies. However, a point that must be addressed regards the fact that the selection of indicators can depend on the environment involved in the application of the model. Finally, future studies will be carried out by analyzing wider samples of companies from Jordan to ensure validation of the HAI model and by trying to find correlation between the H.A.I. and financial performance indicators.

References


The Arab Knowledge Report (2009). Towards productive intercommunication for knowledge; (UNDP) *Arab Fund For Economic and Social Development*.


