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The Importance of Human Capital Analysis: Risk, Ambiguity and Uncertainty

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Abstract

Understanding the financial performance of firms requires analysis of the ambiguities inherent in human behaviour. Regulators currently do not insist that analysts are trained in systemic human capital analysis, however, in an environment in which the investing public has had a crisis of confidence in investment professionals, during periods of epistemic uncertainty where more knowledge can help to reduce risk and uncertainty, it is appropriate for regulators to ensure market participants exercise due diligence by ensuring that as much knowledge is available as possible to investors. Just as securities analysts and fund managers require the appropriate competencies, skills, knowledge and abilities in order to form earnings estimates and investment recommendations, different competencies, skills and knowledge and abilities are required to meet the demands of the analysis of human capital. These include disciplinary knowledge of sustainable human resource management, organisational change and/or organizational behaviour and their links to corporate performance.

Keywords: regulation, risk management, financial services
Introduction

After recent corporate failures, investors demand to know more about the human element as a key indicator of risk and of potential future value in firms. Investors require financial markets professionals to interpret the ambiguity inherent in early warning signs of risk and uncertainty, implying a move away from “lag” to “lead” indicators of a firm’s financial performance. Some human capital analytical models adapted from the discipline of accounting. Some have included attempts to value people assets; creating an index of ‘good’ management practices and relating these to business results; statistics about the composition of the workforce and measures of the productivity and output of people. These models, however, do not interpret the more complex process of managing the uncertainty and ambiguity of human capital in ways which can be readily understood by investors. Investors need to assess whether the configuration of human capital within a firm is internally consistent and provides a context for a firm to deliver its stated strategy.

The United Nations Principles for Responsible Investment create a context for investment markets to broaden equities research to incorporate more ambiguous themes, including analysis of good governance principles and strong environmental management. However, some fund managers, while attempting to capitalise on this emerging mandate, fall into the trap of measuring what they can measure, such as data on health and occupational safety incidents, staff turnover and headcount, rather than analysing what they should measure. While the Environmental, Social and Governance (ESG) principles of UNPRI incorporates the role of Boards and directors’ duties; corporate accountability and disclosure; risk management; corporate responsibility and ‘doing the right thing’ as well as major trends in financial accounting there is insufficient detail in these themes to sufficiently interpret key elements of ambiguity and uncertainty.

Overly simplistic pricing and trading models which do not incorporate human capital and other market realities will fail to incorporate underlying systemic uncertainties and ambiguities. As noted by Ganegoda and Evans, system level ambiguity cannot be reduced by investing in knowledge. Because financial markets include human interaction, they are characterised by ambiguity and can be subject to misinterpretations, as seen in the fallible system of credit rating of asset backed securities (ABS), which Ganegoda and Evans observed had been based on a set of assumptions based on the probability of default, similar to a bond rating scale, even though the loss distribution of the two are significantly different and the notation systems (e.g. BBB) failed to distinguish the much higher level of ambiguity inherent in the ABS ratings. Similarly, Li’s Gaussian copula formula for minimising financial risk of mortgage default was criticised by Nassim Nicholas Taleb: “People got very excited about the Gaussian Copula because of its mathematical elegance, but the thing never worked…Co-association between securities is not measurable using correlation.” David Li, the author of the model, had no pretensions regarding its infallibility: “The most dangerous part is when people believe everything coming out of it.” Additionally, the widely used Black-Sholes-Merton (BSM) pricing model, while successful for a relatively stable environment, had not factored in the potential for crises in human behaviour under conditions of unpredictability. The model was helpful for markets to interpret elements of risk and uncertainty but not ambiguity. However, when a critical mass of financial market players use specific models, it is possible that this high level of social commitment can “elevate a model to a paradigm without appropriate acknowledgement of underlying theoretical justifications….If such ambiguities are not explicitly treated, consequences can be disastrous.”

In investment markets where “quant analysts” use normal distribution models to minimise uncertainty and risk, but not ambiguity, it is not surprising that some institutional investors can become disconnected from the complex reality which the figures are supposed to represent, and regulators may need to respond.

The risk matrix described by Ganegoda and Evans distinguishes between risk and uncertainty. Risk applies to situations where we possess knowledge about the possible set of future outcomes and their underlying probability distributions. Uncertainty applies to situations where knowledge exists about the possible set of future outcomes, but knowledge does not exist about their precise underlying probability distribution. This is consistent with Oberkampf et al. who distinguish between aleatory
uncertainty, or inherent variation in a system, where outcomes follow a known probability distribution and more knowledge does not change the distribution; as distinct from epistemic uncertainty, derived from a level of ignorance of the system, which can be reduced with more knowledge.

Ganegoda and Evans observe that one approach to modelling this kind of episodic uncertainty is to invest in knowledge. However, there are barriers to acquiring knowledge on these aspects of corporate performance: time horizon concerns (e.g. on climate change), significant expense of obtaining and interpreting data (e.g. on geological causes of weather events which may affect the nuclear power industry), conflicts of interest (between different reward systems for academic and corporate researchers), and competitive interests preventing collaboration within a sector. Even so, there is a cost to not investing in this knowledge.

UNPRI and ESG: Modelling Episodic Uncertainty

Environmental, Social and Governance aspects of the United Nations Principles for Responsible Investment represent a coordinated effort to analyse and interpret aspects of both aleatory and episodic uncertainty. ESG can force market participants to move towards a deeper understanding of the ways in which firms generate lasting value, through articulation of the “generative mechanisms”, or the underpinning patterns of behaviour of key actors. ESG can also help illuminate a firm’s relative level of ambidexterity: the ability to both explore new horizons and exploit existing strengths in order to make the investment recommendation process more transparent. In late 2010, UNPRI had over 800 signatories with a total of $22 trillion in assets under management, including by August 2010 over 112 signatories from Australia, comprising around 14% of the total number of signatories. Funds under management or advice of the 112 Australian signatories total approximately $591 billion. In 2010, 360 shareowner resolutions were submitted in the US; 29% of those addressing environmental or social issues received more than 30% of shares voted, unsurprisingly as ESG beta, defined as the set of companies’ financial exposures to environmental and social factors, provides a clear case for seeing ESG as a long-term risk mitigation factor. “Socially responsible” firms can trade at a price premium relative to lagging CSP firms implying that regulators may need to focus on this aspect of aleatory uncertainty.

Both governance and environmental themes have received considerable attention from researchers, including from both investor and corporate perspectives, with optimistic as well as pessimistic scenarios from an investment perspective. Cross cultural issues have also been debated. Climate change in some parts of the world, for instance, can mean investment opportunities for public health. Greenhouse gas emissions, energy and water use, the use of non-renewable resources, other emissions and wastes and biodiversity impacts have increasingly been reported by corporates in sustainability reports for over ten years, and subsequently analysed by securities analysts using data such as reductions in energy use, packaging, paper, resources, emissions, water use and recycling to help guide investment recommendations, even though these vary by industry. Standards are emerging to assist corporates to disclose activities in this arena, and to assist markets to provide a level of comparability and assurance to the process. These standards include: the Equator Principles, HACCP, ISO 9001, ISO14001, Lost Time Injury Rate and the Carbon Disclosure Protocol. Standards in environmental disclosure and assessment are enhanced by the ready availability of new technologies and social media so that potential breaches of protocols are can be immediately broadcast.

Governance aspects of ESG investing are becoming somewhat standardised. In the UK, since mid-2010, the Financial Reporting Council has required firms to make clear statements of a board’s responsibilities relating to risk, including governance risk, with a greater emphasis on the importance of skills and experience on boards and a recommendation that all board members be put up for re-election every year. This kind of data is relatively comparable across firms, allowing for clearer analysis by markets. The Australian Stock Exchange has guidelines for good practice in governance, incorporating formal committees to create and execute corporate policies on strategic issues including remuneration for senior executives and to prepare for regular audits. These relatively simple policy changes appear to have had a positive impact in the Australian corporate governance context.

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Overall, corporate governance ratings have a positive effect on firm performance \cite{xix}, implying that companies can improve performance by adhering to strong corporate governance practices.

The Social ESG themes are more ambiguous and more likely to include epistemic as well as aleatory uncertainty. In some cases, social aspects of ESG investing are defined in terms of labour law compliance, health and injury statistics, community engagement (such as in the London Group Benchmarking Model), social business investment to philanthropy. Some research has focused on the inevitable trade-offs between ecological and social themes \cite{xx}. Other streams of research have focused on the kind of data which is disclosed by firms, and its level of materiality and assurance \cite{xxxi}. Other research has found that it is not the precise nature of the data on social or human capital issues which is of relevance to analysts, rather it is the forward-looking analysis of how human capital investment is likely to generate business opportunities \cite{xxii}. Given the array of definitions of S, and confusion around units of analysis (e.g. at firm or business unit or individual or board level) and on the type of data under analysis, it is not surprising that securities analysts find it difficult to standardize their analyses of human capital and related social themes within ESG investing protocols.

Of each of the three ESG principles, it is the Social aspects which are most ambiguous. However, epistemic uncertainty cannot be modelled through an aleatory lens, although some fund managers analyse singular factors, such as employee engagement scores, as a proxy for all human capital and change management performance, even though these are more likely to provide an illusion of rigour rather than an illumination of the underlying complexity.

While regulators have not yet mandated that market participants need to analyse and interpret aleatory and epistemic uncertainty, recent initiatives from the Responsible Investment Association of Australasia (RIAA) have included awarding certification in responsible investing \cite{xxiii}. This is an important symbolic and practical qualification to address the regulatory reform required to enhance analyst licensing and skill development to incorporate all aspects of ESG investing. Understanding the financial performance of firms requires analysis of the ambiguities inherent in human behaviour \cite{xxiv}. The same day that Lehman filed for bankruptcy on September 15, 2008, three credit ratings agencies had rated the investment bank as above average in its ability to meet its financial commitments. Those who tried to articulate the flaws in the underlying management systems were criticised \cite{xxv}. However, while specific financial results cannot be predicted precisely, the human capital patterns shaping them can be understood \cite{xxvi} and can provide insight into future value creation and destruction within listed firms. Regulators can provide a context for market participants to analyse and interpret human capital at the level of patterns and systems.

Quantitative techniques are valuable to appreciate outcomes within multiple uncertain inputs, but users need to understand the imperfections of their assumptions. There are also non-readily quantifiable issues to take into account. Quantitative valuation methods, such as the BSM and Gaussian Cupola models, are necessary but not sufficient for predicting future value in complex, knowledge based markets. They need to be supplemented by rigorous qualitative research which incorporates interpreting the ambiguity inherent in human capital experienced by firms in changing economic conditions. Human capital professionals are trained in the disciplines of organisational psychology and strategic human resource management are also trained in interpretation of ambiguity. This is distinctly different to the overly simplistic use of accounting principles in human capital metrics, especially when those metrics were designed for internal corporate use, not market use. They do not allow an investor to assess whether a listed company has reduced ambiguity through appropriate configurations of human capital.

Emerging evidence for the role of human capital analysis in the investment process

An investigation of information flows in capital markets was conducted during 2000-2005, as a component of a larger study, undertaken during 1996-2005 in investment banks in Australia, Asia and the UK \cite{xxvii}. Investors can assess generative mechanisms of value creation, in part, through the analysis of qualitative aspects of human capital within listed firms. An illustrative model of human capital analysis within investment markets can be seen in Figure 1, Table 1 and Table 2. Such a system can be described using semantic concepts: ‘actor’, ‘role’ ‘task’ and ‘task artifacts’, within an ‘awareness net’. According to Figure 1, there are 9 task artifacts that connect 9 pairs of task with
By analysing various components of the awareness net, several knowledge gaps have been identified (see Table 2) within the current investment recommendation process. Points 5 and 6, in particular, highlight the role of regulators in improving these knowledge gaps.

Mini case study – Fund managers’ observations on human capital analysis

It is useful to consider systemic ways to bridge the knowledge gaps identified in Table 2. It appears that markets do not systematically acquire the skills which underpin human capital analysis, including strategic human resource management, organisational change management, organisational psychology and organisational behaviour. Most finance professionals are trained in a very different set of underlying disciplinary fields, and these do not typically account for high levels of environmental ambiguity and episodic uncertainty. The nominal function of financial markets analysis is to conduct thorough research investigations into all aspects of the current and prospective financial condition of publicly listed companies and to provide an analysis of the findings in the form of a research report, which serves as a basis for making an investment recommendation xxxviii. However, in spite of significant regulation on all aspects of recruitment, training, development, remuneration and promotion of financial analysts, regulators do not currently focus on the acquisition of skills in the inherently ambiguous nature of human capital within listed firms.

As part of an ongoing research project in the use of human capital analysis by fund managers, selected fund managers were presented with detailed human capital analyses of listed stocks, incorporating publicly available information on the human capital systems used within selected firmsxxxx. The following “thick descriptions” x were noted: one fund manager observed that a history of the CEOs and the chairs of the boards and the new executives provided perspective, context and an understanding of action versus words. He believed his role is to find and financially back management teams and he needed information to do that in a reasonably factual way. He expressed interest in understanding which stocks which have the potential to move from three to four or five stars, based on a five star human capital score, or the reverse, as well as those which are on a five star rating and which may be trending down to less. Another fund manager expressed interest in a range of human capital analysis services, including bespoke reports, “teach ins” or seminars for his team. In terms of engagement with this deeper form of company research, his preference was for a contract to provide a wide range of services. He voted on brokerage commissions which generate specific payment per vote. He noted that within the context of an increasing number of third party and specialist research providers he had a preference for separation of execution and research - both had to be excellent and may be provided by different parties. He noted that some execution contracts require guarantees. A third fund manager regularly commissioned research on ESG issues, which was paid by internal profit centre groups who fund the research via brokerage commissions. They keep the research within their own organisation for approximately one month, to analyse and interpret for internal use and for external clients, and then allow it to be released for use by other finance industry organisations. Even with ESG research, this fund manager has chosen not to use negative filters. After significant time in the funds management industry, he believes that investing is more of an art than a science. He and his colleagues have sought to create a version of a human capital dashboard to incorporate specific metrics which have the most impact for analysts, particularly human capital metrics that link data qualitative to quantitative. This fund manager and his colleagues found some ESG reports to be patronising if the writers assume that analysts do not already look at management as their colleagues cover specific companies for many years.

These observations are consistent with earlier research on traders’ views of human capital analysis: “The traders indicated they benefited from: timeliness of human capital information, which they saw as essential, providing a better balance of real time and “right time” financial and non-
financial information, providing opportunities for sensing and responding to human capital events before their implications are widely known and understood.

However, these fund manager observations also highlight a lack of systematic interpretation of human capital systems as a key component in investment research as one approach to identify and model episodic uncertainty. This knowledge gap is explored later in this paper, and specific potential solutions to bridging this knowledge gap are proposed.

Modelling Ambiguity and Episodic Uncertainty

Based on field research in the finance industry, researchers derived a suite of analytical approaches to model human capital within listed firms, based on an analysis of human capital through management systems, allowing for comparisons across industry sectors and across firms. Unlike the Gaussian and normal distribution based quantitative models, these human capital models incorporate aspects of change management. One extension of this human capital based approach to modelling types of uncertainty is seen in Figure 2, which illustrates it is possible to plot a firm’s leadership style and change management themes and then to make inferences on the appropriate configuration of these relative to a firm’s life cycle. In different stages of the life cycle of a firm, specific change management themes of systematic trial and error are replaced by more sophisticated change management themes. These themes can be characterised by steady growth, divisionalisation, realignment and systems for sustained success and associated human capital management system.

Each of these themes is associated with configurations of management systems which are ideally both internally consistent and consistent with strategy for a firm to optimise its ability to execute on its stated mission. These change management themes can be analysed and interpreted at two levels: firstly at the level of the regulatory process itself, and secondly, at the level of the entities which are being regulated. It is worth noting that as these kinds of knowledge gaps become evident in regulatory processes, regulatory bodies, as with individual companies, can also progress through a process of change management. However, in this paper, we focus on the second process for market participants to use in their own internal processes to improve the outcomes.

Regulators currently do not insist that analysts are trained in systemic human capital analysis, however, in an environment in which the investing public has had a crisis of confidence in investment professionals, during periods of epistemic uncertainty where more knowledge can help to reduce risk and uncertainty, it is appropriate for regulators to ensure market participants exercise due diligence by ensuring that as much knowledge is available as possible to investors. Just as securities analysts and fund managers require the appropriate competencies, skills, expertise, knowledge and abilities in order to form earnings estimates and investment recommendations, different competencies, skills and knowledge and abilities are required to meet the demands of the analysis of human capital, especially at the level of human capital systems. These include disciplinary knowledge of sustainable human resource management, organisational change and/or organizational behaviour and their links to corporate performance.

Currently, investment recommendations are made on a relative basis comparing a company’s performance within a sector or industry and analyses should cover all relevant publicly available information about the company and its business and the sector in which it operates. “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”. These underpinning disciplines of econometrics, engineering and finance are effective in training graduates to model risk and even uncertainty, but they typically do not train graduates to model ambiguity.

The near collapse of the US financial sector in 2008 illustrated that market participants, including investors and regulators, were routinely mistaking measures and symbols for reality, creating conditions where hyper-reality appeared real. This paper calls for institutional investors, equity traders and analysts to analyse ambiguity as well as risk, especially in conditions of episodic uncertainty, and for regulators to ensure that this is embedded in the regulatory system. It is a flawed argument that a
good regulatory regime has to protect participants only under predictable conditions. As the global financial crisis has revealed, using only traditional risk analysis models, few regulators could have predicted the extent of discontinuous change, as most regulators had a regulatory model to manage markets for "smooth sailing", or aleatory rather episodic uncertainty. To this end, a human capital systems perspective, which incorporates human as well as financial capital, is increasingly important for market participants and regulators within a complex, highly interdependent economic system.

The uncertainty can be minimized if institutional investors move beyond analysis and interpretation of traditional data sets, as seen in the UNPRI initiatives. However, even these principles are not adequate to ensure widespread adoption of appropriate levels of modelling episodic uncertainty. While the first and second generation interpretations of corporate social responsibility (CSR) and socially responsible investing (SRI) serve to challenge traditional quantitative risk models, they can be misinterpreted and have been used as an over simplistic proxy for human capital analysis and risk management. These approaches to investment analysis attempt to minimise ambiguity for investors by providing relatively simple industry based screens, such as tobacco, arms and related industries. However, more comprehensive third and fourth generations of CSR and SRI are based on positive filters, such as examples of sustainable business practices, blended with substantial cost savings. While these filters are more sophisticated than the previous generation of investment filters, they are still limited in their scope and their benefit. Investors' power will increasingly rely on their ability to invest in the context of fifth generation CSR and SRI, involving a sophisticated approach to modelling ambiguities inherent in intangible value creation, incorporating human capital.

Implications for Financial Market Participants

In conditions of episodic uncertainty, more knowledge of human capital systems within listed firms, while expensive to obtain, is likely to be more useful to investors than less knowledge. While specific outcomes of human capital risk cannot be fully known, and markets are continually subject to “black swan” events, it is feasible for financial market regulators to consider embedding a more systematic analysis of human capital through the regulatory system. This goes beyond recognition of behavioural economics, and the role of cognitive biases such as overconfidence. Systemic analysis of human capital can also potentially prepare investors for the financial market equivalent of tsunamis, through clearer analysis of previously underestimated data – qualitative and quantitative data. Human capital analysis can provide a complementary approach to financial models, such as the Gaussian Cupola formula, which are based on efficient market hypotheses and normal distributions. The human element creates more variables and complexities which add to ambiguity, uncertainty and risk. Regulators in the future may need to consider the significance of systematically incorporating human capital into all aspects of the financial services industry, as one approach to reduce ambiguity especially in conditions of episodic uncertainty.

Securities analysts and investment managers may need to undertake additional formal degree qualifications to provide the theoretical underpinnings required for robust human capital analysis. This education would draw on the fields of sustainable human resource management, organisational change and organisational behaviour. It would also include training in formal qualitative research methodology. This would involve consultation with university and other diploma qualifying institutions. Investment managers need to acquire human capital competencies and skills from non-traditional labour market sources to complement existing analytical and interpretive expertise. Fund managers and other market participants may benefit from human capital analysts, working alongside their quantitative teams, to provide independent research on those relevant human capital systems within equities research processes. To integrate the analysis of human capital into the investment process, companies will need to provide access to human resource management practices so fund managers have valid data on which to base their human capital investment recommendations. Regulators may need to reconsider the role of independent human capital research for investors if there is to be an increased level of transparency of investment recommendations and decisions to prepare for conditions of episodic as well as aleatory uncertainty.

Specifically, a future research agenda into capacity building within regulators may need to incorporate an investigation of the design and structure of regulatory institutions in terms of their analysis of
ambiguities in human capital risk, within a sample of jurisdictions which illustrate different success factors e.g. Australia (APRA), United Kingdom (FSA), Germany and Spain. An analysis of the decision making processes within regulatory institutions related to human capital risk management would clarify the decision making processes required for regulatory responses to uncertain market conditions.
Figure 1: An awareness net representation of the investment decision process
(Daneshgar, Royal and O’Donnell, 2005)
Table 1: Roles and Steps in the Investment Analysis Process: incorporating current role of regulators and fund managers (adapted from: Daneshgar, Royal and O’Donnell, 2005)

<table>
<thead>
<tr>
<th>Roles</th>
<th>R1: Securities analyst</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R2: Client (investment manager or broker)</td>
</tr>
<tr>
<td></td>
<td>R3: Sales People</td>
</tr>
<tr>
<td></td>
<td>R5: Company</td>
</tr>
<tr>
<td></td>
<td>R6: Security and Investment Commission</td>
</tr>
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<td></td>
<td>R7: Stock Exchange</td>
</tr>
<tr>
<td></td>
<td>R8: Human Capital Expert</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Tasks</th>
<th>T1R1: R1 provides advice to the Client, R2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1R2: R2 requests for advice from R1</td>
</tr>
<tr>
<td></td>
<td>T2R1: R1 prepares and sends the Research Product to Sales, R3</td>
</tr>
<tr>
<td></td>
<td>T2R3: R3 receives Research Product from R1</td>
</tr>
<tr>
<td></td>
<td>T3R1: R1 requests Company Profile from the Company, R5</td>
</tr>
<tr>
<td></td>
<td>T3R5: Provides R1 with the Company Profile</td>
</tr>
<tr>
<td></td>
<td>T4R1: R1 consult SIC, R6, for their Rules and Regulations</td>
</tr>
<tr>
<td></td>
<td>T4R6: R6 provides R1 with Rules and Regulations</td>
</tr>
<tr>
<td></td>
<td>T5R1: R1 consult SX, R7, for Financial Data</td>
</tr>
<tr>
<td></td>
<td>T5R7: R7 provides R1 with the Financial Data</td>
</tr>
<tr>
<td></td>
<td>T6R1: R1 seeks expertise on human capital from R8</td>
</tr>
<tr>
<td></td>
<td>T6R8: R8 provides Expert Advice to the R1</td>
</tr>
<tr>
<td></td>
<td>T7R2: R2 seeks market and price data from R4</td>
</tr>
<tr>
<td></td>
<td>T7R7: R4 provides market and price data to R2</td>
</tr>
<tr>
<td></td>
<td>T8R2: R2 requests to buy shares from R3</td>
</tr>
<tr>
<td></td>
<td>T8R3: R3 provides shares to R2</td>
</tr>
</tbody>
</table>

Table 2: Knowledge Gaps in the Current Investment System (adapted from: Daneshgar, Royal and O’Donnell, 2005)

1. Securities analyst, R1, needs expert advice (R8) in the area of human capital. Such is currently not systematically included in investment recommendations.

2. Currently this collaboration is sub-optimised by non-systemic data on human capital to underpin advice by R1 to R2.

3. Currently, such interaction is based on quantifiable elements, without systematic use of qualitative data.

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.

5. R6 does not currently license capability in analysing qualitative, system-level human capital data.
| 6. | Regulatory standards on human capital data from R7 to R1 emphasise readily quantifiable themes including senior executive remuneration and corporate governance implications. |
Figure 2: Human Capital Analysis Leadership Matrix

<table>
<thead>
<tr>
<th>Environmental context</th>
<th>Leadership style</th>
<th>Change management theme</th>
<th>Management systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Episodic uncertainty</td>
<td>Primary leadership style: Entrepreneurial leadership</td>
<td>Systematic trial and error</td>
<td>Innovation of products, services and processes of all management systems</td>
</tr>
<tr>
<td>Aleatory uncertainty</td>
<td>Transactional leadership</td>
<td>Steady growth</td>
<td>Stability of management systems</td>
</tr>
<tr>
<td>Aleatory uncertainty</td>
<td>Systems based leadership</td>
<td>Divisionalisation – accelerated complex growth, organically or mergers and acquisitions</td>
<td>Reproduction of systems, rapid execution, clarity of core and non core systems</td>
</tr>
<tr>
<td>Episodic uncertainty</td>
<td>Change agent basis for leadership</td>
<td>Realignment of overall business to new conditions</td>
<td>Openness to change of management systems, awareness of flexibility and transformational change</td>
</tr>
<tr>
<td>Episodic uncertainty</td>
<td>Visionary and system based leadership</td>
<td>Organisational sustained success or organisational decline</td>
<td>Embedded systems to sustain success – alternatively, no embedded systems implies fragmentation, stagnation and failure</td>
</tr>
</tbody>
</table>
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Akerlof and Shiller, 2009


Royal and O’Donnell 2008:371

Royal and O’Donnell 2008


Royal and O’Donnell 2008


