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Abstract

Changes in the capital markets create changes in the analytical focus of the work of securities analysts. In previous research, the writers have identified potential benefits of an expert system that can be used by securities analysts in order to make investment decisions based on human capital analysis, which complement standardized financial modeling. Such an expert system can preserve the chronological flow of human capital strategies and practices. In this paper, as the first step towards developing such expert system, the larger context of the collaborative business process within which securities and investment analysts make such investment decisions on behalf of their clients is first identified. An awareness-based knowledge management/sharing model is used to represent such relevant contextual knowledge. The principle of choice for this representation model has been its ability in identifying and measuring the awareness and knowledge-sharing requirements of various actors in such larger collaborative business process. This in turn will enhance collaboration among those collaborating actors.

Key words: knowledge sharing; awareness; human capital analysis; expert systems; finance industry; securities analysts.

1. Background

The way in which knowledge is created and managed is increasingly relevant to analysts in knowledge-based economies, where knowledge creates value to the firm. Understanding knowledge creation and management requires tools other than traditional financial analysis tools, which typically focus on tangible assets. The trend to increased disclosure of intangible drivers of value in the post-Enron environment will increase pressures on firms to articulate and to disclose these drivers. Lev (2001, p. 17) notes that there is currently intense interest in intangibles, even though many companies do not typically have systematic ways of valuing and leveraging intangibles. He adds that intangibles are fundamental drivers of innovation and deverticalisation. One researcher has responded by calculating the costs of human capital within firms (Mayo, 2002). However, the value created by human capital, rather than the costs of managing and accounting for human capital, is the more compelling instigator for systematic human capital analysis in the financial markets.

Research by Watson Wyatt (2002) indicates superior human capital management is a leading, rather than lagging, indicator of improved financial success. Using survey data from 51 organisations in North America and Europe, administered in 1999 and 2001, the researchers divided organizations into three groups based on their overall Human Capital Index (HCI) scores, and found that superior human resource management practices have a positive effect on the future share price of companies. Bassi, Lev, Low, McMurrer, & Sissfield (2001) suggest that non-financial insights make up a large proportion of investment decisions. Therefore, securities analysts need to distinguish and to report on the capability of the management team to execute strategy. So, the imperative to understand the "information on the human capital function that helps them assess rate of return on investment in human resources and predict future performance" is a critical factor for success for themselves as individual professionals, and for the credibility of the industry as a whole.

This imperative has been recognized by socially responsible investment organisations as well as more mainstream participants. Baue (2004a) reports that practitoners from mainstream securities analysis are predicting a merging of analysis from corporate social responsibility and traditional orientations over the coming years. High profile financial market figures, including the former US Vice President, Al Gore, are working to embed social responsibility and other intangibles into mainstream financial analysis, because they belive that: "Business leaders who align their

business strategy and technical development with sustainability and social accountability will deliver superior long-term results to shareholders" (Baue, 2004a).

Baue (2004b) also notes that, while many in the sustainable and responsible investment camp understand that extra-financial and intangible issues impact long-term corporate performance, mainstream investment analysts tend to focus on short-term issues such as quarterly earnings. In response to this pressure, a group of European institutional investors launched the Enhanced Analytics Initiative (EAI), in November 2004, to entice sell-side analysts to cover intangibles by allocating 5% of their broker commissions for such research. Founding members of the EAI include major finance organisations: the UK based Universities Superannuation Scheme, BNP Paribas Asset Management, AGF Asset Management, Germany-based Deutscher Investment Trust (dit) and dresdnerbank investment management (dbi), Netherlands-based PGGM, and UK-based RCM and Generation Investment Management. These founding members manage some €364 billion in assets, as at November, 2004, and estimate that 5% of their brokerage commissions will amount to approximately €4.5 million. One of the principles behind the EAI has been that sell side analysts do not typically provide extra-financial analysis and clients typically do not ask for it. According to one founding member of the EAI, David Russell from Universities Superannuation Scheme,

> *"The fund managers do not ask for it [because] they are often unaware of the implications that these issues could have on the companies in which they invest." "By providing the financial and business case for the sell side to incorporate these issues, the EAI will break this negative cycle" Baue (2004b).*

Within the context of this challenge to be more systematic in their coverage of intangibles, analysts are likely to benefit from a range of tools, techniques and professional development opportunities which can leverage their existing skill base and draw from new and relevant bodies of knowledge.

In previous research, the authors demonstrated the need for an expert system that supports securities analysts in making investment decisions on behalf of their clients (Royal, Daneshgar, O'Donnell, 2003b). This paper is an early attempt towards creation of such expert system called Human Capital Analyser (HCA) that provides expert advice to the securities analysts about the human capital of various companies. Expert systems and applications (ES) are computer-based systems that employ a set of rules based upon human knowledge to solve problems that require human expertise (Marakas 2003, p. 298).

Expert Systems imitate reasoning processes based on the concept of information fit used by human experts to come up with some expert advice. From among many types of Business Intelligence and Decision Support Systems (DSS) the ES type was chosen for building the HCA mainly because it provides expert advice to the security and investment analysts throughout various phases of their investment decisions. It is a general belief within the ES development community that activities where human experts are overburdened, undersupplied, expensive, or for the most part unavailable, are prime candidates for an ES opportunity (Marakas, 2003). Previous studies conducted by the authors reveal that majority of the above conditions apply to today's investment analyst professionals (Royal, Daneshgar, O'Donnell, 2003a).

2. Motivation

As a first step in developing an expert HCA system, a methodology is presented for identification and representation of collaboration knowledge for the business process where securities analysts make their investment decisions. Identification and representation of such knowledge is critical to the future directions that the HCA development team should take from now on.

The writers' latest investigations revealed that a successful HCA should be flexible enough to be integrated with the major current information systems that are used by investment analysts; and in particular, it should be web-enabled. The above indicators reveal a collaborative attribute for the future HCA. That is, to some degree, the system should support various collaborating actors whose interactions with the system may also affect other actors' interactions with the

system. In the light of such major evaluation criteria for HCA an awareness-based knowledge representation model was used to represent such overall collaborative business process.

3. A Framework for Representation of Collaborative Investment Decision Processes

The objective of this framework is to represent knowledge about various aspects of collaboration, that in turn may eventually be used for creating a set of generic rules as well as domain-specific knowledge structures that constitute the bulk of the knowledge base and inference engine components of the expert HCA. The strength of this framework particularly lays in its ability to visualize and measure the knowledge-sharing requirements of various actors in larger inter-organisational business processes that encompass all potential actors who may somehow be affected by actions of one actor, in this case, the investment decisions of securities analysts. This will also assist in designing integration of HCA with current information systems used by securities analysts.

The model component of the framework consists of five collaborative semantic concepts including 'actor', 'role', 'task', 'role artifact' and 'task artifact', as well as their relationships. The model is called *awareness net*. These collaborative semantic concepts are briefly discussed in the following paragraphs. For a complete discussion on this framework refer to Daneshgar (2004):

ACTORS:

These are human agents that enact a set of *tasks* by assuming one or more *roles* within the process. In the awareness net there is no graphical representation for the 'actors'; instead, they are represented indirectly by the relevant *role*(s) that they play within the process.

ROLE:

A set of norms expressed in terms of obligations, privileges, and rights enabling actors to perform certain tasks within the process. In Figure 1 filled circles represent roles.

STRUCTURED TASK (or task for short):

An object made of a sequence of *actions* or *execution steps* that can be planned from the known dependencies in order to achieve a specific process goal. In Figure 1 unfilled circles represent *tasks*.

ACTION:

A sequence of goal-directed microscopic execution steps that utilise certain resources and/or artifacts for their execution. There is no graphical representation for the actors however they are represented within the process script as embedded attributes of the *task* object.

COLLABORATIVE TASK:

Is composed of two or more *tasks* that have a common goal, and (must) share a *task artifact*. A collaborative task is always associated with a unique task artifact, and two or more simple tasks. They are graphically represented by a subset of the awareness net consisting of a pair of related *tasks* and the common *task artifact*. In Figure 1 the sub-graph consisting of two collaborating role vertices, their relevant pair of task vertices and their role artifacts, and their common task artifact would represent a collaborative task.

ROLE ARTIFACT:

This object carries knowledge/resources about how to perform the actions within a *task*. The *role artifacts* are personal and are either possessed by the actors, or they know how to obtain them when required. For this reason it is assumed in this article that *role artifacts* can be stored either within the actor's mind in a way that others cannot formally access and use this knowledge, or is stored explicitly in personal knowledge bases in a way that can only be fully understood by anybody who has access to it. Within the awareness net the arcs that connect a *role* vertex to its *task* vertices are graphical representations of the *role artifacts*. In Figure 1 the broken lines represent the task artifacts.

TASK ARTIFACT:

This object carries knowledge about how various *actions* associated with a *collaborative task* are executed. Contrary to the *role artifacts* where they may or may not exist explicitly within the organised knowledge bases, it is assumed here that *task artifacts* are always kept within the

organised knowledge bases in order to be accessible and be shared by multiple *actors* when performing *collaborative tasks*. Arcs that connect a pair of *task* vertices together graphically represent *task artifacts*. In Figure 1 role artifacts are shown by straight lines.

An initial investigation of the capital market in Australia resulted in an *awareness net* that is shown in Figure 1. The expanded definitions for various labels on the awareness net are explained below:

Roles

R1: Securities analyst
R2 Client
R3: Sales People
R5: Company
R6: Australian Security and Investment Commission
R7: Australian Stock Exchange
R8: Expert

Tasks

T1R1: R1 provides advice to the Client, R2
T1R2: R2 requests for advice from R1
T2R1: R1 prepares and sends the Research Product to the Sales People, R3
T2R3: R3 receives Research Product from R1
T3R1: R1 requests Company Profile from the Company, R5
T3R5: R5 provides R1 with the Company Profile
T4R1: R1 consults ASIC, R6, for their Rules and Regulations
T4R6: R6 provides R1 with Rules and Regulations
T5R1: R1 consults ASX, R7, for Financial Data
T5R7: R7 provides R1 with the Financial Data
T6R1: R1 seeks expertise on human capital from R8
T6R8: R8 provides Expert Advice to the R1
T7R2: R2 seeks market and price info from R4
T7R7: R4 provides market & price info to R2
T8R2: R2 requests to buy shares from R3
T8R3: R3 provides shares to R2

Role Artifacts & Task Artifacts

According to the Awareness Net of Figure 1, there are 9 task artifacts that connect 9 pairs of task with same labels. These are T1T1, T2T2, …, T8T8 and represent potential pairwise collaborations among the actors. The role artifacts are represented by lines connecting a Role to a Task. These lines can be referred to as R1T1, R1T2, …. and R8T6.

By analysing various components of the above awareness net the following collaboration challenges were initially identified. The majority of such challenges call for an effective IT infrastructure support for which HCA can be a part, or a whole. Such group-support system will then supports various roles involved in the following collaboration challenges. These challenges include:

1. Securities analyst, R1, needs support from an expert (R8) in the area of human capital. Such is currently non-existent.
2. Currently this collaboration is sub-optimised by the fact that there is an insufficient data on human capital assets of organizations, to underpin advice by R1 to R2
3. Currently, such interaction is either not being conducted, or is being at a highly superficial level.
4. A knowledge gap exists in this collaboration as a result of a lack of skill base in both R1 and R5 in terms of gathering and analysing the human capital data. This results in a situation where there exists no standard analytical framework for this matter.
5. R6 is not currently requiring human capital data analysis as part of licensing certification for R1.

6. Challenges still exist in providing human capital data from R7 to R1 outside the small changes in current reporting standards for senior executive remuneration and corporate governance issues.

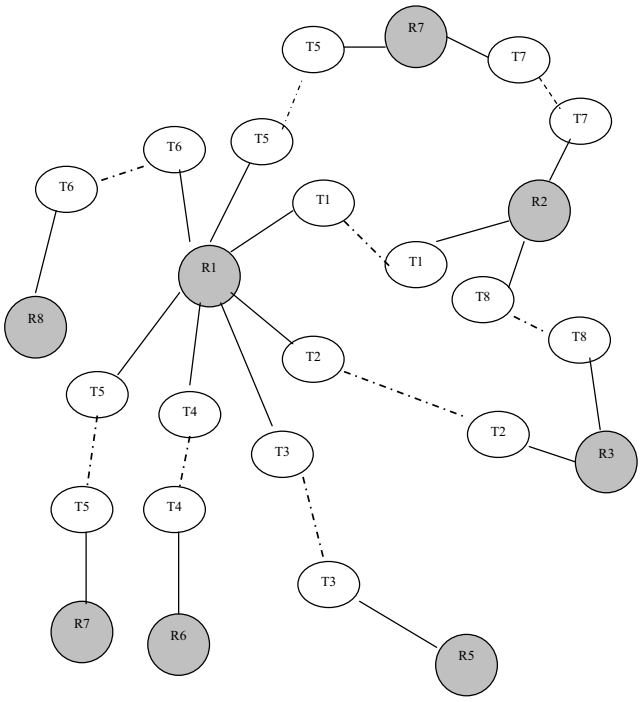

Fig. 1. An Awareness Net representation of the Investment Decision Process in Australia

The awareness net concept can model the potential for an expert system to assist securities analysts and fund managers and researchers to more systematically access otherwise hard to find information on human capital for the purpose of making more transparent investment decisions.

4. Conclusions and Future Research Agenda

The previous work by the authors challenged the largely quantitative financial basis of investment decisions and recommendations. Their work highlights the need for existing investment analysis practice and processes to be supported by more qualitative research in the form of a complementary research tool based on human capital analysis. This paper presents a knowledge sharing representation methodology for knowledge acquisition, storage and representation of an expert system called the Human Capital Analyser (HCA). The HCA facilitates the process of analysis of qualitative data on intangible assets. In doing so, the HCA bridges a knowledge gap in the work of securities analysts, as they undertake the process of making more transparent investment recommendations. The evidence in this paper suggests that securities analysts, and the finance industry, would benefit from more systematic analysis of human capital. As a first step in developing an HCA Expert System, this paper provides a methodology for representation of the overall business context within which securities analysts make investment decisions. Work is in progress for identifying appropriate reasoning and explanation algorithms as prerequisites for designing knowledge base and inference engine components of the HCA.

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