Facilitating Organisational Sustainability Through Expert Investment Systems

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Abstract: This paper uses literature from the fields of organisational sustainability and human capital, which have demonstrated a link between sustainable human capital and the financial performance of the firm, to argue that securities analysts need to be able to systematically analyse human capital in order to provide transparent and well-informed investment recommendations. It is the function of securities analysts to attempt to predict the future financial performance of firms within an industry sector. Models for this analysis have traditionally been heavily quantitative, relying on mathematical models of future earnings forecasts, based on published annual financial statements from listed companies. Securities analysts' quantitative modeling methods are directly underpinned by qualifications and certification processes that encourage demonstrated skills in quantitative methods. The authors provide an opportunity for securities analysts to systematically gain insights on the human capital of firms using a future expert system, called Human Capital Analyser (HCA), whose general characteristics are also outlined in the conclusion of this article. This expert system will help bridge the knowledge gap in the work of securities analysts.

Keywords: knowledge representation; human capital analysis; expert systems; finance industry; securities analysts.

1. The value of organisational sustainability

Generations of investors, managers and fund managers have asked the deceptively simple question, "How can we predict the future value of the firm?" Historically, the answers have been found in complex financial modeling, econometric forecasts and statistical analysis. Yet, there is a trend towards more qualitative analysis of the current and future value of the firm.

Organisational sustainability research pioneers such as Dunphy, Griffiths and Benn (2003) use qualitative analysis of firms to argue for indices of financial, environmental and human sustainability. They provide a case for the adoption of corporate sustainability principles in every element of the organisation. Dunphy et. al. (2003:12) state "an organisation is sustainable [when] its stakeholders continue to support it". Stakeholders include financiers, employees and the wider society and environment, which form the context in which the firm operates. Dunphy et. al. propose the adoption of an environmental sustainability index, in conjunction with a human sustainability index, which would measure the progress of the organisation along a potential six steps to genuine sustainability. The authors of this paper believe that this concept of systematically analysing environmental and human sustainability can be taken one step further, and might be a valuable addition to the methodology used by securities analysts as they value firms for investment purposes.

The work of De Geus (1999) on the lifespan of companies, Collins and Porras (2000) on visionary organisations, Elkington (2001) on the triple bottom line, Senge (2000), Beer and Nohria (2000) on multiple objective functions, Drucker (2001) on the rise of the new social entrepreneurship, Watson Wyatt (2002) on human capital indices and Collins (2001) on companies which are "built to last", has a common sub-theme: that organisational sustainability in general, and human capital sustainability in particular, can be seen as potential indicators of the future performance of the firm.

This body of literature, and additional research by the authors of this paper, leads to the following proposition: As the sustainability of human capital is likely to influence the future financial performance of the firm, it needs to be systematically analysed by the financial markets. This would be a complementary process to more traditional financial measures.

To systematically analyse the sustainability of human capital in a firm within its industry sector requires a level of objectivity, and an expert system can provide objectivity. This paper presents the outline of a future expert system, titled Human Capital Analyser (HCA), based on principles of organisational and human capital sustainability. This expert system bridges a gap between otherwise disparate fields of organisational sustainability and corporate finance. The Human Capital Analyser does not, at this stage, deal with environmental analysis, as further research

needs to be done to ensure appropriate frameworks and metrics.

1.1   Evidence for the financial impact of sustainable human capital

Of specific interest to the organisational sustainability debate is the Watson Wyatt Worldwide Research (2002), which indicates superior human capital is a leading, rather than lagging, indicator of future financial success. Surveys were administered in 1999 and 2001 to fifty one organisations in North America and Europe. The organisations wereplaced into three groups based on their overall Human Capital Index (HCI) scores. The HCI was derived from matching survey data to market value, returns to shareholders and Tobin's Q to create an index of human capital. Using the organisations' five-year total returns to shareholders, the researchers found that organisations with a low HCI averaged a 21% five-year return, those with a medium HCI averaged 39% and those with a high HCI averaged 64%. This analysis noted that human capital can be managed and exploited to increase shareholder value.

Supporting this research are Bassi, Lev, Low, McMurrer, & Sissfield (2001) who found that non-financial insights make up a large proportion of investment decisions. In their survey of 275 active US institutional investors on their basis for investment, approximately 35% of investment decisions were reported as based on non-financial data, of which over half is related to human resources issues, while other non-financial data includes marketing, strategy and quality. Over 60% indicate that between 20-50% of decisions are non financial. Bassi, et. al. (2001: 348) note that, although "the quality of the business plan or strategy is important…The focus is on action." Therefore, securities analysts need to distinguish and to report on the capability of the management team to execute strategy. The future HCA, as an expert system, can assist in a more systematic analysis of the rhetoric versus the reality of the human capital of listed firms. This helps to make insights on human capital relatively more rigorous and transparent.

Further evidence of the connection between sustainable human capital and the financial value of the firm is seen in Hewitt and Associates examination of employee engagement and commitment to create an index of Best Employers, 2003. They found in their Australian data that Best Employers experienced 13% revenue growth between 2000 and 2002 compared with 7% for other companies. Average profit growth was 21% in the same period (2000-2002) for Best Employer companies compared with negative 44% for other, non-Best Employer, companies in the survey. This study is part of a wider study that covers over 25 countries, 350 companies and 125,000 employees.

Boston Consulting Group researched one hundred German companies, covering ten industrial sectors over a seven year period from 1987-1994, (Bilmes, Wetzker, and Xhonneux (1997). Companies which produced a greater total shareholder return than their competitors also scored highly on such measures as: expenditure per employee, contribution of employees as reflected in mission statements, promotion opportunities and flexible work hours, among other evidence of sustainable human capital practices.

Collins' (2001) "visionary" companies ploughed a greater percentage of year's earnings back into the company, returning less in cash dividends to shareholders. They invested more heavily in management practices and human capital, specifically in training, recruiting and the professional development of staff, and in R&D and property and plant. Visionary companies outperformed their non-visionary counterparts on all key financial measures. Prior to this, Collins and Porras (1994) had analysed eighteen paired comparison visionary companies, and these companies had outperformed the US stock market, by a factor of fifteen at the time of the study. They were six times more successful than comparison companies.

Another study indicating links between human capital and financial performance is Schuster's (1986) employee surveys and interviews of 1300 of the largest U.S. industrials and non-industrials. His aim was to research whether a significant relationship exists between the way in which organisations manage their employees and profitability. His findings included a statistically positive relationship between the use of employee-centred management practices and superior financial performance. An average return on equity of those firms at the time using one or more innovative, sustainable human capital practices was 11% higher than those firms not using any of the practices.

In terms of more specific components of sustainable human capital, Ranft and Lord (2000) recognise that strategically significant

intellectual property, in some cases, rests within individuals, rather than in the firm itself, a potentially important issue for financial markets to incorporate in their analysis. Also, Gupta, Iyer, and Aronson (2000) have noted that knowledge management can have an impact on the efficiency and the performance of the firm.

The American Management Association 1996 study indicated a strong correlation between increased training budgets and larger profits and productivity flowing from workforce reductions. The study found that organisations performed better when they were strategically well-positioned in the changing environment and pushed the pace of internal organisational change fast enough to match the external pace of change, cited in Dunphy (2000).

Without these kinds of insights into the relative sustainability of human capital within firms within an industry sector, the investment analysis process is suboptimal.

A major study by Turner and Crawford (1998) of 243 case studies in Australia and New Zealand to determine the capabilities that drive corporate renewal found specific clusters of competencies affect performance, including business technology (operational), market responsiveness (operational), performance management (operational/reshaping), engagement and development of employees (reshaping). Quantitative financial analysis, as typically used by securities analysts, would not be able to distinguish these human capital capabilities.

Kotter and Heskett (1992) found that corporate culture has a major effect on corporate performance and, although difficult to change, corporate culture can be made more performance enhancing. O'Reilly and Pfeffer (2000) examine successful companies that use ordinary people to achieve extraordinary results and find that an organisation that has well-articulated values, puts culture first, has a strong alignment and consistency in the people-centred practices that express those values, and where senior management maintain these values, are able to compete very successfully. Dunphy and Stace (2001), provide case studies of companies which improved financial performance as a result of appropriate leadership styles and change management strategies.

Cox and Blake (1991), concluded there are six areas where specific human capital practices are highly related to organisational performance. Abbott, De Cieri, and Iverson (1997), provide an examination of the dollar cost associated with exit of high performing managerial women. Total costs (direct and indirect) associated with separation, replacement and training of these and new employees are considerable. Researchers such as Royal (2000), Collins (2001), Dunphy (2000), Turner and Crawford (1998), Watson Wyatt Worldwide Research (2002) and Bassi et al. (2001) use rigorous qualitative techniques to provide evidence for their findings on the positive relationship between sophisticated use of human capital and future financial performance of the firm.

Typically, few of these of these insights systematically inform the process by which securities analysts calculate earnings forecasts.

2. How do securities analysts analyse listed companies?

Securities analysts, on either the sell side or buy side, make investment recommendations in a research report, on a "relative basis comparing a companies' performance within a sector or industry... It is not limited to financial statements, [and includes] research on the company, industry, product or sector, and public statements by and interviews with executives of the company, its customers and suppliers" (Fernandez 2001). Securities analysts work for a brokerage firm, bank, investment bank and or fund management institution. They draw financial data from published financial accounts, and then create earnings forecasts using financial modeling.

The quantitative component of the securities analysts work is underpinned by undergraduate qualifications in finance and business, or in specialised quantitative fields such as engineering or actuarial studies (Royal & Althauser, 2003). Certification of securities analysts in Australia, by the Securities Institute and similar bodies, is centred on a demonstration of highly developed quantitative skills. As the skill sets have been so strong in quantitative areas, a knowledge gap has emerged in terms of analysts' skills in analysing qualitative data, such as human capital data.

More than half of the shares issued by US based companies have become controlled by institutional investors who are becoming increasingly concerned with the evaluation of a firm's internal performance, (Szarycz, 2001). In

Australia, as the number of retail investors increases, through compulsory superannuation levies, the investing public is increasingly interested in all elements of firm performance. However, as most corporate websites and brokers reports indicate, the performance measures used are primarily described in quantitative and financial terms, such as Economic Value Added (EVA), Cash Flow Return On Investing (CFROI), other accounting ratios, Balanced Scorecard, Value Based Management (VBM) and Activity Based Costing (ABC).

Lev, (2001:17) notes that there is currently intense interest in the intangible assets of a firm, which may include human capital. Many companies do not have systematic ways of either valuing or leveraging intangibles, yet intangibles are fundamental drivers of innovation. The costs of managing and organising human capital within firms has been analysed effectively by Mayo (2002). The authors of this paper argue that the value created by sustainable 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.

As noted earlier, the future HCA can be used by securities analysts to systematically access insights into human capital. These insights, together with more traditional financial analysis, provide further transparency into the investment recommendation process.

2.1 Applying human capital analysis

In complex contemporary knowledge-based organisations, it is often difficult to distinguish the causes of sustainable high performance. However, the model presented in Figure 1 does provide a basis for qualitative analysis of the human capital of a firm. It is the basis of the HCA, which can be used by securities analysts to identify emerging patterns in human capital that ultimately affect financial performance and market valuation. With appropriate training and support, a securities analyst may be able to use the HCA to systematically access additional insights into a firm's human capital.

It is worth warning that human capital analysis needs to be carefully applied. Delery (1998) and Harris and Ogbonna (2001) emphasize the complexity of mediating variables between strategic human resource management and performance. The publication of the Watson Wyatt research into the links between

shareholder value and human resource management has assisted researchers, who still need to be cautious in linking complex variables. Delery (1998) notes that some human resource practices are additive (independent, non overlapping effects on outcomes), some are interactive (depend on other elements in the system) and some may be substitutes for one another. So, securities analysts need to be able to access comprehensive and rigorous data on the subtleties of systems of human capital. Human capital analysis should always be used in conjunction with traditional financial analysis.

The HCA, like any expert system, has specific technical and logical requirements. Representation of knowledge within the knowledge base component of the expert system is one major pre-requisite for the development of any expert system. The proposed expert system incorporates an awareness-based knowledge representation and knowledge-sharing tool used to represent and share knowledge that flows within the investment recommendation processes.

3. Closing the skill gap

An expert system (ES) is a system that uses human knowledge captured in a computer to solve problems that ordinarily require human expertise (Turban, 2001). These systems imitate reasoning processes experts use to solve specific problems. It is claimed that such systems could function better than any single human expert in making judgments in a specific, usually narrow, area of expertise (referred to as a domain). The writers believe that this possibility may have a significant impact on the task of human capital analysis performed by the securities analysts when making investment decisions on behalf of their clients. In order to clarify the role and importance of the proposed knowledge representation tool within a given context, characteristics of an ES called HCA that can be used by securities analysts for this purpose is highlighted and discussed in this section.

The proposed HCA must allow for the following functionalities wherever necessary:
- Generic reasoning rules that reside in the inference engine component must be able to be broken by the user; in this capacity the expert system will play the role of an 'adviser',
- Knowledge structures within the knowledge-base component can be restructured by the user,

- Users are degraded gracefully. This is based on the previous observations made by the capital investment experts that are already aware of limitations of the users of the proposed system.

3.1 Expertise of the HCA

Such expertise include the following types of knowledge:
- Organisational Sustainability
- Human Capital Sustainability
- Strategic Human Resource Management
- Organisational Behaviour
- Change Management

The above knowledge enables securities analysts to make more efficient and effective decisions.

The first and third authors of this paper acted as the finance expert for the HCA. These persons possess the following required qualifications as an expert in the area of investment recommendation processes:
- They are frontrunners of research and practice in human capital analysis with expertise in teaching, researching and consulting in the areas of Organisational Sustainability, Human Capital Sustainability, Strategic Human Resource Management, Organisational Behaviour, Change Management
- Also, they have already identifiable solutions to the problem of human capital analysis (Royal & O'Donnell, 2002), (Royal, Daneshgar & O'Donnell, 2003) and (Royal and Althauser, 2003).
- They have explained the solution to a non-expert *knowledge engineer* (the second author) clearly, and the knowledge engineer has already understood the solution and has structured the knowledge, and created a preliminary version of the knowledge base

for the proposed HCA, and is shown in the next section.

3.2 Transferring expertise

The objective of the HCA is to transfer knowledge from the human capital analysts (the experts) to a computer system, and then to other securities analysts (nonexperts). This process involves the following four activities:
- Knowledge Acquisition from experts
- Knowledge representation
- Knowledge inference, and
- Knowledge transfer to the user.

Preliminary results for the first activity above has already been presented and published in (Royal, Daneshgar & O'Donnell, 2003). This will lay necessary foundation for the remaining three activities that constitute the authors current research activity in progress. In this article an extension of the first activity above is demonstrated. Such extension focuses on the implementation and design issues related to the knowledge acquisition and representation, and is discussed below.

3.3 A framework for knowledge acquisition:

Knowledge acquisition is the accumulation, transfer, and transformation of problem-solving expertise from experts or documented knowledge sources to a computer program for constructing or expanding the knowledge base (Turban 2001; 411). In this paper a framework is proposed for acquisition and representation of the knowledge of human capital as an important factor in making investment decisions (Daneshgar, 2003). The objective of this framework is to arrive at 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 HCA. A graphical demonstration of this framework appears as Figure 1 and is explained in more detail in the next section.
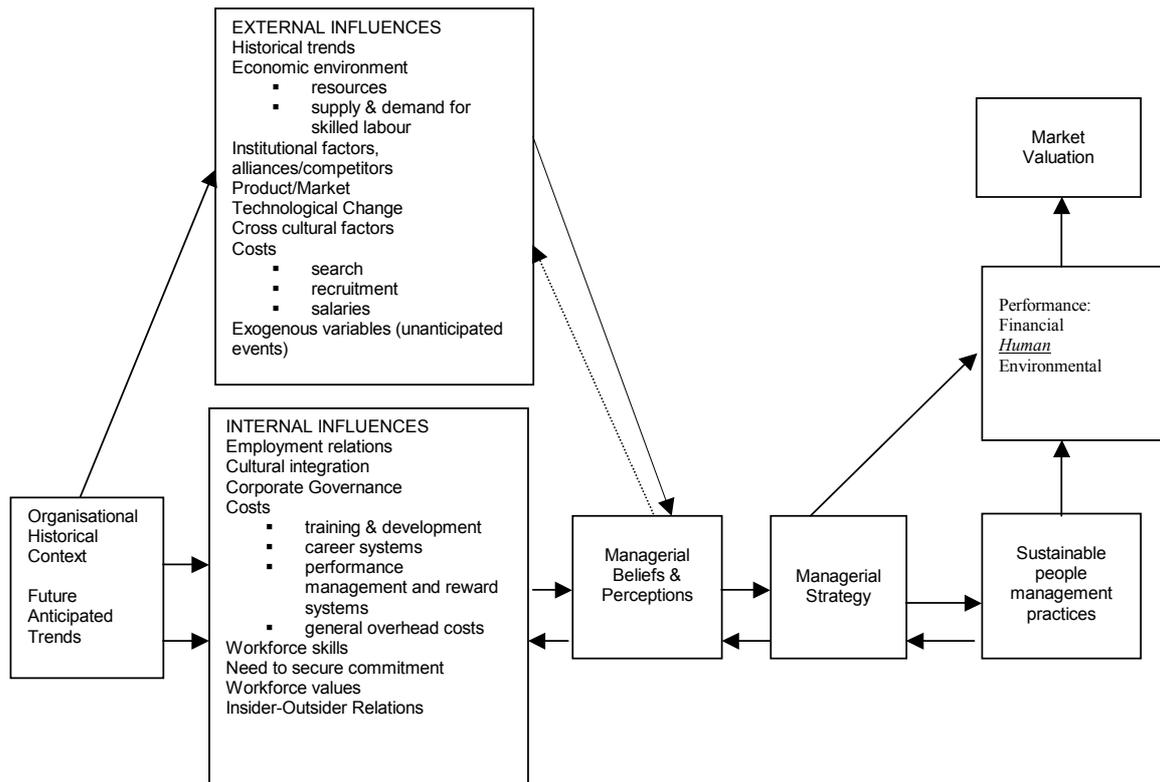
Figure 1: Human capital drivers of the value of the firm (adapted from Royal, 2000)

4. Deriving the factors for human capital analysis

As Figure 1 indicates, the following human capital factors were derived (Royal, 2002:238), as relevant to the expertise provided by human capital analysts. These factors are structured on the basis of their variability and will be weighted on the basis of their importance in the analysis of human capital.

The model examines key variables which shape management beliefs and perceptions which then drive the human capital systems, appropriate to the context of the organisation, which help to drive the value of the firm. Internal influences that affect managerial beliefs and perceptions and management strategy include: the state of employment relations, cultural factors, and costs associated with the need to secure commitment of employees (such as reward, performance management, career and development systems) and insider-outsider relations.

External influences that affect managerial beliefs and perceptions and management strategy include historical trends, the competitive nature of the economic environment, institutional factors, the nature of the product, technological changes and the costs associated with recruitment. The internal and external influences are interrelated, but they have not evolved in a linear fashion.

Even though cause and effect are less clear in qualitative models than in mathematical models, the HCA expert system, based on this model, would assist securities analysts to identify emerging patterns in human capital which ultimately affect financial performance and hence market valuation. So, the expert system would allow the securities analyst to access information and insights on themes such as those listed below. As noted earlier, human capital data can act as a lead indicator of future financial performance, so these insights are potentially valuable to securities analysts, their clients and to the finance industry.

Elements of analysis in the HCA:
1. Organisational history/culture
2. Macroeconomic environment
3. Financial data and market trend
4. Stage of competitiveness
5. Labour market conditions
   - Supply/demand for labour
   - Relative costs of search/recruitment
   - Salaries
6. Intellectual Capital

- Product/services
- Trends

7. Importance of technology
8. Importance of cross-cultural fitness or alignment
   - Macro level: organisational fit with its environment
   - Micro levels: internal alignment with strategy
9. Exposure to external risks/opportunities
10. Employment relations
    - Union activity/industrial relations
    - Cultural integration/alignment with corporate strategy
    - Level of engagement and commitment
    - Relevance of insider-outsider relations eg, customer, supplier, etc.
11. Composition of executive team/board and its alignment with strategy
12. Classification of human capital systems
    - Training, recruiting, career planning within traditional, professional, individual models.
    - Is the above mix appropriate in this organisation?
13. Are managerial beliefs and perceptions consistent with strategy?
14. Overall, are human capital practices designed to execute strategy?

Insights from this analysis would be considered by the users of the HCA in addition to traditional forms of financial data analysis.

5. Criteria for an appropriate knowledge representation framework

Once the above knowledge is acquired, it must be organised in an application knowledge base for later use. The reason for such a need is that throughout this article, the process of making investment decision is treated as a collaborative process. For example, a *client* may seek advice from a *securities analyst* for making some investment decisions. The *securities analyst*, on the other hand, may request a copy of company profile from various companies before a share purchase is made for that company. This will make *client, securities analysts* and *prospective company* actors of the potentially collaborative process that performs investment research for the *client*. Therefore, in order to effectively manage such collaborative process it would be necessary to provide actors with certain

degree of automated support that provides required awareness to the actors within the process so that collaboration among these actors are maintained at appropriate levels.

Over the years, a variety of knowledge representation frameworks have been developed each serving specific purposes depending on the users' requirements and system development strategies (Daneshgar, 2003). In search for an appropriate representation tool for the purpose of the proposed HCA system it was primarily noticed that the tool must be programmable using existing hardware, software and communication technologies. Next, the representation tool must be designed so that the facts and other knowledge contained within them can be used in provision of awareness to the actors when and where they are needed for maintaining collaboration among actors.

One condition for successful implementation of such awareness provisioning mechanism is the presence of a knowledge representation tool that can represent knowledge about investment decisions in a way that suits both the storage requirements of the Knowledge Base component, as well as the reasoning requirements of the Inference Engine for the proposed HCA.

We may summarise this section by concluding that the collaborativeness of the investment decisions implies that:
1. Various actors within the process rely on services provided by other actors either directly or indirectly. such collaborative process on would require The above factors however require a context
2. For these actors to collaborate effectively, an awareness provisioning mechanism must be in place so that awareness requirements of the actors in such collaborative environment are maintained at appropriate levels.

Development of a knowledge representation with above characteristics is a challenging task for the authors and constitutes one of their major research activities in progress.

6. Conclusion

Human capital analysis is grounded in the literature on organisational sustainability, pioneered by Dunphy (2000) and extended in the research of Drucker (2001), Senge (2000), Collins and Porras (2000) De Geus (1999), Elkington (2001) and Collins (2001). This paper presents an expert system, called

"Human Capital Analyser" to systematically bridge the knowledge gap in the work of securities analysts to assist them to analyse human capital in listed firms. Insights from the human capital of firms can provide further transparency in the investment recommendation process. The HCA expert system acts as a theoretical and practical bridge between corporate finance and organisational sustainability. More objective analysis of human capital by securities analysts can act as a force for positive change, to ensure clearer alignment of human capital with strategy and thus organisational sustainability. All stakeholders, including investors, managers and employers, as well as the finance industry, can benefit from more transparent and systematic human capital analysis.

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