Drivers of Voluntary Intellectual Capital Disclosure in Listed Biotechnology Companies[1] - Research Paper

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Abstract

Purpose: to investigate the key drivers and level of voluntary disclosures in biotechnology company annual reports.

Methodology/Approach: using an intellectual capital disclosure index score voluntary disclosures in a large sample of listed biotechnology companies, and test the relationship between voluntary disclosures of intangible firm value with traditional Agency Theory variables. The relationships were tested statistically using correlation and multiple-regression analysis.

Findings: The key drivers of voluntary intellectual capital disclosures were the level of board independence, firm age, level of leverage and firm size. Multiple regression analysis demonstrated that board independence, leverage and size had a significant relationship with the level of voluntary intellectual capital disclosure. Separate regression controlling for large-sized and small-sized firms demonstrated that voluntary intellectual capital disclosure was only driven by board independence and the levels of firm leverage in large firms. The small firms did not demonstrate this relationship.

Research limitations/implications: Implications of this research are that smaller biotechnology companies' managers are not motivated by external debt-holder demands to make voluntary disclosures about intangible firm-value. In addition large biotechnology companies, better able to establish independent board oversight, appear more effective at driving voluntary intellectual capital disclosures; perhaps in response to greater demand by owners. A limitation of this study is its Australian context and that data is analysed only from 2005 financial year annual reports.

Originality/value: To our knowledge this is an original paper whose findings have valuable implications for managing intellectual capital at the firm level. We clearly demonstrate that disclosures about intangible firm value is being driven by traditional Agency Theory Variables and more contemporary corporate governance issues, and that

small firms may be ignoring the importance of disclosing more about their intellectual capital.

Introduction

The aim of this research project is to investigate the nature and extent of voluntary intellectual capital disclosures which are made by biotechnology companies. This is done in the context of Agency Theory (Jensen and Meckling, 1976), and traditional Agency Theory variables were used to investigate potential drivers of voluntary intellectual capital disclosures by management of these firms.

Biotechnology companies are a fascinating example of firms with intangible value. This intangible value can include: a skilled workforce; highly collegial R&D oriented culture; public benevolent motivations and outcomes; registered intellectual property; proprietary techniques and IT applications; and, highly innovative strategic alliances.

Intellectual capital reporting about the nature of a firm's intangible assets is an important way of bridging the information gap which may exist between managers and firm owners (Eccles and Mavrinac, 1995). This information gap is very likely to exist in young industries like the biotechnology industry, and is the inspiration for a growing body of research on the importance of firm intellectual capital disclosures (Mouritsen et al. 2004; Nielsen et al. 2006). There is a global trend and demand for more useful and comprehensive non-financial information about the operating activities of firms (Anderson and Epstein, 1996; GRI, 2006). Research has demonstrated that companies in industries like the biotechnology industry need to bridge the information gap between managers and owners, as this can be critical to future capital-raising potential (Aboody and Lev, 2000; Barth et. al., 2001). In the study of Aboody and Lev (2000), the importance of private information relating to R&D intellectual capital was demonstrated since firm managers were shown to gain because of their inside-information about this

important knowledge commodity. More than half of the listed Australian biotechnology firms today are actively engaged in R&D-only activities. This could mean that there is potential within the Australian biotechnology industry for a net transfer of wealth to be occurring in favour of firm management over owners.

The intellectual capital statement, the meaning of its contents and its interpretation, seems a valid academic intellectual pursuit to build and transfer information about firm intangible value from managers to owners. The essential nature of an intellectual capital statement is that it attempts to disaggregate information that is not traditionally disclosed in a firm's balance sheet. A recent critical finding from the intellectual capital literature is the importance of a 'knowledge narrative' to explain how knowledge is more than a token valuable, and how a knowledge management strategy and investments in knowledge resources make a difference to firm success (Mouritsen et al., 2005). It has been clearly demonstrated that non-financial disclosures can positively impact upon management credibility, analysts' understanding, and investors' patience over poor performance (Eccles and Mavrinac, 1995).

Firm failure to accept the importance of disclosing the value of their less tangible assets has been associated with certain negative consequences, including: 1) investors with small shareholdings having less access to information about a company's intangible assets than larger shareholders; 2) opportunistic behaviour of firm managers if information about intangibles remains private; and, 3) cost-of-capital may increase to non-disclosing firms because of risk assessment by investors and banks who can only value the company with information about its tangible property (Marr et al., 2003).

In contrast to the negative consequences of non-disclosure there are some compelling arguments which justify non-disclosure of intellectual capital information, including: 1) the 'Transparency Drawback' of managers disclosing information which competitors can use strategically against

them (Depoers, 2000); 2) regulatory barriers imposed by potential legal claims if private information becomes public; 3) prescriptive requirements of generally accepted accounting practices; 4) national culture (Chaminade and Johanson 2003); and, 5) the risk-averse behaviour of auditors when advising firms on annual report disclosures (Vergauwen and van Alem, 2005).

Internationally, some countries have regulating intellectual capital reporting initiatives, these include: 1) Austrian legislation for intellectual capital reporting by all state-owned universities; 2) United Kingdom legislation for implementation of Operating and Financial Review statements, repealed in early 2006 and now only a 'Business Review' is required (Department of Trade and Industry, 2006) ; and, 3) French legislation forming part of its Nouvelles Régulations Économiques for high market capitalization companies.

Countries setting voluntary guidelines, include the: 1) Australian Government Consultative Committee on Knowledge Capital (AGCCKC, 2001; Gap Congress on Knowledge Capital, 2005); 2) Australian Code of Best Practice for Reporting by Life Science Companies (AusBiotech and ASX, 2005) launched in September, 2005; 3) European Commission initiated 'Measuring Intangibles to Understand and Improve Innovation Management' (MERITUM) Guidelines; 4) Danish Ministry of Science, Technology and Innovation (DMSTI, 2003) guidelines which have grown from the MERITUM project; 5) Japan's Keizai Doyukai (Japan Association of Corporate Executives) white paper on corporate social responsibility and Japan's Nippon Keidanren (Japanese business federation) Charter of Corporate Behaviour; and, 6) The Global Reporting Initiative sustainability report (GRI, 2006). The above summary of regulations and guidelines is a synopsis from the first of Prof. Wai Fong Chua's reports on extended performance reporting for the Institute of Chartered Accountants in Australia (Chua, 2005).

In Australia there is no legal or GAAP requirement for public companies to produce end-of-year financial reports with information relating to intellectual capital, nor are they obliged to

committed disclosures on social, societal and environmental factors which may have a positive impact upon reported earnings quality. The dearth of information traditionally supplied to equity investors in these companies has prompted action from Australian regulators and biotechnology industry lobby groups. Recently, the ASX launched the 'Code of Best Practice for Reporting by Life Science Companies' (AusBiotech and ASX, 2005) – a joint initiative. The ASX 'Code of Best Practice for Reporting by Life Science Companies' is a list of suggestions purporting to enhance ASX listing rules disclosure requirements.

A preliminary evaluation of the ASX/AusBiotech code of best practice and its guidance seem to indicate that it may not fulfil its objectives. The first six pages of the code guidance are preamble relaying ASX continuous disclosure requirements to the reader; pages seven to eighteen contain the actual guidance and seven of those pages relate solely to the treatment of information about intellectual property rights, regulatory filings, clinical trials and medical devices. It would appear from the code that the types of continuous disclosure which are being encouraged are highly-biased in favour of the type already disclosed best in the annual reports and on the web-sites of these companies: 1) registered intellectual property; 2) product technology already in late-stage commercialization; and, 3) clinical trial reports. Are regulatory authorities in Australia are trying to send a message that relatively "hard" intangibles (Stewart, 2001) are less likely to be fully disclosed, and are therefore in need of regulatory backing?

A key driver of the research on intellectual capital disclosure is the premise that mastering disclosure of "soft" intangibles like employee knowledge, customer relations, strategic vision and intellectual property management is where companies may need help and also ultimately is the key to uncovering an organization's value. These "soft" intangibles are the focus of narrative in well-defined intellectual capital statements which elucidate the value of firm intangibles using the three dimensions of human capital, organisational capital/internal relations and customer/external relations (Mouritsen, Bukh et al. 2005).

In this study the 78-item voluntary intellectual capital (IC) disclosure index developed by Bukh, Nielsen, Gormsen and Mouritsen (2005) was used to score IC disclosures by 102 listed biotechnology companies in their 2005 Annual Reports. The measure employed by Bukh et al. (2005) disaggregates voluntary intellectual capital disclosures by firms into six dimensions: 1) employees; 2) customers; 3) information technology; 4) processes; 5) research and development; and 6) strategic statement. In this study a number of independent variables will be used to examine the relationship between intellectual capital disclosure and a firm's size, including: board independence, ownership concentration, age of the company and leverage.

The 2005 Australian annual reporting period is an interesting starting point for any planned longitudinal research on annual reporting disclosure practices since it will be the last before harmonization and the application of the International Financial Reporting Standards (IFRS).

Hypothesis Development

The central research question which is being addressed by this project can be presented as follows:

> **"What is the nature and extent of intellectual capital disclosures by biotechnology firms and what are the key drivers of voluntary disclosure by firm managers about intangible firm value?"**

Traditional accounting disclosure papers focus almost exclusively on formulating research hypotheses within an Agency Theory conceptual framework, with its overarching themes of ownership, control, agency, opportunism and cost. This is an entirely appropriate theoretical framework within which to develop our current set of hypotheses.

Agency theory, probably the central theory to all accounting theory, explains that separation of ownership and control in companies creates a moral hazard where managers, as agents for shareholder owners act for their own economic self-interest (Jensen and Meckling, 1976). Positive accounting theory (PAT) is the branch of accounting theory which attempts to explain the manager agent's behaviour and accounting policy choice decisions. Considering the economic consequences of particular decisions, with regard to incentive and reward schemes put in place to motivate and reward them (Deegan, 2005; Watts and Zimmerman, 1986; Zeff, 1978). In the changing global reporting environment today, managers should understand and address the important economic consequences of not making voluntary disclosures about the firm's intellectual capital base.

Size of the firm

Large companies are often scrutinized by particular stakeholder groups and therefore positive disclosure practices such as intellectual capital disclosure might be predicted if a firm is attempting to minimize political costs. This study uses market capitalization as a proxy for political visibility. In particular, work on the Australian oil and gas industry companies has shown that size is a significant factor impacting voluntary intellectual capital disclosure (Singh and VanderZahn, unpublished). However, for Danish IPO prospectuses size was not a determinant for intellectual capital disclosure (Bukh, Nielsen et al. 2005). Bukh and others identify an earlier study by Robb et al. (2001) that found prospective and historical non-financial disclosures in the annual reports were affected by size and international operations.

Ownership concentration

Another determinant of intellectual capital disclosure that will be analysed here is ownership concentration. Ownership concentration is a measure of voting power distribution – either to the owners or the managers. Sometimes also measured as the proportion of management ownership, it represents a motivation for non-financial disclosures to aid alignment of interests between

managers and owners. Low ownership concentration in firms is equated to manager control, whereas high ownership concentration firms are equated to owner control. Research to date has contributed conflicting accounts of whether ownership concentration is likely to be a determinant of intellectual capital disclosure in firm annual reports. For example, a significant relationship was demonstrated between ownership structure and voluntary segment disclosures in diversified Australian firms (McKinnon & Dalimunthe, 1993), but Singh and VanderZahn's (unpublished) intellectual capital study confirms Craswell & Taylor's (1992) study of voluntary reserve disclosures, in that there was no significant association with ownership structure.

Board independence

The monitoring ability of the board will depend on its individual members' ability to represent the shareholders by assessing firm activities and controlling the behaviour of firm managers. The percentage of independent directors on the board and the size of the board have both been positively associated with measured levels of disclosure in past studies (Craven and Wallace, 2001; Jaggi and Leung, 2006).

Age of the firm

Bukh, Nielson et al. (2005) identify that company age has often been used in previous studies as a proxy for risk. From this perspective it might be expected that younger companies with 'less history' will be more reliant upon non-financial disclosures. In other words, prospective information about earnings will be more useful than limited historical data for investors to value the firm (Amir and Lev, 1996). In Bukh's study above, they did not find that age was an explanatory factor for firm intellectual capital disclosures.

Firm leverage

Traditional agency theory also predicts that highly leveraged firms which have significant obligations under existing debt covenants incur monitoring costs to reach equilibrium between self-interested managers as agents for external debt-holders (Dhaliwal et al., 1982). The paper of Watts and Zimmerman (1986) further explains that the more external financing that is employed by an organization the more management will attempt to use different policies for their own benefit. While Singh and VanderZahn (unpublished) find there is a significant positive correlation between oil and gas firm leverage and intellectual capital disclosure they also review two other papers with contrary results. A positive correlation between firm leverage and voluntary segment disclosures was found by Bradbury (1992). No relationship was found between the same two variables measured in New Zealand firms (Chow and Wong-Boren, 1987).

The research detailed above has led us to make the following null hypotheses:

> *H_oSize:* There is no significant association between the political visibility of biotechnology firms and the level of voluntary intellectual capital disclosure measured in the annual report.
>
> *H_oOwnership:* There is no significant association between the voting power distribution amongst the top twenty shareholders in biotechnology firms and the level of voluntary intellectual capital disclosure measured in the annual reports.
>
> *H_oIndependence:* There is no significant association between the level of Board independence in biotechnology firms and the level of voluntary intellectual capital disclosure measured in the annual report.

H_oAge: There is no significant association between the age of the biotechnology firm and the level of voluntary intellectual capital disclosure measured in the annual report.

H_oLeverage: There is no significant association between the level of responsibility to external debt providers for biotechnology firm and the level of voluntary intellectual capital disclosure measured in the annual report.

Methodology

This paper uses a 78-item disclosure index developed by Bukh, Nielson et al. (2005). The disclosure index is a method of scoring particular information disclosures using either a one for 'yes' and zero for 'no' for each item. This categorical record is then converted into a percentage index of disclosure for each company by dividing the sum of disclosures by the denominator of total items measured. In the publication by Bukh, Nielson et al. (2005) intellectual capital disclosures are divided into six categories: employee, customer, information technology, processes, research and development and strategic statement, which are scored from 27, 14, 5, 8, 9 and 15 individual items, respectively - a total of 78 individual items.

Marston and Shrives' review paper (1991) provides a clear outline of why disclosure indices are a valid empirical method for data collection and measurement of information content in company annual reports. The early work of Gray and others (Gray et al. 1984) has demonstrated that scoring annual reports using the methods outline above can give valuable insight to the level of particular disclosures. There are alternative methods for gathering intellectual capital information from annual reports (Guthrie et al., 2004, Guthrie et al. 2000) and as a form of content analysis are equally as valid as the use of a disclosure index. Guthrie and others identify a number of studies in which intellectual capital information content has been measured in

company annual reports using alternative methods (Bozzolan et al., 2003; Brennan, 2001; Guthrie et al., 1999, 2003; Olsson, 2001).

Originally data was collected for 102 companies, but after excluding duplicates and outliers, to satisfy assumptions of normality for linear regression, the final sample of companies for analysis was n=96. The raw data voluntary intellectual capital disclosure score for each item, measured as a percentage of the final 96-company sample size, is presented in Appendix 1 for reference. The cohort of companies had an average age of 12 years in operation from date of incorporation to the end of the 30 June 2005 financial year; the youngest company had been in operation for 13 months and the oldest was 47 years. Total revenues from the statement of financial performance for the 30 June 2005 financial year averaged AUD$ 60 million; the lowest revenue for a single company was AUD$ 54,000 and the highest was AUD$ 3.25 billion. The largest employer company of the sample had a global workforce of just over 7,000; the smallest employer company had just a handful of employees. Companies of the sample had an average market capitalization of AUD$ 158 million; the lowest for a single company was AUD$ 1.7 million and the highest was AUD$ 6.34 billion. Share market data at the time of writing of this paper revealed that all listed biotechnology stocks represented only about 3% of equity market capitalization in Australia.

The approach in this study was to start with a valid instrument with a reasonably detailed item checklist of potential intellectual capital disclosures. This instrument and a range of possible independent variable data fields were constructed into a data collection worksheet. In total, five research staff were employed to collect the data with any one individual's maximum and minimum contribution being 13% and 36%, respectively. After the data collection worksheet was reviewed, each research staff member was given two company annual reports to score. The scoring of the initial reports from each individual was reviewed for consistency. If there was a significant difference in the IC disclosure index without adequate explanation, the collection

worksheet was reviewed and that individual given another two reports to score. After some consistency was achieved, individuals were given batches of ten reports to score and return for data entry. Separate analysis of data from the 36% and 21% of the sample companies which were collected by two different individuals showed similar correlation and relationships for the regression model as for the whole sample (data not shown). This gives a high degree of confidence in the overall result for the sample and reduces the likelihood that differences in scoring method for any one individual collector are a contributing factor to the results in this study.

Since the annual reports are the main communication channel for Australian listed companies, this study will focus on the intellectual capital disclosures in the 2005 financial year end annual reports. Annual reports are widely distributed and publicly available, and the voluntary disclosures made in the annual reports are at the discretion of management. As such, information that is disclosed by other means, such as on the company web-site, is not included in this study.

Measure of Intellectual Capital disclosure (Dependent variable)

The 78-item disclosure index originally developed by Bukh, Nielson et al. (2005) to measure intellectual capital disclosures in Danish company IPO prospectuses is used in this study. The percentage of the disclosure index as a total is calculated in accordance with the following formula which was presented in the above publication.

$$\textbf{Score} = (\Sigma\, d_i/M) \times 100\%$$

Score = Disclosure index dependent variable (ICDIndex, in this study)

di = expresses item i when the item's value is 1 with disclosure and 0 when there was no disclosure.

M is 78 which is the total number of items being measured.

Bukh, Nielsen et al. (2005) refer to support for the conclusion that an extensive list of items scored in this fashion can be ranked equally since an extensive list of items results in gradual equalization (Firth, 1979), and other studies have found in cases like this that weighting produces little difference in the final results (Chow and Wong-Boren, 1987).

Measures of independence, age, ownership concentration and leverage (Independent variables)

Factors affecting firm disclosures were identified through Agency Theory. Variables used to capture each independent variable are discussed below.

Independence

The independence of the board of directors of the biotechnology companies was measured by the number of independent directors on the board in the 2005 financial year as a percentage of total number of directors of the company. This data was available from the second item in the Australian company's corporate governance statement, and is a mandatory annual report disclosure required by the Australian Stock Exchange (ASX) listing rules (Structure the board to add value).

Age

The age of the companies were measured in months from the date of incorporation to the end of the 2005 financial year which for most of the companies was 30 June 2005. Only six of ninety-six companies in the final sample had a year end date other than 30th June 2005.

Ownership concentration

The ownership concentration in each company was measured as the percentage of total shares on issue that were held by the twenty largest shareholders. This was measured shortly after the end of the 2005 financial year.

Leverage

The level of external financing of the companies was measured by the ratio of total liabilities over total assets at the end of the 2005 financial year.

Measure of size (Control variable)

There is no definitive measure of political visibility but size has been used as a proxy for political visibility in a number of empirical studies, and measures of size which have been applied include total assets, total sales and in the case of this study market capitalization (Astami & Tower, 2006; Bowen et al 1981**;** Watts & Zimmerman, 1986).

Table I provide a description of the dependent, independent and control variables measured and analysed in this study.

"take in Table I"

Data analyses

The data collected for this study was analysed through the use of bivariate correlation and linear regression analysis using SPSS version 14.0 software. Backward regression analysis is used to test the hypotheses. The main regression model is:

$$\text{ICDI}\mathit{Index}_j = \lambda_j + \beta_1 \%\text{Top20Sh}_j + \beta_2 \text{LnLeverage}_j + \beta_3 \text{LnAge}_j + \beta_4 \text{Ln}\%\text{Indep}_j + \beta_5 \text{LnMarkCap}_j + \eta_j$$

Where:

%Top20Sh = percentage of shares owned by the 20 largest shareholders of the company at 2005 year end;

LnLeverage = natural log of total liabilities over total assets of the company at 2005 year end;

LnAge = natural log of the age of the company in months from the date of incorporation to the last day of the company's 2005 financial year;

Ln%Indep = natural log of the percentage of Board directors that were independent in the 2005 year; and

LnMarkCap = natural log of the market capitalization of the company at 2005 year end.

λ_j = the coefficient on the intercept term;

β_j = the coefficients 1 through 5 on the independent and control variables; and

η_j = the error term.

Results

Descriptive statistics

Table II reports the descriptive statistics for the study. The mean (median) level of intellectual capital disclosure for the Australian biotechnology firms studied is 14.96% (median 14.10%) with the maximum and minimum level of disclosure for individual firms being 38.5% and 1.3%, respectively. Individual item measures are recorded in Appendix A.

The intellectual capital disclosure index is the sum of the firm's disclosure in six areas, namely employees, customers, information technology, processes, research development and strategic statement. The mean levels of disclosure for the six measures of voluntary intellectual capital disclosure was 2.96%, 1.44%, 0.15%, 1.67%, 3.99% and 4.78%, respectively. Intellectual capital disclosures relating to employees, research and development and strategic statement are the highest and customer and information technology items scored lowest. It is interesting to

compare our results with those of the Danish pharmaceutical and research IPO prospectuses (Bukh et al., 2005) where the mean disclosure index of intellectual capital was 27.6% for n=7. In this study, another industry group equivalent that was studied also had a high index compared to the current: IT and technology companies in Bukh et al. (2005) were 33% for n=17. The nature of prospective information in the IPO's releases might explain the difference. Of the 96 Australian companies in the sample, 87 recorded no information technology IC, 31 recorded no customer IC, 30 recorded no processes IC, 26 recorded no employee IC, but only 10 recorded no research and development IC and 8 recorded no strategic statement IC.

The mean LnMarkCap of the companies was 10.24 or an absolute value of AUD $158 million with the largest company in the sample having a market capitalization at 30 June 2005 of AUD $6,342 million and the smallest AUS$1.8 million. The mean LnAge of the companies was 4.64 or an absolute value of 145 months or 12 years, the oldest company was 47 years and the youngest was 1 year at the 2005 financial year end. The mean Ln%Indep of the companies was 3.38 or an absolute value of 46% with a maximum level of board independence measured at 80% and minimum 0%. It should be noted that the average level of board independence was low considering an ASX Corporate Governance Requirement for a majority of independent directors.

"take in Table II"

Correlation matrix analysis

Table III presents the Pearson bivariate correlation matrix. The significant and positive relationship between ICDIndex and Ln%Indep ($r = 0.238$, $p = 0.020$) is consistent with the expectation that firms with a larger number of independent directors conduct more thorough monitoring and analysis of managers' activities and serve a more effective watch-dog function over the presentation of non-financial information in the reports. The positive correlation

between ICDIndex and LnAge (r = 0.249, p=0.014) is consistent with the proposition that biotechnology firms which have been incorporated for a longer period of time will disclose more voluntary intellectual capital information. It might be expected that with a mean age of only 12 years the 96 sample companies on average would be more reliant on intellectual capital disclosures than older companies. This finding does not support the proposition that non-financial disclosures will be more useful as a tool for younger companies to inform market participants about their future permanent income prospects (Amir and Lev, 1996).

A significant correlation is also found between ICDIndex and LnLeverage (r=0.207, p= 0.043), supporting the notion that the more highly leveraged firms may provide greater disclosure of information to minimise their agency costs of debt (Dhaliwal et al., 1982). This paper corroborates the findings of Singh and VanderZahn (Curtin University, unpublished) in the oil and gas industry where a significant positive correlation was demonstrated between leverage and the levels of voluntary intellectual capital disclosure. Although less applicable to the current scenario, but also related to voluntary disclosure: Bradbury (1992) found a positive correlation between firm leverage and voluntary segment disclosures.

Significant and positive correlations between independent and control variables are noted. LnMarkCap is positively and significantly correlated with LnAge which is entirely expected (r=0.227, p=0.026). Multicollinearity is not a concern in this study as the maximum Pearson correlation values are below the critical value of 0.8 (Hair, et al., 1995; Greene, 1999).

"take in Table III"

Multiple Regression Analysis Results

Table IV presents the results of the multiple regression analysis based on the following General Linear Model.

$$\underline{\mathbf{ICDI}\boldsymbol{Index}_j} = \lambda_j + \beta_1 \%\mathbf{Top20Sh}_j + \beta_2 \mathbf{LnLeverage}_j + \beta_3 \mathbf{LnAge}_j + \beta_4 \mathbf{Ln\%Indep}_j + \mathbf{B}_5 \mathbf{LnMarkCap}_j + \eta_j$$

The results of backward linear regression analysis between ICDIndex and the independent variables in the above model indicate that coefficient for LnLeverage (p=0.059) is moderately significant when compared with ICDIndex. This finding is consistent with expectations, supporting the hypothesis that highly leveraged firms disclose more voluntary intellectual capital information because it may reduce monitoring costs and agency costs of debt to balance the opposing needs of managers and debt-holders (Dhaliwal et al., 1982). Supporting the board independence hypothesis, the regression results show that there is a very significant relationship between Ln%Indep and ICDIndex (p=0.030). The significance of this result indicates that the structure of the board in these biotechnology companies is a factor in determining the level of intellectual capital disclosures. As outlined in the hypothesis section earlier the structure of the board is of vital significance to assessing firm activities and controlling managers' behaviour. So it appears that the level of board independence in biotechnology companies is an important determining factor in the firms levels of voluntary intellectual capital disclosure (Craven and Wallace, 2001; Jaggi and Leung, 2006).

"take in Table IV"

The most significant result of the regression is that the relationship of size (LnMarkCap) and ICDIndex was demonstrated to a high level (p<0.000). To further investigate the effect of size, the dataset was separated into large and small firms. Firms whose LnMarkCap is equal to or above the mean are considered large, while firms that fall below the mean are small firms. A backwards regression was conducted to identify the relationship between the independent and dependent variable. The General Linear Model used is:

$$\underline{\mathbf{ICDI}\boldsymbol{Index}_j} = \lambda_j + \beta_1 \%\mathbf{Top20Sh}_j + \beta_2 \mathbf{LnLeverage}_j + \beta_3 \mathbf{LnAge}_j + \beta_4 \mathbf{Ln\%Indep}_j + \eta_j$$

The results shown in Table V indicate that the model proposed is only relevant for large biotechnology firms. Board independence (Ln%Indep) and leverage (LnLeverage) were both statistically significant only for the companies with LnMarkCap greater than or equal to the mean, indicating that an increase in board independence and leverage is associated with an increase in the disclosure of intellectual capital items in the annual report for large firms only.

"take in Table V"

Discussion

Biotechnology companies are a fascinating example of firms with intangible value. Some of the more interesting intangible assets which make these firms special are: a skilled workforce; highly collegial R&D-oriented culture; public benevolent motivations and outcomes; developing intellectual property; proprietary techniques and IT applications; and, highly innovative strategic alliances.

The results of this research project, investigating the intellectual capital disclosures of Australia's youthful biotechnology industry are informative for the preparers of non-financial information in these organizations. If they can be summarised generally, the statistical analysis demonstrated that there are significant differences in the key drivers for intellectual capital disclosures by listed biotechnology firms in Australia. More specifically, the firm leverage, board independence and firm size were determinants for the level of voluntary intellectual capital disclosure that these firms were making in their 2005 year end annual reports. Prior research has demonstrated that the quality of communication with capital markets is important to firms because managements' interpretations and those of capital markets can vary significantly (Eccles and Mavrinac, 1995). The voluntary disclosures that are contained within formalised intellectual capital statements and other disclosures should be valuable information

for capital markets. There has even been some very recent progress in research which advises stakeholders in methods of interpretation for the information contained within firm intellectual capital statements (Nielsen et al., 2006). What meaning can be attributed to the content of intellectual capital disclosures is otherwise outside the considerations of this paper.

This investigation has demonstrated that Australia's biotechnology company's generally disclose less about intellectual capital in their annual reports than could be expected from the results of prior research (Bukh et al., 2005). There is strong positive correlations between the level of voluntary intellectual capital disclosures and board independence, firm age, firm size and the level of leverage. There was no correlation between disclosure practice and the level of ownership concentration indicating that institutional shareholders may not be lobbying management and the board for greater accountability. The relationship between the above correlations was further investigated in the large and small biotechnology companies and it was discovered that board independence and leverage were only determinants of intellectual capital disclosure in large biotechnology firms. This is an interesting result in the light of Bukh et al. (2005) recent findings for Danish IPO prospectuses. Danish IPO's measure on average 2-fold more intellectual capital disclosures in the IT, pharmaceuticals and research industry group than was recorded here for Australian biotechnology company annual reports. Direct comparison of the statistical measures formulated in Bukh et al. (2005) is probably not valid because of significant differences in the objectives of annual reporting voluntary disclosures (measured here) and the capital-raising voluntary disclosures in a prospectus. A reasonable expectation would be that management motivation for voluntary intellectual capital disclosures in a prospectus is likely to be much stronger than for the relatively conservative annual reporting process of firms investigated during this study.

Another contributing fact to the higher levels of disclosure in prospectuses might derive from considering regulatory concessions allowed for the IPO process. The low ICDIndex score in this

study are consistent with the findings of Singh and VanderZahn (Curtin University, unpublished) for the Australian oil and gas industry.

These results clearly indicate that Australian biotechnology firms as a whole are organizations which do not disclose intellectual capital information well. The emphasis is on disclosure of information about strategy and research and development activity, and in organizations which rely heavily on highly-educated and skilful employees there is comparatively little disclosure of employee-related items. This might partly be explained by a desire that the firms have to protect this intangible knowledge base from the attention of potential rivals, and takeover or poaching activities.

The overall implications of our findings are that smaller biotechnology companies' managers are not motivated by external debt-providers' demands to make voluntary disclosures about intangible firm-value. In contrast external debt-providers were demonstrated to bring pressure upon the management of large biotechnology companies. Predictably, large biotechnology companies' boards were better able to establish board independence which was shown to link back to more comprehensive intellectual capital reporting.

Limitations

Because this study has been conducted exclusively with Australian biotechnology companies it is important to emphasize the potential impact any Australian regulation may have had upon the financial reporting process which was analysed. In the introduction above we discussed the usefulness of the new ASX AusBiotech, Code of Best Practice for Reporting by Life Science Companies, which was launched late in 2005. The requirements of this Code have not affected the current study because of its release date, but more importantly appear restricted in their application to mandatory continuous disclosure of material items as required by the ASX Listing Rule 3.1. In this study we have examined annual report disclosures so these guidelines

would not affect the comparison of our findings with other studies. The Introduction to this paper identifies that regulation of Intellectual Capital reporting is still relatively rare; to the authors' knowledge mandatory disclosures are required only for Austrian public-sector universities and French high-market capitalization companies.

It is important to stress that this study has been conducted on a company annual reporting period for one year. A future longitudinal study is planned to discount the possibility that the results collated for this paper were subject to error because of sampling from only one financial year.

Future Research

An interesting recommendation for further research would be to investigate some of the other drivers of intangible value for biotechnology and research and development intensive firms. For example, can effective firm-level intellectual property management practices be correlated with high-level voluntary intellectual capital disclosures? In other words, how do particular intangible assets management practices contribute to a firm culture of open, honest and informative reporting of intangible value? It will be fascinating to find out.

References

Aboody, D. and Lev, B. (2000), "Information asymmetry, R&D, and insider gains", The Journal of Finance. LV(6): 2747-66.

Amir, E. and Lev, B. (1996) "Value-relevance of non-financial information: The wireless communication industry." Journal of Accounting and Economics, 22(1): 3-30.

Anderson, R.H. and Epstein, M.J. (1996), "The usefulness of corporate annual reports to shareholders in Australia, New Zealand, and the United States: an international comparison", Studies in Managerial and Financial Accounting. Vol 4. Elsevier Science Ltd.

Astami, E. and Tower, G. (2006) "Accounting-policy choice and firm characteristics in the Asia Pacific region: An international empirical test of Costly Contracting Theory", *The International Journal of Accounting,* 41(1): 1-21

AusBiotech and ASX (2005) Code of Best Practice for Reporting by Life Science Companies. Retrieved 29 August, 2006, from http://www.asx.com.au/investor/pdf/biotech_best_practice.pdf

Australian Government Consultative Committee on Knowledge Capital. Retrieved 29 August, 2006 from http://www.globalaccesspartners.org/agcckc.pdf.

Barth, M.E., Kasznik, R. and McNichols, M.F. (2001) "Analyst coverage and intangible assets" *Journal of Accounting Research*. 39(1): 1-34.

Bradbury, M.E. (1992) "**Voluntary disclosure** of financial **segment** data: New Zealand. evidence" *Accounting and Finance*. 32(1): 15-26.

Brennan, N. (2001), "Reporting intellectual capital in annual reports: evidence from Ireland", *Accounting, Auditing & Accountability Journal*, 14(4): 423-36.

Bozzolan, S., Favotto, F. and Ricceri, F. (2003), "Italian annual intellectual capital disclosure: an empirical analysis", *Journal of Intellectual Capital*, 4(4): 543-58.

Bowen, R.M., Noreen, E.W. & Lacey, J.M. (1981) "Determinants of the Corporate Decision to Capitalize Interest." *Journal of Accounting and Economics*, 3(2): 151-179.

Bukh, P.N. (2003) "The relevance of intellectual capital disclosures: a paradox?" *Accounting, Auditing & Accountability Journal*, 16(1): 49-56.

Bukh, P.N., Nielsen, C., Gormsen, P. and Mouritsen, J. (2005) "Disclosure of information on intellectual capital in Danish IPO prospectuses. *Accounting, Auditing and Accountability Journal*. 18(6): 713-732.

Chaminade, C. and Johanson U. (2003). "Can guidelines for intellectual capital management and reporting be considered without addresssing cultural differences." *Journal of Intellectual Capital*, 4(4): 528-542.

Chow, C.W. and Wong-Boren, A. (1987), "Voluntary financial disclosures by Mexican corporations", *The Accounting Review*, 62(3): 533-41.

Chua, W.F. (2005) Extended performance reporting: an overview of techniques. The Insitute of Chartered Accountants in Australia. Retrieved 1 September, 2006 from http://www.charteredaccountants.com.au/files/documents/EPR_an_overview_of_techniques.pdf

Craswell, A.T. and Taylor, S.L. (1992), "Discretionary disclosure of reserves by oil and gas companies: an economic analysis", *Journal of Business Finance and Accounting*, pp.295-308.

Cravens, K.S. & Wallace, W.A. (2001) "A Framework for Determining the Influence of the Corporate Board of Directors in Accounting Studies", *Corporate Governance: An International Review*.19(1): 2-24.

Dhaliwal, D.S., Salamon, G.L. & Smith, E.D. (1982) "The Effect of Owner versus Management Control on the Choice of Accounting Methods", *Journal of Accounting and Economics*, Vol. 4(1): 41-53.

Deegan, C. (2005) "Australian Financial Reporting." McGraw Hill: Sydney, 4th Edition.

Department of Trade and Industry (2006) "Better Business Framework". Retrieved 29 August, 2006, from http://www.dti.gov.uk/bbf/corp-gov-research/page21369.html.

Depoers, F. (2000). "A cost benefit study of voluntary disclosure: some empirical evidence from French listed companies." *The European Accounting Review* 9(2): 245-263.

DMSTI (2003) Intellectual Capital Statements - The New Guidelines, Danish Ministry of Science, Technology and Innovation, Copenhagen.

Eccles, R. G. and Mavrinac, S. C. (1995) "Improving the Corporate Disclosure Process." *Sloan Management Review* 36(4): 11-25.

Firth, M. (1979) "The impact of size, stock market listing, and auditors on voluntary disclosure in corporate annual reports", *Accounting and Business Research*, 9(Autumn): 273-80.

GAP Congress on Knowledge Capital. 3&4 November 2005, Melbourne, Australia. Retrieved 29 August, 2006, from http://www.globalaccesspartners.org/kcreport.pdf.

Gray, S.J., McSweeney, L.B. & Shaw, J.C. (1984) *Information Disclosure and the Multinational Corporation*, Chichester, John Wiley & Sons.

Gray, S.J. & Roberts, C. (1989) "Voluntary information disclosure and the British Multinationals" in Hopwood, A. (Ed.), *International Pressures for Accounting Change*, pp. 116-139, Hemel Hempstead, Prentice-Hall International.

Greene, W. (1999) *Econometric Analysis*, 4th edition, New York, U.S.A.: Prentice Hall.

GRI (2006) Sustainability Reporting Guidelines (Draft) G3 version for public comment 2 January 2006 – 31 March 2006. Retrieved 29 August, 2006 from http://www.grig3.org/pdf/g3guidelines.pdf.

Guthrie, J. and Petty, R. (2000) "Are companies thinking smart?", *Australian CPA*, July: 62-5.

Guthrie, J., Petty, R. and Yongvanich, K. (2004) "Using content analysis as a research method to inquire into intellectual capital reporting." *Journal of Intellectual Capital*, 5(2): 282-293.

Guthrie, J., Johanson, U., Bukh, P.N. and Sanchez, P. (2003) "Intangibles and the transparent enterprise: new strands of knowledge", *Journal of Intellectual Capital*, 4(4): 429-440.

Guthrie, J., Petty, R., Ferrier, F. and Wells, R. (1999) "There is No Accounting for Intellectual Capital in Australia: A Review of Annual Reporting Practices and the Internal Measurement of Intangibles within Australian Organisations." OECD Conference Report, Amsterdam, June.

Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1995) *Multivariate Data Analysis*, 4th edition, Engelwood Cliffs, New Jersey, U.S.A.: Prentice Hall.

Jaggi, C. and Leung, S. (2004) "Corporate Board Independence, Family Ownership Dominance and Earnings Management: Evidence from Hong Kong." *AFAANZ Annual Conference 2004*, Alice Springs, Australia.

Jensen, M.C. and Meckling, W.H. (1976) "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure", *Journal of Financial Economics*, October: 305-360.

Lemke, K. W. & Page, M. J. (1992) "Economic Determinants of Accounting Policy Choice", *Journal of Accounting and Economics*, Vol. 15: 87-114.

Marr, B., Mouritsen, J., and Bukh, P.N. (2003) "Perceived Wisdom." *Financial Management* Jul/Aug: 32.

Marston, C.L. and Shrives, P.J. (1991) "The Use of Disclosure Indices In Accounting Research: A Review Article". *British Accounting Review*. 23: 195-210.

Mouritsen, J., Bukh, P.N., and Marr, B. (2004) "Reporting on intellectual capital: why, what and how?" *Measuring Business Excellence* 8(1): 46-54.

Mouritsen, J., Bukh, P.N., and Bang, H.K. (2005) "Understanding Intellectual Capital in Innovative Medium-sized Firm: The Case of Maxon Telecom", *Australian Accounting Review*, 15(2): 30-39.

Nielsen, N., Bukh, P.N., Mouritsen, J., Johansen, M.R. and Gormsen, P. (2006) "Intellectual capital statements on their way to the stock exchange." Journal of Intellectual Capital. 7(2): 221-240.

Olsson, B. (2001) "Annual reporting practices: information about human resources in corporate annual reports in major Swedish companies." Journal of Human Resource Costing and Accounting, 6(1):39-52.

Parker, C. (2003). "A Deplorable Situation." *CA Charter*, Nov: 60-62.

Singh, I. and VanderZahn, J.L.W.M. "Intellectual Capital Disclosures Practices of Australian Oil and Gas Firms: An Agency Theory Perspective (Curtin University of Technology, unpublished).

Stewart, T.A. (2001) *The Wealth of Knowledge: Intellectual Capital and the Twenty-First Century Organization*, Currency: Sydney.

Vergauwen, P. G. M. C. and van Alem, F. J. C. (2005). "Annual report IC disclosures in The Netherlands, France and Germany." *Journal of Intellectual Capital* 6(1): 89-104.

Watts, R.L. and Zimmerman, J.L. (1986) *Positive Accounting Theory*, Engelwood Cliffs, NJ:Prentice Hall.

Zeff, S.A. (1978) "The Rise of Economic Consequences", *Journal of Accountancy*, December: 56-63.

Table I. Description of all dependent, independent and control variables measured and analysed during the course of this study

Title	Variable Description
Dependent	
ICD*Index*	The original 78-item disclosure index measured as a composite of employee, customer, information technology, procedures, research and development and strategic statement measures (Bukh, Nielsen et al. 2005).
Independent	
%Top20Sh	The percentage of shares owned by the 20 largest shareholders of the company at 2005 year end.
LnLeverage	The natural log of total assets/total liabilities of the company at 2005 year end.
LnAge	The natural log of the age of the company from the date of incorporation to the last day of the company's 2005 financial year.
Ln%Indep	As a proxy for corporate governance effort: The natural log of the percentage of Board directors that were independent (Independent directors/Total directors) in the 2005 year.
Control	
LnMarkCap	As a proxy for size: the natural log of the Market Capitalization of the company on the last day of the company's 2005 financial year.

Table II. Descriptive Statistics of Dependent and Independent Variables

Statistics

		ICDI*ndex*	ICDI*emp*	ICDI*cust*	ICDI*it*	ICDI*proc*	ICDI*rd*	ICDI*strat*	Ln%Indep	LnAge	%Top20Sh	LnMarkCap	LnLeverage
N	Valid	96	96	96	96	96	96	96	96	96	96	96	96
Mean		14.96	2.96	1.44	.15	1.67	3.99	4.78	3.38	4.64	56.27	10.24	-2.13
Std. Error of Mean		.78	.27	.16	.05	.17	.25	.31	.14	.09	1.80	.15	.12
Median		14.10	2.60	1.30	.00	1.300	3.80	3.80	3.91	4.56	59.25	9.95	-2.09
Std. Deviation		7.64	2.65	1.55	.49	1.71	2.44	3.02	1.39	.86	17.64	1.46	1.19
Skewness		.68	.75	1.63	3.54	1.34	.184	.84	-1.89	-.28	-.36	1.08	-.23
Kurtosis		.46	.55	2.82	12.76[#]	1.80	-.747	1.27	2.03	-.31	-.32	1.86	.14
Range		37.2	12.8	6.4	2.6	7.7	9.0	15.4	4.38	3.79	80	8.17	6.26
Minimum		1.3	.0	.0	.0	.0	.0	.0	.00	2.54	12	7.49	-5.39
Maximum		38.5	12.8	6.4	2.6	7.7	9.0	15.4	4.38	6.33	92	15.66	.86

There were too few biotechnology firms measuring IT disclosures to make ICDI*it* a valid measure.

Table III. <u>All Companies</u> - Pearson bivariate correlation matrix of independent and dependent variables

Correlations – All companies (n=96)

		ICDIndex	Ln%Indep	LnAge	%Top20Sh	LnMarkCap	LnLeverage
ICDIndex	Correlation	1	.238(*)	.249(*)	-.061	.405(**)	.207(*)
	Sig. (2-tailed)		.020	.014	.557	.000	.043
Ln%Indep	Correlation		1	.035	.058	.178	-.106
	Sig. (2-tailed)			.733	.576	.083	.304
LnAge	Correlation			1	-.192	.227(*)	.350(**)
	Sig. (2-tailed)				.062	.026	.000
%Top20Sh	Correlation				1	.026	-.046
	Sig. (2-tailed)					.803	.655
LnMarkCap	Correlation					1	.136
	Sig. (2-tailed)						.187
LnLeverage	Correlation						1

Table IV. <u>All Companies</u> - Backwards regression analysis of all biotechnology firms.

<u>General Model Equation</u>: ICDI$Index_j$ = λ_j + β_1%Top20Sh$_j$ + β_2LnLeverage$_j$ + β_3LnAge$_j$ + β_4Ln%Indep$_j$ + β_5LnMarkCap$_j$ + η_j			
Variables	β	**t-statistic**	**p**
Constant	-4.933	-0.944	0.348
Ln%Indep	1.115	2.207	0.030
LnLeverage	1.119	1.912	0.059
LnMarkCap	1.821	3,717	0.000

Summary: N=96, R^2 = 0.230, Adj R^2 = 0.205, F = 9.151, Sig=0.000

Table V. Backwards regression analysis of firm size.

General Model Equation: $ICDI Index_j = \lambda_j + \beta_1 \%Top20Sh_j + \beta_2 LnLeverage_j + \beta_3 LnAge_j + \beta_4 Ln\%Indep_j + \eta_j$						
	Above mean – large firms			**Below mean – small firms**		
Variables	**β**	**t-value**	**p**	**β**	**t-value**	**p**
Constant	13.252	3.581	0.001	12.725	15.548	0.000
Ln%Indep	3.130	3.264	0.002			
LnLeverage	3.092	3.179	0.003			
Model Summary:						
N	96			96		
R^2	0.305			0.000		
Adj R^2	0.268			0.000		
F-statistic	8.137			-		
Significance	0.001			-		

Appendix A – Raw Data Collected for n = 96 Companies

	Employees (27 items)	**n=96, 100%**
E1	Employee breakdown by age	0
E2	Employee breakdown by seniority	1
E3	Employee breakdown by gender	0
E4	Employee breakdown by nationality	3
E5	Employee breakdown by department	3
E6	Employee breakdown by job function	3
E7	Employee breakdown by level of education	2
E8	Rate of employee turnover	1
E9	Comments on changes in the number of employees	24
E10	Comment on employee health and safety	8
E11	Employee absenteeism rate	0
E12	Discussion of employee interviews	1
E13	Statements of policy on competency development	9
E14	Description of competency development programs and activities	7
E15	Education and training expenses	1
E16	Education and training expenses by number of employees	0
E17	Employee expenses by number of employees	9
E18	Recruitment policies of the firm	3
E19	Separate indication firm has a HRM department, division or function	3
E20	Job rotation opportunities	0
E21	Career opportunities	1
E22	Remuneration and incentive systems	58
E23	Pensions	44
E24	Insurance policies	34
E25	Statements of dependence on key personnel	8
E26	Revenues per employee	0
E27	Value added per employee	0

	Customers (14 items)	
C1	Number of customers	1
C2	Sales breakdown by customer	3
C3	Annual sales per segment or product	55
C4	Average purchase size by customer	1
C5	Dependence on key customers	10
C6	Description of customer involvement in firm's operations	2
C7	Description of customer relations	7
C8	Education/training of customers	2
C9	Ratio of customers to employees	0
C10	Value added per customer or segment	13
C11	Absolute market share (%) of the firm within its industry	4
C12	Rel. mkt share (not expressed as percentage) of the firm	5
C13	Market share (%) breakdown by country, segm, prod	3
C14	Repurchases	1

	Information Technology (IT) (5 items)	
IT1	Description of investments in IT	1
IT2	Description of existing IT systems	2
IT3	Software assets held or developed by the firm	2
IT4	Description of IT facilities	2
IT5	IT expenses	4

	Processes (8 items)	
P1	Information and communication within the company	12
P2	Efforts related to the working environment.	7
P3	Working from home	0
P4	Internal sharing of knowledge and information	12
P5	External sharing of knowledge and information	38
P6	Measure of internal or external processing failures	8
P7	Discussion of fringe benefits and company social	3

	programs	
P8	Environmental approvals and statements/policies	44

	Research & Development (R&D) (9 items)	
RD1	Statements of policy, strategy and/or objectives of R&D activities	65
RD2	R&D expenses	79
RD3	Ratio of R&D expenses to sales	1
RD4	R&D invested into basic research	5
RD5	R&D invested into product design and development	5
RD6	Details of future prospects regarding R&D	54
RD7	Details of existing company patents	32
RD8	Number of patents and licenses etc.	29
RD9	Information on pending patents	30

	Strategic statement (15 items)	
SS1	Description of new production technology	31
SS2	Statements of corporate quality performance	14
SS3	Information about strategic alliances of the firm	49
SS4	Objectives and reason for strategic alliances	43
SS5	Comments on the effects of the strategic alliances	30
SS6	Description of the network of suppliers and distributors	14
SS7	Statements of image and brand	36
SS8	Corporate culture statements	9
SS9	Statements about best practises	44
SS10	Organisational structure of the firm	43
SS11	Utilization of energy, raw materials and other input goods	3
SS12	Investment in the environment	2
SS13	Description of community involvement	4
SS14	Information on corporate social responsibility and objective	5
SS15	Description of employee contracts/contractual issues	31