

ABSTRACT

The purpose of this research project was to examine the voluntary disclosure quality for intellectual capital by Australian biotechnology companies between 2003 and 2010. Measurement was made in the annual reports of the same 28 biotechnology firms in 2003, 2006 and 2010. Content analysis of narrative and measurement items, based on Sveiby's 'Intangible Assets Monitor' categories (Internal, External and Human Capital) were used to accurately record the quality of voluntary ICD. Although expected, there was no demonstrable increase in the quality of voluntary ICD measured by Wilcoxon Signed Rank Test. In fact, the only significant change in quality of ICD reporting in the firm's annual reports was a significant decrease in 'Internal Capital' of the type most commonly recorded for intellectual property, financial relations and corporate culture. Key success factors for 'Human Capital' ICD, for example staff qualifications and know-how, or 'External capital' ICD, like those about collaborations, licensing agreements and grant funding, were certainly not absent from disclosures, but an expected increase in quality was not detected. A limitation of this study is its Australian context. Financial managers' distraction by 2006 IFRS harmonization (intangible asset balance sheet de-recognition) and insulation of the Australian equities market to recent global events may partly explain our observation.

1.1 INTRODUCTION

Major transformations are taking place in the global economy as historic debt levels and instability compete with government recognition about the need for spending on research for future development. With this transformation, the fundamental value of firms increasingly lies on their intangible assets to generate income. Owning the best infrastructure no longer necessarily ensures a competitive advantage as much as the promise of innovative process and intellectual property ownership (Wong and Gardner, 2005). The basis of competition experienced by firms has shifted from traditional physical and financial resources to intangible resources (Khan and Ali, 2010). Intellectual capital (IC) is recognised as a key value driver for creating and sustaining competitive advantage for companies (Li et al., 2008; Ghosh and Wu, 2007). Examples of successful firms with significant intellectual capital abound in the biotechnology sector globally; Johnson & Johnson, CSL, Pfizer and Cochlear, to name a few.

The fear of increasing cost of capital from information asymmetry with investors and lenders motivates managers in high-technology or research-intensive firms to make voluntary disclosures about intangible firm value and intellectual capital (IC). Investors can choose among securities under the assumption that security prices at any time "fully reflect" all available information (Fama, 1970). Efficient capital markets theory therefore predicts that the information quality of accounting information will redress the adverse selection risk to

capital market participants of information asymmetry. In the context of worsening global economic debt position stakeholder theory would predict financial reporting sensitivity to the balance sheet solvency position and also future debt requirements.

Intellectual capital disclosures (ICD) by firms are voluntary disclosures about intangible firm value are unregulated. Wyatt (2008) explored what financial and non-financial knowledge of intangibles is value-relevant for investors. In particular, her review of studies in the area categorized the firm's technological resources as firms' research and development (R&D) expenditure and related intellectual property. Bosworth and Rogers (2001) and Lev and Sougiannis (1996) confirm that R&D (i.e. R&D expenditures and patent activity) are positively related to a firm's market value and subsequent stock return. Managers, in their quest to obtain a more favourable source of capital, release information regarding R&D (amongst other disclosures) and such disclosures have been found to correlate with market-to-book values of public companies (Deng et al., 1999; Hirschey, 1998; Lev, 2001; Brynjolfsson and Yang, 1999). The pre-commercialisation, research and development and proof-of-concept activities of biotechnology companies make them a unique industry in which to study ICD (White et al., 2010). Equities market regulators in Australia, for example, realised the special information asymmetry problems of biotechnology firms' stakeholders and published voluntary intellectual property reporting guidelines to redress this situation (ASX, 2005).

This longitudinal study seeks to divulge the nature and quality of intellectual capital that biotechnology companies have been disclosing in their annual reports. In doing so, this study hopes to extend the research within the field of voluntary disclosure measurement, especially in how it relates to intellectual capital reporting, by examining empirical evidence over the period 2003, 2006 and 2010. In the Australian financial reporting context these time points are interesting as they rest either before or after some key global and local event which may have affected ICD. First 2003 as a base year falls outside the possible distracting effect of post-Enron corporate governance reform and reporting. Second, 2003 to 2006 is a period of deepening global economic pressures, reducing debt finance availability "Information quality" measures the value which the information provides to the user. The importance of a quality measure for voluntary intellectual capital disclosures has been gaining traction, with more recent studies measuring and discussing quality (see Yi and Davey, 2010).

The aims of this research, therefore, are to investigate:

1. How does the nature of ICD by Australian biotechnology companies change from 2003 to 2010?
2. How does the quality of ICD by Australian biotechnology companies change from 2003 - 2010?

1.2 MOTIVATION AND SIGNIFICANCE

The transition towards a knowledge economy brings about significant challenges to the accounting profession as current accounting standards do not sufficiently address the information needs of stakeholders. The growing prominence of voluntary disclosure in annual reports, on company websites and through continuous disclosures to the market is an attempt to bridge this gap.

Corporate disclosures serve as a mechanism for negotiating the relationship between a firm and its stakeholders (Gray et al., 1995b) and as a “strategy for managing, or perhaps manipulating, the demands of particular groups” (Deegan and Blomquist, 2006, p. 349). With the growing awareness of the importance of IC, many managers voluntarily disclose information on the intellectual capital of their companies in annual reports to reduce information asymmetry and improve transparency between management and various stakeholders (Guthrie and Petty, 2000; Pablos, 2002; Schneider and Samkin, 2008; Vergauwen et al., 2007). This information gap is very likely to exist in young industries like the biotechnology industry, and is the catalyst for a growing body of research on the importance of firm intellectual capital and dedicated annual reporting statements (Mouritsen et al., 2004; Nielsen et al., 2006). In the past, there have been dedicated studies of intellectual capital disclosures by the biotechnology industry. For example, Cerbioni and Parbonetti (2007); Cumby and Conrod (2001); Guo et al. (2004), and White et al. (2007, 2010). Biotechnology firms have been found to be more likely to report information on intangibles since they may have difficulty legitimising their status via the “hard” assets that have traditionally symbolised corporate success (Guthrie et al., 2004). Intellectual capital is, however, difficult to capture and measure. There is no widely accepted accounting framework for IC disclosure around the world and current IC disclosure worldwide is limited and highly variable.

The academic research interest in the field of ICD reporting practice only started growing in prominence in the last decade (Bukh et al., 2005; Guo et al., 2004; Guthrie et al., 2006; Kristandl and Bontis, 2007; Vergauwen and van Alem, 2005; Van der Zahn et al., 2007; White et al., 2007). Early research-based insight about voluntary ICD practice was obtained from companies around 2000 when the Danish guideline for Intellectual Capital Statements was developed and tested among a large number of Danish companies (Boedker et al., 2008; Bukh et al., 2005; Bukh and Jensen, 2008; Mouritsen and Larsen, 2005; Mouritsen et al., 2005; Mouritsen, 2004; Nielsen et al., 2006). Early stages of IC accounting research focused mainly on the nature of intellectual capital disclosures as an important way of bridging the information gap which may exist between managers and firm owners (Eccles and Mavrinac, 1995). There has been a global trend and demand for more useful and comprehensive non-financial information about the operating activities of firms (Anderson and Epstein, 1996; Global Reporting Initiative, 2011) and specific capital markets research has demonstrated that companies 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).

While studies that investigated the nature of voluntary ICD have been extensive; the quality aspect of voluntary ICD has often been overlooked. Contemporary studies have attempted to rectify this problem by focussing on quality (Guthrie and Petty, 2000; Oliveira et al., 2006; Vandemaele et al., 2005). Financial disclosure is an abstract concept which cannot be measured directly (Cooke and Wallace, 1989). Drawing comparisons from the corporate social responsibility (CSR) area, it has also been identified that the quantity of disclosure does not always equate to quality (e.g. Frost and Wilmshurst, 2000). The quality of ICD influences user's perception of corporate performance, which in turn influences decision making. Full disclosure is essential for market efficiency (Fama, 1970).

This study will extend the current literature by assessing the quality of IC disclosures using a quality scale (0-3) for each item in the IC disclosure framework to determine the quality and importance of the three categories of IC disclosures: Internal, External and Human Capital. Essentially the content analysis measurement is of frequency and then the highest quality of disclosure.

This study contributes to the growing literature on ICD by examining the nature and quality of disclosures made by an important sector of a knowledge economy. The results of this study will provide an insight into the IC reporting trend of the biotechnology industry and

Intellectual Capital Disclosure Quality Changes
in the Biotechnology Industry, 2003-10

contribute to the extant literature and on overall global view of IC reporting. From a normative perspective, managers may also develop a better understanding of historic trends in IC disclosure that prescribe changes for improving intellectual capital reporting.

2.1 DEFINITION OF INTELLECTUAL CAPITAL

Existing literature offers a number of definitions of IC (Stewart, 1997; Sveiby, 1997; Petty and Guthrie, 2000; Martensson, 2000; Ordonez de Pablos, 2005) with IC as value creators of firms (Lynn, 1998). It is agreed that the benefits of IC are accrued over a long period and may not be immediately identifiable (ASCPA and CMA, 1999; Brooking, 1997; CMA, 1998; Edvinsson, 1997; Edvinsson and Malone, 1998; Edvinsson and Sullivan, 1996; Klein, 1998; Knight, 1999; Stewart, 1997; Ulrich, 1998). For this study, IC is defined to include all the knowledge-based intangible processes and assets which are not normally shown on the balance sheet, and can be leveraged to give rise to future value (Roos et al., 1997).

2.2 NATURE OF INTELLECTUAL CAPITAL DISCLOSURE

An easier way to describe IC is by its components (Woodcock and Whiting, 2009). Frameworks used to identify intellectual capital have been developed in prior research by Bontis (2001), Edvinsson and Malone (1997), Roos et al. (1997), Stewart (1997) and Sveiby (1997). Each of these frameworks classifies intellectual capital into components or categories, and is used by researchers to identify the nature of intellectual capital disclosure.

SVEIBY'S (1997) INTANGIBLE ASSETS MONITOR

Another tripartite framework that was often used in prior ICD studies (Petty and Cuganesan, 2005) was that originally developed by Karl Erik Sveiby (1997, p. 8-11). Sveiby (1997) classified the difference between a firm's book value and market value as an intangible asset. He theorized that this asset is treated as invisible as it lacks a generally accepted definition and a measurement standard (Sveiby, 1997). He classified intangible assets into three categories, namely:

- Internal structures (organisational capital);
- External structures (customer/relational capital); and
- Employee competence (human capital).

Intangibles classified under internal structure include items such as patents, concepts, models, information systems and anything else within the firm that has a higher value than the value of its physical assets (i.e. cost) (Guthrie et al., 1999; Sveiby, 1997; Wong and Gardner, 2005). Such intangibles are produced by employees or can be acquired, however, they cannot be

taken away from the firm when employees leave at the end of the working day (Guthrie et al., 1999; Roos et al., 1997; Wong and Gardner, 2005). Organisational culture and spirit are also considered part of internal structure, as are organisational structures and legal parameters (Sveiby, 1997).

The external structure includes relationships with customers and suppliers, brand names, trademarks and reputation. Some of these can be considered to be proprietary but only in a temporal sense and, even then, not with any degree of confidence. These relationships are determined by how well a company solves its customers' problems so there is always an element of uncertainty as they can change over time (Sveiby, 1997, p.11). Due to the nature of this uncertainty, the economic value of this relationship is at present not determined by any generally accepted definition or measurement system (Guthrie and Petty, 2000).

In a knowledge organisation, the three categories of intangible assets sums the invisible assets on the balance sheet as there is little machinery other than employees and, because only people can act, employees become both the minders of the machines and the machines themselves (Sveiby, 1997). This is an interesting intellectual and academic concept.

Much research has used Sveiby's (1997) framework to provide insights into the state of intellectual capital disclosure both within countries (Abeysekera and Guthrie, 2005; April et al., 2003; Brennan, 2001; Bozzolan et al., 2003; Goh and Lim, 2004; Guthrie et al., 1999; Olsson, 2001; Petty and Cuganesan, 2005) and between countries (Guthrie et al., 2006; Vandemaele et al., 2005). The principal research method for these studies is content analysis of annual reports. In Australia, Guthrie and Petty (2000) are acknowledged as the pioneers in applying content analysis to IC reporting by companies.

Guthrie et al. (1999) did a study for the OECD which looked at the intellectual capital disclosure of a sample of Australian annual reports using a modified version of Sveiby's (1997) intangible assets monitor. This modified framework was derived from several professional pronouncements on intellectual capital (see IFAC, 1998; CMA, 1998). The study involved examining the annual report of each company and coding the information contained therein according to a developed framework of intellectual capital indicators.

Employing the same technique, Guthrie and Petty (2000) modified the framework used in Guthrie et al. (1999) to achieve a better convergence with items likely to be reported by

Australian companies. The 24 items (nine relating to internal capital, nine to external capital, and six to human capital) are shown in Table 1.

INSERT TABLE 1

The framework used by Guthrie and Petty (2000) disaggregates voluntary intellectual capital disclosures by companies into three categories:

- Internal Capital;
- External Capital; and
- Human Capital.

A review of the literature revealed external capital as being the most highly disclosed category in annual reports. Guthrie and Petty (2000) investigated the disclosure of intellectual capital items by Australia's 19 largest listed companies and one IC best practice company. The findings indicated 40% of the sample reported external capital items and reporting of both internal capital and human capital categories were evenly matched at 30% each. One possible reason for this is "the emphasis in recent years on rationalizing distribution channels, reconfiguring firm-value chains, and reaccessing customer value (customer profitability analysis etc.)" (Guthrie and Petty, 2000, p. 248). The same finding was again present in Guthrie et al.'s (2006) study, which showed that reporting of external capital accounted for almost half of the observed reporting practices for the Australian data set; as well as in Goh and Lim (2004), where external capital was most disclosed at forty-one percent. One possible reason, as suggested in White et al. (2010), was that customer items are reported more and customers are a significant stakeholder group for Australian firm managers. April et al.'s (2003) findings from studying South African mining companies concurred with that of Guthrie and Petty (2000) in that external capital was the most reported category. April et al. (2003) attributed the findings to "globalisation pressures and the increasing need for companies to focus on external factors such as distribution channels, value chains and customer relationships" (April et al, 2003, p. 178) as most emphasis was placed on "business collaborations", "work-related staff competencies", "management processes", "customers" and "brands" attributes, in the external capital category. In Italy, Bozzolan et al.'s (2003) study replicated and extended Guthrie and Petty's (2000) study by modifying the framework slightly after considering the results of the FASB (2001) project. The findings showed external structure was reported the most, followed by internal structure and then human

capital. Their findings on the average amount of disclosure also concurred with Guthrie and Petty's (2000) study that there is an awareness of the importance of intellectual capital variables (Bozzolan et al., 2003). Vandemaele et al. (2005) used Bozzolan et al.'s (2003) classification framework when examining the annual reports of companies in the Netherlands, Sweden and the UK in a longitudinal study. They too, found that an increased number of firms are disclosing more about external structure, compared to the other two IC categories.

Vandemaele et al.'s (2005) results showed on average that the Dutch, Swedish and UK sample companies had a significant increase in their IC disclosures over the period 1998-2000, however a non-significant increase was observed in the 2000-2002 period. Vandemaele et al. (2005) suggested that the slow-down in the upward trend in IC disclosure might be because companies have met the information need of investors with respect to IC and the potential cost for disclosing more IC might hurt the competitive situation of a company for example; therefore acting as a disincentive for companies to disclose more. However, studies conducted in other countries found contrary results. Abeysekera and Guthrie (2005) compared intellectual capital reporting frequency of the top 30 firms listed on the Colombo Stock Exchange in the time period between 1998/1999 to 1999/2000. The results of the 2-year study indicated that firms in Sri Lanka reported an overall increase in disclosure in all categories of intellectual capital. Petty and Cuganesan (2005) examined the voluntary intellectual capital disclosure by listed Hong Kong companies and they too found that while disclosure levels were low, it was increasing over time.

Guthrie and Petty (2000) found that there was no consistent framework for firms to disclose their IC in Australia. Few companies appear to be proactive in measuring and reporting their IC to their stakeholders, although most of them have realized the growing importance of IC for their future success. The findings of subsequent studies have supported Guthrie and Petty's (2000) findings (e.g Bozzolan et al., 2003; Wong and Gardner, 2005; Shareef and Davey, 2006; Schneider and Samkin, 2008).

Guthrie et al. (2006) compared the levels of IC disclosures in Hong Kong and Australia using a modified version of the framework based on Guthrie and Petty (2000). The framework was modified differently for the two geographical contexts. The elements in the IC framework for the Australian study were slightly modified to account for recent developments in the country. This resulted in a total of 18 IC attributes being investigated in the Australian study.

For the Hong Kong study, a total of 27 IC attributes were investigated. This was to account for the work of Bozzolan et al. (2003) and others in extending the classification schema used in Guthrie and Petty (2000). A finding in Guthrie et al.'s (2006) study was that the reporting of IC was inconsistent and varied in nature between different countries. The Hong Kong dataset showed IC disclosure to be evenly split amongst the three categories of IC, however the Australia dataset showed external capital was the most frequently reported with human capital reported the least.

Accordingly, the following null hypothesis is proposed:

Hypothesis 1: There is no change in the nature of IC disclosure over the years 2003 – 2010.

2.3 QUALITY OF INTELLECTUAL CAPITAL DISCLOSURE

Petty and Cuganesan (2005) highlighted that future research in intellectual capital disclosure studies could focus on the quality of disclosure in annual reports in order to extend current research. However, while extensive research has been done with regards to the nature of intellectual capital disclosures, the quality aspects of it has been under-represented in the literature. Yi and Davey (2010) reviewed previous research in IC disclosure and whether any measure of quality was included in their research. It was noted that while a lot of prior studies looked into intellectual capital disclosures using the many frameworks available, studies generally failed to measure the quality of intellectual capital disclosures (see Yi and Davey, 2010).

Studies conducted in different continents have consistently found IC disclosure quality to be low. In particular, Yi and Davey (2010) found the average disclosure quality of IC by 49 mainland China companies to be at 0.44¹, with two thirds of the companies scoring below 0.5. The average quality score for each category of intellectual capital (internal, external and human capital) was below 0.50. The low quality scoring indicates that most of the reported attributes were expressed in narrative rather than numerical or monetary terms (which would have been indicated by a higher scoring). Guthrie et al. (2006), in their study of intellectual capital disclosure in Hong Kong and Australia, revealed that nearly every instance of intellectual capital reported was in narrative rather than numerical terms, which was similar

¹ Average disclosure quality out of a maximum of 1.

to the findings in Ireland by Brennan (2001). There is a general consensus in the studies reviewed that the low-quality scoring in research to date (Bozzolan et al., 2003; Shareef and Davey, 2006; Schneider and Samkin, 2008; Wong and Gardner, 2005) is because there is no established and generally accepted framework to quantify IC information (Guthrie and Petty; 2000; Guthrie et al., 2006; Yi and Davey 2010), and any quantification might give rise to inaccurate meaning (Abeysekera and Guthrie, 2005; Guthrie et al., 1999).

The demand for greater disclosure of information by companies has a number of drivers: the post-Enron desire for trust and transparency; “audit society”; the changing nature of value; internet and the growing “corporate social responsibility” agenda (Bezhan, 2010). Specifically in Australia, the onset of the global financial crisis as well as funding cuts by the federal government had severely affected the fund-raising capabilities of the Australian biotechnology companies (Biotech Business; Global Financial Crisis Making Biotech Business Model Unsustainable, According to Ernst & Young; May 20, 2009; Robertson, 2009). In an increasingly competitive market, where funding is getting harder to come by, non-financial disclosures can have a positive impact on management creditability, analysts’ understanding, and investors’ patience over poor performance (Eccles and Mavrinac, 1995). Guthrie et al. (2004) argued that firms are more likely to report information on intangibles if they cannot legitimise their status via the “hard” assets that traditionally had symbolised corporate success. This would suggest that the quality of IC disclosure would be higher for the biotechnology industry since “biotechnology companies are a fascinating example of firms with intangible value” (White et al., 2007, p. 517) as more than half of the listed Australian biotechnology firms are actively engaged in research and development-only activities (White et al., 2007). Similarly, Bruggen et al. (2009) as well as Kamath (2008) have found that industries, specifically the high-technology industries, that rely more on intellectual capital, disclose more information on IC.

The post-Enron era, the subsequent onset of the global financial crisis, and the continuing global recession have left investors and the public devastated and sceptical of those left in charge. Increasingly, the public and investors are seeking more information pertaining to the operating activities of the companies above and beyond those required by legislation. The fear of increasing cost of capital from information asymmetry with investors or lenders motivates managers to make voluntary disclosures about intangible firm value like its intellectual capital (IC) (Jensen and Meckling, 1976). The literature has suggested that the

quality of intellectual capital disclosure is expected to remain low because there is no established framework for intellectual capital reporting. This study hypothesizes that the quality of IC disclosure by Australian biotechnology firms will improve over the years due to recent events (Anderson and Epstein, 1996; Bezhani, 2010; Global Reporting Initiative, 2006) and findings from prior research (Bruggen et al., 2009; Guthrie et al., 2004; Kamath, 2008).

Accordingly, the following null hypothesis is proposed:

Hypothesis 2: There is no change in the quality of IC disclosure over the years 2003 – 2010.

2.4 LOCATION OF INTELLECTUAL CAPITAL DISCLOSURES

Guthrie et al. (2004) established that meaningful accounting studies investigating quality of IC disclosure had to examine the reporting theme, the form of disclosure, and the location of the disclosure to yield meaningful results. This can be achieved by examining the relative emphasis on each theme, whether the disclosure was quantified or not, and the location of the disclosure (Guthrie et al., 2004). Guthrie et al. (2006), in their study of Hong Kong and Australian firms, divided the annual reports into five sections: 1) the vision/strategy section; 2) the director's section; 3) the business/operational section; 4) the financial section; and 5) the "other" sections. Their findings showed IC elements were most widely reported in the "business/operational" section of the annual report with nearly half of all reporting in that section. The "other" section, which included any items that did not fit into the classification of the remaining sections, was the second most popular with nearly one quarter of all IC items disclosed in that location. The least amount of disclosure was in the financial section. This is as expected since there are no corporation laws or accounting standards that require the quantification of IC. This approach provides a description of the disclosure practices of organisations (Guthrie et al., 2004).

This study also measured the location of the highest quality voluntary ICD made by biotechnology firms.

3.1 RESEARCH METHODS

Content analysis of annual reports was adopted as the primary research method. As an instrument for data collection, content analysis involves codifying qualitative and quantitative information into pre-defined categories based on selected criteria in order to derive patterns in the presentation and reporting of information (Guthrie et al., 2004). The 2003, 2006 and 2010 annual reports from 28 Australian biotechnology companies (listed on the Australian Stock Exchange) were the original objects of study from which voluntary ICD data were collected. Voluntary ICD in the companies' annual reports were analysed using the framework developed by Guthrie and Petty (2000). Guthrie et al. (2006) re-modified the IC framework to account for recent developments in Australia as well as the work of other researchers. The items are listed in Table 2.

INSERT TABLE 2

3.1.1 QUALITY OF INTELLECTUAL CAPITAL DISCLOSURE

Some researchers criticised that a number is not necessarily worth more than a comment (Marston and Shrivess, 1991). This is because a qualitative discussion might provide the reader with a better understanding of the topic at hand while providing a set of numbers by itself might not necessarily have the same effect. Nevertheless, Botosan (1997) argues that quantitative information is more precise and therefore more useful to readers of annual reports. This study examined the degree of IC disclosure in the annual reports of biotechnology companies, whether it had been quantified, and, in the process determine the quality of ICD in the biotechnology industry.

Previous studies have assessed the quality of IC disclosure using differing quality criteria scales. For instance: a six point scale (0-5, 5 for quantitative/monetary disclosure with narrative; 4 for quantitative/monetary disclosure; 3 for narrative disclosure; 2 for obscure disclosure; 1 for immaterial disclosure and 0 for non-disclosure) was used by Schneider and Samkin (2008), Shareef and Davey (2006), and Yi and Davey (2010); a four point scale (0-3, 3 for monetary disclosure; 2 for numerical disclosure; 1 for narrative form and 0 for non-disclosure) was used by Guthrie et al. (1999) and Guthrie et al. (2006); a three point scale (0-2, 2 for quantitative disclosure; 1 for qualitative disclosure and 0 for non-disclosure) was used by Bozzolan et al. (2003) and Wong and Gardner (2005); and a two point scale (0-1, 1 for disclosure and 0 for non-disclosure) was used by Brennan (2001), Bontis (2003), Goh and

Lim (2004), and Abeysekera and Guthrie (2005). The six point scale is the most comprehensive, allowing more discrimination when assessing the quality of disclosure. Studies using this scale identified some IC items which were narrative in nature and were problematic and impractical to assign quantitative or monetary value to. Shareef and Davey (2006) identified three items, namely “technological process”, “management process” and “company names/ground names”, while Yi and Davey (2010) identified “management philosophy/corporate culture”, “work-related knowledge”, and “entrepreneurial spirit” as items that were only disclosed in the narrative form. Based on these two prior studies (Shareef and Davey, 2006; Yi and Davey, 2010) these items were assigned a maximum score of three (narrative disclosure) when collecting data in this study. In addition, studies by Guthrie et al. (1999) and Guthrie et al. (2006), both found that IC items that were disclosed were expressed in narrative rather than numerical terms. Therefore, based on the literature reviewed, it was concluded that a four point (0-3) scale would be sufficient to capture the quality of IC disclosure in annual reports and ensure the reliability of the results.

In this study, a value of zero (0) was assigned if the variable did not appear in the annual report; a value of one (1) if the variable appeared in narrative form; a value of two (2), if the variable was expressed in specific (numerical) terms; and a value of three (3), if the variable was quantified in dollar terms (refer to Table 3).

INSERT TABLE 3

Some items in the framework could only be given a maximum score of one (1) due to its narrative nature. These items were “Management philosophy”, “Corporate culture”, “Management processes” in the internal capital category; “Company names” in the external capital category; and “Work-related knowledge”, “Entrepreneurial spirit” in the human capital category. After thoroughly reviewing all of the text in approximately ninety annual reports during the scoring process, it was discovered that there were no possible numerical or monetary form of disclosures. Therefore, with this reflection and logical reasoning that it could not be foreseen how any might even be possible, the above mentioned items were given a maximum score of one (1).

3.1.2 LOCATION OF INTELLECTUAL CAPITAL REPORTING IN THE ANNUAL REPORTS

Guthrie et al. (2004, p.289) stated that “studying the quality of disclosure by examining the relative emphasis on each theme, whether the disclosure is quantified or not, and the location

of disclosure is the approach mostly likely to yield meaningful results". This approach not only provided a description of the disclosure practices of organisations, but also identified the key issues that needed to be focused on in subsequent in-depth investigations on how these organisations identify, measure, and report their IC (Guthrie et al., 2004).

As such, this study built on the five sections originally used by Guthrie et al. (2006) and divided the annual reports into the following seven sections:

INSERT TABLE 4

3.1.3 DATA CAPTURE

To ensure the reliability of the data collected, two coders were employed for consistency. The method that was employed was for one coder to read the annual reports, identify and record information related to each item of the ICD index onto a coding sheet. For each of the items data was gathered and recorded in terms of: 1) quality of data, and 2) location. A second coder randomly checked the data collected to ensure consistency in the coding process.

3.1.4 CONTROL VARIABLES

Positive Accounting Theory (PAT) predicts that managers will monitor and attempt to reduce information asymmetry with investors and lenders for fear of increasing cost of capital by making voluntary disclosures about intangible firm value, such as its intellectual capital (IC), to bridge that knowledge gap (White et al., 2010). PAT also predicts such positive disclosure practices might be predicted if the firm was attempting to minimise the greater political costs associated with large companies. Therefore in this study, market capitalisation was used as a proxy for size whereas leverage was used to reflect the significant obligations that managers have under existing debt covenants.

3.1.4.1 COMPANY SIZE

As Foster (1986, p.44) states, "the variable most consistently reported as significant in studies examining differences across firms in their disclosure policy is firm size" (Chow and Wong-Boren, 1987; Cooke, 1989; Hossain and Adams, 1995; Meek et al., 1995; and Watson et al., 2002). A review of the literature identified studies examining IC disclosure practices controlling for company size using various proxies such as market capitalization (Guthrie et al., 2004; Petty and Cuganesan, 2005), sales (Bozzolan et al., 2003; Cordazzo, 2007) and

number of employees (Bukh et al., 2005). This study uses market capitalisation as a proxy for size as listed companies will have this information readily available in their annual reports. Moreover, most Australian biotechnology companies are actively engaged in research and development-only activities (White et al., 2007) and therefore are more reliant on shareholders for much of their financing needs. It is, therefore, expected that larger firms will report higher quality and more intellectual capital disclosures due to the greater resources available to them in conducting research and development and for reporting subsequent IC.

3.1.4.2 COMPANY LEVERAGE

Traditional agency theory predicts that highly leveraged firms have significant obligations under existing debt covenants and incur monitoring costs to achieve equilibrium between self-interested managers as agents for external debt-holders (Dhaliwal et al., 1982). Watts and Zimmerman (1986) further explained that as organisations employ more external financing, management are more likely to attempt to use different policies for their own benefit. This study used the level of company's leverage (total balance sheet liabilities divided by total assets) as a proxy to reflect the obligations that managers had under existing debt covenants to voluntarily disclose IC. A positive correlation between firm leverage and voluntary segment disclosures was found by Bradbury (1992) while no relationship was found between the same two variables measured in New Zealand firms (Chow and Wong-Boren, 1987). However, White et al. (2007) found strong evidence in Australian biotechnology companies that leverage was found to be a significant driver in biotechnology companies' voluntary IC disclosure. Therefore, because of the leverage effect on intellectual capital disclosures, this study will control the leverage effect on intellectual capital disclosures in order to study the trend of intellectual capital disclosure.

3.1.5 DATA COLLECTION

When scoring each annual report, information pertaining to the quality of intellectual capital disclosed as well as the location of the disclosure was recorded onto a scoring sheet (See Appendix 2). As mentioned previously, random checks were conducted to ensure coding consistency. Information from the coding sheets was then transferred into a spreadsheet for further data analysis. The raw scores for each year were recorded as follows: 1) the nature of ICD; 2) the quality of ICD; and 3) the location of ICD.

Data pertaining to the market capitalisation and level of company's leverage were sourced from the *FinAnalysis* database. The market capitalisation and leverage data for 2003, 2006 and 2010 for each company were collected and inputted into a spreadsheet.

3.1.6 DATA ANALYSIS

In this study, the distribution of the data collated was not normally distributed; skewness and kurtosis were high and because of this non-parametric statistics were used. IBM's SPSS (Version 19) software was used for statistical analysis of the data. In order to test for any significant relationships between the variables, Spearman's Rank Correlation Coefficient was run to determine the correlations between the variables in each year. Mann-Whitney U tests were performed to test if leverage and market capitalisation had a significant effect on the quality of the disclosed intellectual capital categories. Lastly, Wilcoxon Signed Rank Tests were performed to determine if there were any significant change in intellectual capital disclosure quality between years.

In order to show the reporting trend of intellectual capital disclosure in the annual reports, data collected pertaining to the location of IC disclosed for each year was summed. The total count of ICD in each section of the annual reports for each year was computed as a percentage of the total count in that particular year. The percentage count for each section was then used to identify where IC was primarily disclosed for each year and compared amongst the years to present a reporting trend.

4.1 RESULTS

Over the 2003 – 2010 period, biotechnology companies sampled in this study disclosed all three aspects of intellectual capital, however, the frequency of disclosure varied greatly among these three categories. The results for 2003 (Table 5.1), 2006 (Table 5.2) and 2010 (Table 5.3) show that the sampled biotechnology companies reported external capital disclosures most frequently at 48 per cent for 2003, 44 per cent for 2006, and 49 per cent. Human capital was the least reported category for disclosure, accounting for only 15 – 16 per cent of total discourse in any one year. Internal capital disclosures accounted for 37 per cent of total disclosure in 2003, 40 per cent in 2006, and 35 per cent in 2010 (refer to Tables 5.1, 5.2 and 5.3).

4.2 INDIVIDUAL ATTRIBUTE FINDINGS

The individual attribute findings reported in this section relates to the items in the disclosure framework that were used in this study. The disclosure frequency of each different quality of disclosure for each IC item is shown in Tables 5.1, 5.2 and 5.3.

4.2.1 INTERNAL CAPITAL ATTRIBUTES

In the internal capital category (refer to Tables 5.1, 5.2 and 5.3), “Corporate culture” (item 1.3) was the most frequently reported internal capital item as it was reported by 19 companies out of 28 in 2003 (refer to Table 5.1), and was fully disclosed by all companies in 2006 and 2010 (refer to Tables 5.2 and 5.3). The least reported item “Information/networking systems” (item 1.5), was only reported by less than 3 companies in any of the years studied.

Comparing the frequency of reporting internal capital items over the years, “Intellectual Property” (item 1.1), “Corporate culture” (item 1.3), and “Financial relations” (item 1.6) constantly had a relatively higher frequency of disclosure among the internal capital items.

4.2.2 EXTERNAL CAPITAL ATTRIBUTES

In the external capital category (refer to Tables 5.1, 5.2 and 5.3), “Brands” (item 2.1) was the most frequently reported external capital item, being reported by no less than 26 companies in any period. The least reported category item was “Customer loyalty” (item 2.3) with less than 5 companies reporting it in any one period. The frequency of reporting external capital items over the years showed “Brands” (item 2.1), “Customers” (item 2.2), “Company names”

(item 2.4) and “Business Collaborations” (item 2.6) as being the items that had a relatively higher frequency of disclosure among the external capital items.

INSERT TABLE 5.1

4.2.3 HUMAN CAPITAL ATTRIBUTES

In the human capital category (refer to Tables 5.1, 5.2 and 5.3), the only item that was disclosed by all companies in the three reporting periods was “Know-how” (item 3.1). “Education” (item 3.2) was not disclosed in any of the three reporting periods while the remaining items were irregularly reported with a low quality score.

INSERT TABLE 5.2

INSERT TABLE 5.3

4.3 DESCRIPTIVE STATISTICS ON THE QUALITY OF INTELLECTUAL CAPITAL CONTENT IN THE ANNUAL REPORTS

4.3.1 DISCLOSURE QUALITY FOR 2003

As the distribution of the data pertaining to the quality of intellectual capital disclosure that was collated was not normal, it was more suitable to use the median to compare the intellectual capital disclosure quality score for IC (internal capital), EC (external capital), and HC (human capital). For the 2003 data set, the median disclosure quality scores for internal capital, external capital and human capital were 0.58, 0.42 and 0.18, respectively. The gap in disclosure quality between the three categories is 0.4 with scores of 0.58 for internal capital (the highest score) to 0.18 for human capital (the lowest score). The median for market capitalisation was AU\$21.1 million, with the largest company in the sample having a market capitalization at 30 June 2003 of AU\$512.5 million and the smallest with AU\$3.1 million market capitalisation. The median leverage score of the sample companies was 0.15. The highest level of firm leverage recorded in the sample was 0.52 and the lowest at 0.01. These descriptive statistics are presented in Table 6.1.

INSERT TABLE 6.1

4.3.2 DISCLOSURE QUALITY FOR 2006

Likewise for the 2006 data set, the median disclosure quality scores for the three categories of voluntary intellectual capital disclosure were 0.42, 0.32 and 0.18 for internal capital (IC), external capital (EC) and human capital (HC) respectively. The gap in disclosure quality between the three categories is 0.24 with scores of 0.42 for internal capital (the highest score) to 0.18 for human capital (the lowest score). The median for market capitalisation was AU\$22.1 million, with the largest company in the sample having a market capitalization at 30 June 2006 of AU\$377.8 million and the smallest with AU\$3.7 million market capitalisation. The median leverage score of the sample companies was 0.16. The highest level of firm leverage recorded in the sample was 1.27 and the lowest at 0.31. These descriptive statistics are presented in Table 6.2.

INSERT TABLE 6.2

4.3.3 DISCLOSURE QUALITY FOR 2010

For the 2010 data set, the median disclosure quality scores for the three categories of voluntary intellectual capital disclosure were 0.42, 0.37 and 0.18 for internal capital (IC), external capital (EC) and human capital (HC) respectively. The gap in disclosure quality between the three categories is 0.24 with scores of 0.42 for internal capital (the highest score) to 0.18 for human capital (the lowest score). The median for market capitalisation was AU\$12.7 million with the largest company in the sample having a market capitalization of AU\$264.4 million and the smallest with AU\$2.1 million market capitalisation at 30 June 2006. The median leverage score of the sample companies was 0.23. The highest level of firm leverage recorded in the sample was 5.98 and the lowest was 0.07. These descriptive statistics are presented in Table 6.3.

INSERT TABLE 6.3

4.3.4 CORRELATION MATRIX ANALYSIS

Tables 7.1, 7.2 and 7.3 present a correlation matrix reporting non-parametric Spearman's rank coefficients for the ranked variables used in this study for the years-ending 2003, 2006 and 2010.

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A significant positive relationship was observed between the quality of human capital disclosure and internal capital disclosure ($r = 0.40$, $p = 0.03$), and human capital disclosure and external capital disclosure ($r = 0.49$, $p = 0.01$) in the 2003 data set (see Table 7.1). However, the same relationship was not observed in the 2006 or 2010 data sets (see Tables 7.2 and 7.3 respectively).

No significant correlation was found between the quality of any intellectual capital disclosure and firm size or amount of leverage in any of the data sets (refer to Tables 7.1, 7.2 and 7.3).

INSERT TABLE 7.1

INSERT TABLE 7.2

INSERT TABLE 7.3

A review of Tables 7.1, 7.2 and 7.3 showed the maximum correlation between variables were not above the critical multicollinearity limit of 0.8 (Hair et al., 1995). There was no significant correlation between the quality of different intellectual capital categories (IC, EC and HC) and size (market capitalisation) over the period studied. This is an interesting finding because it is contrary to the significant effect of size on the frequency of measured IC disclosure in past studies (Abdolmohammadi, 2005; Bozzolan et al., 2003; White et al., 2007).

Similarly, there was no significant correlation between the quality of different intellectual capital categories (IC, EC and HC) and leverage over the period studied. This was contrary to other ICD studies where leverage was found to have a significant influence on the frequency of IC disclosure (Bradbury, 1992; White et al., 2007). The results of this study appear to complement and extend other researchers' findings in that significant increases in frequency of ICD by larger companies, or in response to increased leverage, may not correlate with high-quality disclosure.

4.3.5 LONGITUDINAL ANALYSIS OF QUALITY OF INTELLECTUAL CAPITAL DISCLOSURE

In order to determine if there were any significant differences in the quality of intellectual capital disclosures over time, Wilcoxon Signed Rank Test was used. The results are presented in Tables 8.1, 8.2 and 8.3.

4.3.5.1 INTERNAL CAPITAL

The results of the Wilcoxon Signed Rank Test indicated that there was a significant difference in the quality of internal capital disclosures for the same companies between 2003 and 2006, as well as between 2003 and 2010. However, this was not noted for 2006 and 2010. The results are presented in Table 8.1 below.

INSERT TABLE 8.1

Comparing the 2003 and 2006 internal capital quality scores, it was found that 16 companies had higher internal capital scores in 2003, 6 companies had a higher quality score in 2006 and the remaining 6 had no change in the quality of disclosure (refer to Table 8.1). Comparing the 2003 scores with the 2010 scores, it was found that 18 companies had higher quality scores in

2003, 6 companies had a higher quality score in 2010, while 4 companies did not change the quality of their disclosure.

4.3.5.2 EXTERNAL CAPITAL

There was no significant differences found in the quality of external capital disclosures for the companies between 2003/06, 2006/10 or 2003/10 (refer to Table 8.2).

INSERT TABLE 8.2

While the results showed no significant change in the quality of external capital disclosure over the years, an interesting observation is that the disclosure of external capital information over the period 2003 – 2010 had actually decreased in quality. Of the total sample 19 companies had a higher quality of disclosure in 2003 than they did in 2010, with only 9 companies having reported higher quality external capital information in 2010.

4.3.5.3 HUMAN CAPITAL

No significant differences were found in the human capital category quality scores for the periods that were studied (refer to Table 8.3).

INSERT TABLE 8.3

While there is no significant change in the quality of human capital disclosure over the years, the results of this test showed 9 companies reporting higher quality information pertaining to human capital in 2003 as compared to 2010, with 6 companies reporting lower quality information. However, 13 companies were found to have no change in the quality of human capital disclosure.

4.4 LOCATION OF INTELLECTUAL CAPITAL DISCLOSURES

To measure the location of intellectual capital disclosures the annual report was divided into seven locations, namely Vision/Strategy (1), Director's Report (2), Business/Operational section (3), Financial statements and notes (4), Chairman's letter (5), CEO's letter (6) and Others (7). Tables 9.1, 9.2 and 9.3 present the descriptive statistics with regards to the location of intellectual capital disclosures for each year. The total counts of disclosure for each year ranged from 632 in the 2010 data set (lowest) to 757 in the 2003 data set (see

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Tables 9.1, 9.2 and 9.3). A review of Tables 9.1 to 9.3 showed consistency in the disclosure location of ICD in 2003, 2006 and 2010, respectively.

INSERT TABLE 9.1

Table 9.1 shows that more than half of the total IC disclosures in 2003 can be found in the Director's Report and Business/Operational sections of the annual reports (29.06% and 26.16%, respectively). This was consistent in the 2006 and 2010 data sets, with a total percentage of 65.79% and 45.72% disclosed in 2006 and 2010 (see Tables 9.2 and 9.3, respectively).

INSERT TABLE 9.2

INSERT TABLE 9.3

The least amount of disclosure was in the Vision/Strategy section, accounting for no more than 1% of total counts recorded in any one year. This was expected, since only disclosures relating to visions and strategies would typically be disclosed in that section (see Tables 9.1, 9.2 and 9.3). A fair amount of intellectual capital disclosure was found in the Chairman's letter and CEO's letter sections of the annual report, with a total of 18.36% in 2003; 16.50% in 2006; and 19.78% in 2010. This was a surprising result as these two sections were typically short sections when compared to the other sections in the annual report.

5.1 DISCUSSION AND IMPLICATIONS OF RESULTS

Using content analysis of annual reports of a sample of Australian biotechnology companies ($n=28$), the nature and quality trend of IC disclosure were investigated. The study used data from the same 28 firms over a seven year period. In total, a content analysis of 84 corporate annual reports was measured over the years 2003, 2006 and 2010.

5.1.1 NATURE OF INTELLECTUAL CAPITAL DISCLOSURE

The descriptive data presented in Table 5.1 (2003), Table 5.2 (2006) and Table 5.3 (2010) record the frequency and maximum level of quality disclosed in each of the 28 biotechnology companies' annual reports. Two interesting observations are possible. The first results showed that external capital is the most frequently disclosed category of intellectual capital in all of the three periods when management annual reporting disclosure were measured. Narrative disclosures about brand, customers, company names and business collaborations were frequently disclosed components (items) of external/relational capital; the most disclosed category of intellectual capital. This findings was consistent with leading prior research in the field (April et al., 2003; Bozzolan et al., 2003; Guthrie and Petty, 2000; Guthrie et al., 2006). A clear pattern emerged that external capital was the most frequently disclosed category of intellectual capital, followed by internal capital and, lastly, human capital.

The above findings are very novel in that a longitudinal examination of this type, measuring categories of intellectual capital disclosed by the same biotechnology firms over time, has not been done before. An interesting implication of this result is that, over the time period studied, the categories of intellectual capital chosen to be disclosed by firm managers is yet to reflect what might be expected in an academic sense from firms in the industry. For example, if the concept of intellectual capital is contextualized within this industry and especially if key success factors for Biotechnology are incorporated in the reflection, then the following intellectual capital disclosures should be high quality and frequent: 1) R&D disclosures about firm intellectual property; 2) R&D disclosures about firm collaboration; 3) R&D disclosures about strategic alliances with research partners; 4) licensing disclosures about successful exploitation of intellectual property; 5) Knowledge disclosures about scientific qualifications of executives; 6) Knowhow disclosures about processes; and, 7) R&D disclosures from non-reciprocal revenue recognition issues when grant income is spent. The above synopsis

indicates an expectation that internal and human capital disclosure frequency would both be greater for these companies. Therefore it appears that preparers of non-financial information in Australian biotechnology companies at least may have a skewed focus towards reporting on external capital components compared with those expected by the equities market, relating to internal and human perspective and their key success factors.

From analysing the intellectual capital items chosen to be disclosed by firm managers, specific items were identified to be consistently disclosed more often than the rest, across the years studied. The specific emphasis placed on the disclosure of these items might indicate the importance managers' place on intellectual capital reporting. However, the lack of attempt to further intellectual capital reporting in their annual reports (i.e. by disclosing other items) and the skewed focus towards reporting on external capital components suggest that the discussion on IC as it takes place in academia, has not yet found its way to corporate Australia in this industry sector (Vergauwen and van Alem, 2005). Current disclosure practise is ad-hoc and illustrates a picture of managers having a limited knowledge of the topic of intellectual capital as well as possibilities for increasing communications to the market with it. In other words, information asymmetry identified between managers and investors in this high-technology industry does not appear redressed over time.

5.1.2 QUALITY OF INTELLECTUAL CAPITAL DISCLOSURE

The average quality scoring achieved for each category of IC by biotechnology companies cannot be considered high, with all scores, except the internal capital score for 2003, below 0.50. These findings were not unexpected as there is currently no established and generally accepted framework to quantify IC information in Australia or elsewhere in the world (Guthrie and Petty; 2000; Guthrie et al., 2006; Yi and Davey 2010), and any quantification might give rise to inaccurate meaning (Abeysekera and Guthrie, 2005; Guthrie et al., 1999). . Comparing the minimum and maximum quality score of human capital disclosure and the fact that "Know-how" was the only prevalent item disclosed in this category, gives credence to the idea that there might be a lack of understanding of attributes in the human capital category. The same could be said for the internal and external capital categories, with some items constantly having a higher quality score throughout the period studied. It could be suggested that managers of biotechnology companies may lack the resources or capacity to collect important hard data and increase the quality of disclosures about their firm's intellectual capital.

Amongst all the intellectual capital items that were measured, “Intellectual Property” had the highest quality scoring. The high incidence and quality of reporting intellectual property suggest that biotechnology companies place a high emphasis on patents, trademarks and copyrights. A possible reason for this might be due to the nature of biotechnology companies’ operations, since the majority of Australian biotechnology companies, at least in 2005 data, were engaged in research and development-only activities (White et al., 2007) and intellectual property forms the core of the organisation’s asset base. This finding lends support to prior research that IC disclosures may be industry specific (Abdolmohammadi, 2005) and industries that rely more on IC disclose more information on IC (Bruggen et al., 2009, Kamath, 2008). “Brands”, “Customers” and “Know-how” were also frequently disclosed and given a relatively higher quality scoring which indicate that biotechnology firms which cannot legitimise their status via the “hard” assets that traditionally have symbolised corporate success (Guthrie et al., 2004) are more likely to report information on the intangibles that they possess. The deficiency of a quantitative expression of other IC items indicates a perceived lack of attempt to translate intellectual capital into quantifiable figures (Brennan, 2001; Guthrie and Petty, 2000) and that the sector might still be at the stage of simply understanding where the real value of a firm lies, rather than qualifying the IC attributes or assigning dollar values to them (Guthrie and Petty, 2000).

Another finding of this study was a significant positive relationship between the three categories of intellectual capital in 2003 (refer to Table 7.1). This finding is consistent with the expectation that firms in earlier years had an emerging awareness of intellectual capital and firms which chose to disclose their intellectual capital do so by reporting all three aspects of intellectual capital. A possible explanation for the emerging awareness might be companies’ expectations that IC reporting would be an important aspect of the International Financial Reporting Standards (IFRS) implementation. Therefore, firms reported more information on IC in the 2003 annual reports in preparation for the change in reporting standards. However, as this was not the case when the IFRS was implemented in 2005, this significantly positive relationship was not noted in the latter years of 2006 and 2010.

Moreover, the adoption of the IFRS required companies to adhere to strict reporting standards and fundamentally changed the way information in annual reports was presented. As a result, less emphasis might have been placed on intellectual capital disclosures after the implementation. The strict reporting standards by the IFRS also limits the disclosures that

companies could make in their annual reports, particularly in the recognition of intangible assets (AASB 138). Therefore, compliance with it could be that limited regulated disclosure of intangibles for financial managers, especially in the internal capital category, distracted their attention from voluntary reporting of extra external and human capital information. This explanation is further supported by the results of the Wilcoxon Signed Rank Test (refer to Table 8.1), where there was a significant change in the internal capital category scores between period 2003 and 2006, as well as between 2003 and 2010. The results showed more companies having a higher internal capital quality score in 2003 than in 2006 or 2010, further indicating a possibility that the adoption of the AASB 138 might be one reason behind the decrease in the disclosure of internally generated intellectual capital information.

It was very interesting that no significant correlation between the quality of IC disclosure and market capitalisation or leverage was found. More specifically, the company's size and leverage were not determinants for intellectual capital disclosure that biotechnology companies were making in their 2003, 2006 and 2010 annual reports. The lack of a significant relationship between size, leverage and intellectual capital disclosure quality is contrary to the results of several prior research studies which showed size and leverage were significant drivers for the frequency of ICD.

Lastly, the results showed there was a decrease in the quality of IC disclosure over the years, even though the change was insignificant for the external and human categories of intellectual capital. A possible explanation for this might be that companies deemed that they had met the information needs of investors with respect to IC with the implementation of the IFRS. With the subsequent onset of the global financial crisis, and the continuing global recession, companies may have arrived at the point where the cost of disclosing IC outweighs the benefit of doing so, therefore resulting in the insignificant decrease in IC quality disclosure observation.

5.1.3 LOCATION OF INTELLECTUAL CAPITAL DISCLOSURE

Although the items disclosed by any individual company, in general, were distributed in various sections of the annual report; this study showed intellectual capital items being most widely reported in the director's report and business/operational sections of the annual report consistently throughout the 2003, 2006 and 2010 annual reports. While the disorganised nature of distribution suggest that there is no distinct systematic pattern of IC reporting for

Australian biotechnology companies, the findings of this study were similar to Guthrie et al. (2006) in that nearly half of all IC reported were in the “business/operational” section of the annual report. The count of disclosure might suggest a modest commitment in communicating their IC information to an external audience (Guthrie and Petty, 2000; Shareef and Davey, 2006).

Lastly, a fair amount of intellectual capital disclosure was found in the chairman’s letter and CEO’s letter of the annual report. While the percentage of disclosure were not large, considering the short length of these two sections (as compared to other sections), it can be proposed that management do place an emphasis on intellectual capital, as evidence by them writing about it in their communications. Along with the fact that the quality of ICD in this study was found to be low, it can be assumed that while managers place an emphasis on intellectual capital reporting, they may need more tools/knowledge to translate their understanding into high quality disclosures across all categories of intellectual capital.

6.1 LIMITATIONS

One limitation of this study is that it only examines the annual reports of listed Australian biotechnology companies that were operating during the period 2003 – 2010, therefore results are industry and country specific and cannot be generalized. This limitation is somewhat mitigated by the analysis of 28 companies throughout the period under examination, rather than a random sample of companies in each period.

In this study, potential limitations or bias may exist from the use of the disclosure framework. There is no disclosure framework comprehensive enough to measure all aspects of IC and the 18-item framework used in this study is no exception. While the content analysis approach of Guthrie et al. (2004) and other scholars was used to measure the quality of intellectual capital disclosure, inevitably, there is some subjectivity involved when reading the annual report to access, classify and score information. In addition, only 28 companies were examined in this study. While it is acknowledged that a bigger sample size would allow generalizability of results, time limitations and the availability of certain data set the sample size as such.

7.1 SUGGESTIONS FOR FUTURE RESEARCH

There is fair scope for extending the present work. Future research can: 1) increase the sample size, for instance, by selecting more companies over the time period to be studied; and, 2) comparing the level of intellectual capital disclosure between countries. Further research could apply research methods other than content analysis (e.g. questionnaires, survey, interviews or mixed-methods) in order to obtain a more in-depth view of how Australian biotechnology firms manage, measure and report their IC.

Table 1 Guthrie and Petty's (2000) Modified Intangible Asset Monitor

Internal Capital	External Capital	Human Capital
Patents Copyrights Trademarks Management philosophy Corporate culture Management processes Information systems Networking systems Financial relations	Brands Customers Customer loyalty Company names Distribution channels Business collaborations Licensing agreement Favourable contracts Franchising agreements	Know-how Education Vocational qualification Work-related knowledge Work-related competencies Entrepreneurial spirit

Source: Guthrie and Petty (2000)

Table 2 Modified Intangible Asset Monitor

1.0 Internal (Structural) Capital Items	Description of items
<u>1.1</u> Intellectual Property	Comprises patents, copyrights and trademarks
<u>1.2</u> Management philosophy	As evidenced by vision/mission statements
<u>1.3</u> Corporate culture	Comprises the attitudes, experiences, beliefs and values of the company
<u>1.4</u> Management processes	Relates to processes within a company
<u>1.5</u> Information/networking systems	Details the development, application and impact of information/networking systems
<u>1.6</u> Financial relations	Relationships between the company and finance providers, such as banks
2.0 External (Customer/Relational) Capital Items	Description of items
<u>2.1</u> Brands	Details of brands and reputation building
<u>2.2</u> Customers	Information (indicators) relating to customers
<u>2.3</u> Customer loyalty	Indicators of customer satisfaction/positive feedback
<u>2.4</u> Company names	Names of companies collaborating with the company
<u>2.5</u> Distribution channels	Information regarding how a company's service and products reach its customers
<u>2.6</u> Business collaborations	Business collaboration involving the company
<u>2.7</u> Licensing agreements	Licensing agreements and franchising agreements held by a company
3.0 Employee Competence (Human Capital) Items	Description of items
<u>3.1</u> Know-how	Employee knowledge
<u>3.2</u> Education	Education/ongoing programmes initiated by the company
<u>3.3</u> Training	Training programmes undertaken/provided by the company
<u>3.4</u> Work-related knowledge	Gained "on the job" or as part of ongoing training
<u>3.5</u> Entrepreneurial spirit	Encompasses innovativeness; proactive and reactive abilities; and changeability

Source: IC Framework adopted from Guthrie et al. (2006); Description adapted from Schneider and Samkin (2008).

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Table 3 Quality of disclosure scale

Disclosure Score	Description
0	Item was not disclosed
1	Item disclosed was purely narrative with no specific information given
2	Item discussed in detail supported by numerical information
3	Item was expressed in monetary form

Table 4 Section of annual report where IC are disclosed

Section Number	Section of Annual Report
1	Vision / Strategy
2	Director's Report
3	Business / Operational Section
4	Financial Section
5	Chairman's Letter
6	CEO's letter
7	Others

Table 5.1 Frequency of IC item disclosure based on Internal Capital, External Capital and Human Capital classification in 2003

1. Internal Capital	Frequency of maximum disclosure Quality				Total	Mean Quality Score	Weighting of Importance
	0	1	2	3			
1.1 Intellectual Property	1	0	4	23	27	0.92*	
1.2 Management philosophy	16	12	N/A	N/A	12	0.43	
1.3 Corporate culture	9	19	N/A	N/A	19	0.68	
1.4 Management Processes	13	15	N/A	N/A	15	0.54	
1.5 Information/networking systems	25	2	1	0	3	0.05	
1.6 Financial relations	6	1	0	21	22	0.76	
Total					98		0.37**
2. External Capital							
2.1 Brands	1	9	6	12	27	0.68	
2.2 Customers	4	3	3	18	24	0.75	
2.3 Customer loyalty	24	2	2	0	4	0.07	
2.4 Company names	3	25	N/A	N/A	25	0.89	
2.5 Distribution channels	16	7	4	1	12	0.21	
2.6 Business Collaborations	6	11	8	3	22	0.43	
2.7 Licensing agreements	14	8	4	2	14	0.26	
Total					128		0.48
3. Human Capital							
3.1 Know-how	0	0	25	3	28	0.70	
3.2 Education	28	0	0	0	0	0.00	
3.3 Training	27	1	0	0	1	0.01	
3.4 Work-related knowledge	18	10	N/A	N/A	10	0.12	
3.5 Entrepreneurial spirit	27	1	N/A	N/A	1	0.01	
Total					40		0.15

*Mean Quality Score: $[(0*1) + (1*0) + (2*4) + (3*23)] / (3*28)$

**Weighting: Internal capital count / Total count = $98 / (98+128+40)$

N/A: Nature of item did not allow scoring of more than 1.

Table 5.2 Frequency of IC item disclosure based on Internal Capital, External Capital and Human Capital classification in 2006

1. Internal Capital	Frequency of maximum disclosure quality					Total	Mean Quality Score	Weighting of Importance
	0	1	2	3				
1.1 Intellectual Property	7	3	3	15	21	0.64*		
1.2 Management philosophy	19	9	N/A	N/A	9	0.32		
1.3 Corporate culture	0	28	N/A	N/A	28	1.00		
1.4 Management Processes	13	15	N/A	N/A	15	0.54		
1.5 Information/networking systems	26	0	1	1	2	0.06		
1.6 Financial relations	9	2	0	17	22	0.63		
Total						94		0.40**
2. External Capital								
2.1 Brands	2	5	8	13	26	0.71		
2.2 Customers	8	1	5	14	20	0.63		
2.3 Customer loyalty	28	0	0	0	0	0.00		
2.4 Company names	7	21	N/A	N/A	21	0.75		
2.5 Distribution channels	21	5	2	0	7	0.11		
2.6 Business Collaborations	9	8	9	2	19	0.38		
2.7 Licensing agreements	17	4	5	2	11	0.24		
Total						104	0.44	
3. Human Capital								
3.1 Know-how	0	3	21	4	28	0.68		
3.2 Education	28	0	0	0	0	0.00		
3.3 Training	27	1	0	0	1	0.01		
3.4 Work-related knowledge	19	9	N/A	N/A	9	0.11		
3.5 Entrepreneurial spirit	28	0	N/A	N/A	0	0.00		
Total						38	0.16	

*Mean Quality Score: $[(0*7) + (1*3)+(2*3)+(3*15)] / (3*28)$

**Weighting: Internal capital count / Total count = $94 / (94+104+38)$

N/A: Nature of item did not allow scoring of more than 1.

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Table 5.3 Frequency of IC item disclosure based on Internal Capital, External Capital and Human Capital classification in 2010

1. Internal Capital	Frequency of maximum disclosure quality				Total	Mean Quality Score	Weighting of Importance
	0	1	2	3			
1.1 Intellectual Property	4	1	5	18	24	0.77*	
1.2 Management philosophy	22	6	N/A	N/A	6	0.21	
1.3 Corporate culture	0	28	N/A	N/A	28	1.00	
1.4 Management Processes	23	5	N/A	N/A	5	0.18	
1.5 Information/networking systems	27	1	0	0	1	0.01	
1.6 Financial relations	15	0	0	13	13	0.46	
Total					77		0.35**
2. External Capital							
2.1 Brands	2	4	5	17	26	0.77	
2.2 Customers	11	3	3	11	17	0.50	
2.3 Customer loyalty	27	0	1	0	1	0.02	
2.4 Company names	3	25	N/A	N/A	25	0.89	
2.5 Distribution channels	19	7	1	1	9	0.14	
2.6 Business Collaborations	11	11	3	3	17	0.31	
2.7 Licensing agreements	18	4	2	4	10	0.24	
Total					105		0.49
3. Human Capital							
3.1 Know-how	0	0	24	4	28	0.71	
3.2 Education	27	1	0	0	1	0.01	
3.3 Training	26	1	1	0	2	0.04	
3.4 Work-related knowledge	24	4	N/A	N/A	4	0.05	
3.5 Entrepreneurial spirit	28	0	N/A	N/A	0	0.00	
Total					35		0.16

*Mean Quality Score: $[(0*4) + (1*1) + (2*5) + (3*18)] / (3*28)$

**Weighting: Internal capital count / Total count = $77 / (77+105+35)$

N/A: Nature of item did not allow scoring of more than 1.

Table 6.1 Descriptive statistics of quality measure and control variables in 2003

Descriptives		Quality Measure			Control Variables	
		IC	EC	HC	MktCap	Leverage
<i>n</i> valid		28	28	28	28	28
Mean		0.57*	0.43	0.23	48863734	0.16
SE of mean		0.03	0.04	0.01	1.814E7	0.03
Median		0.58	0.42	0.18	21083221	0.15
SD		0.15	0.19	0.06	9.598E7	0.13
Skewness		0.36	0.05	1.66	4.49	1.60
Kurtosis		-0.30	-0.51	4.40	21.87	2.48
Actual Range	Minimum	0.3	0.11	0.18	3140800	0.01
	Maximum	0.9	0.79	0.45	512479167	0.52
Theoretical Range	Minimum	0	0	0		
	Maximum	1	1	1		

IC: Internal Capital EC: External Capital HC: Human Capital MktCap: Market Capitalisation

*Mean Quality Score: Sum of all internal capital items mean quality score in 2003 / Number of internal capital items measured $[(0.92+0.43+0.68+0.54+0.05+0.76)/6]$.

Table 6.2 Descriptive statistics of quality measure and control variables in 2006

Descriptives		Quality Measure			Control Variables	
		IC	EC	HC	MktCap	Leverage
<i>N</i> valid		28	28	28	28	28
Mean		0.49*	0.37	0.22	54256741	0.27
SE of mean		0.03	0.03	0.01	1.628E7	0.05
Median		0.42	0.32	0.18	22126464	0.16
SD		0.18	0.14	0.08	8.613E7	0.29
Skewness		0.40	0.07	0.37	2.67	2.15
Kurtosis		-0.19	-1.32	-0.20	7.33	4.95
Actual Range	Minimum	0.17	0.16	0.09	3676867	0.03
	Maximum	0.92	0.58	0.36	377804773	1.26
Theoretical Range	Minimum	0	0	0		
	Maximum	1	1	1		

IC: Internal Capital EC: External Capital HC: Human Capital MktCap: Market Capitalisation

*Mean Quality Score: Sum of all internal capital items mean quality score in 2003 / Number of internal capital items measured $[(0.64+0.32+1.00+0.54+0.06+0.63)/6]$.

Table 6.3 Descriptive statistics of quality measure and control variables in 2010

Descriptives		Quality Measure			Control Variables	
		IC	EC	HC	MktCap	Leverage
<i>N</i> valid		28	28	28	28	28
Mean		0.43*	0.36	0.22	37972117	0.55
SE of mean		0.04	0.03	0.01	1.151E7	0.21
Median		0.42	0.37	0.18	12734906	0.23
SD		0.19	0.14	0.08	6.088E7	1.14
Skewness		-0.11	-0.04	3.11	2.67	4.37
Kurtosis		-0.88	-0.31	12.21	7.28	20.78
Actual Range	Minimum	0.08	0.11	0.18	2143665	0.07
	Maximum	0.75	0.68	0.55	264417389	5.98
Theoretical Range	Minimum	0	0	0		
	Maximum	1	1	1		

IC: Internal Capital EC: External Capital HC: Human Capital MktCap: Market Capitalisation

*Mean Quality Score: Sum of all internal capital items mean quality score in 2003 / Number of internal capital items measured [(0.77+0.21+1.00+0.18+0.01+0.46)/6].

Table 7.1 Spearman correlation matrix of Intellectual Capital dimensions disclosure quality and control variables for 2003

		IC	EC	HC	MktCap	Leverage
IC	Correlation Coefficient	1.00	0.34	0.40*	0.02	-0.01
	Significance (2-tailed)	.	0.08	0.03	0.92	0.97
EC	Correlation Coefficient		1.00	0.49**	0.26	-0.25
	Significance (2-tailed)		.	0.01	0.18	0.19
HC	Correlation Coefficient			1.00	0.10	0.06
	Sig. (2-tailed)			.	0.62	0.75
MktCap	Correlation Coefficient				1.00	0.06
	Significance (2-tailed)				.	0.77
Leverage	Correlation Coefficient					1.00
	Significance (2-tailed)					.

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

IC: Internal Capital EC: External Capital HC: Human Capital MktCap: Market Capitalisation

Table 7.2 Spearman correlation matrix of Intellectual Capital dimensions disclosure quality and control variables for 2006

		IC	EC	HC	MktCap	Leverage
IC	Correlation Coefficient	1.00	0.10	0.31	-0.02	-0.04
	Significance (2-tailed)	.	0.63	0.11	0.94	0.86
EC	Correlation Coefficient		1.00	0.20	0.02	-0.20
	Significance (2-tailed)		.	0.32	0.92	0.31
HC	Correlation Coefficient			1.00	0.25	-0.26
	Significance (2-tailed)			.	0.21	0.18
MktCap	Correlation Coefficient				1.00	-0.37
	Significance (2-tailed)				.	0.05
Leverage	Correlation Coefficient					1.00
	Significance (2-tailed)					.

IC: Internal Capital EC: External Capital HC: Human Capital MktCap: Market Capitalisation

Table 7.3 Spearman correlation matrix of Intellectual Capital dimensions disclosure quality and control variables for 2010

		IC	EC	HC	MktCap	Leverage
IC	Correlation Coefficient	1.00	-0.02	0.23	0.23	-0.12
	Significance (2-tailed)	.	0.90	0.24	0.23	0.54
EC	Correlation Coefficient		1.00	0.13	-0.10	0.29
	Significance (2-tailed)		.	0.50	0.61	0.14
HC	Correlation Coefficient			1.00	-0.10	0.23
	Significance (2-tailed)			.	0.60	0.25
MktCap	Correlation Coefficient				1.00	-0.32
	Significance (2-tailed)				.	0.10
Leverage	Correlation Coefficient					1.00
	Significance (2-tailed)					.

IC: Internal Capital EC: External Capital HC: Human Capital MktCap: Market Capitalisation

Table 8.1 Wilcoxon Signed Rank test for Quality of Internal Capital in 2003, 2006 and 2010

		N	Mean Rank	Sum of Ranks	Z	Significance
2006 Score - 2003 Score	Negative Ranks	16 ^a	12.56	201.00	-2.45	0.014
	Positive Ranks	6 ^b	8.67	52.00		
	Ties	6 ^c				
	Total	28				
2010 Score - 2006 Score	Negative Ranks	17 ^d	10.06	171.00	-1.46	0.15
	Positive Ranks	5 ^e	16.40	82.00		
	Ties	6 ^f				
	Total	28				
2010 Score - 2003 Score	Negative Ranks	18 ^g	13.67	246.00	-2.76	0.01
	Positive Ranks	6 ^h	9.00	54.00		
	Ties	4 ⁱ				
	Total	28				

- a. 2006 Score < 2003 Score
- b. 2006 Score > 2003 Score
- c. 2006 Score = 2003 Score
- d. 2010 Score < 2006 Score
- e. 2010 Score > 2006 Score
- f. 2010 Score = 2006 Score
- g. 2010 Score < 2003 Score
- h. 2010 Score > 2003 Score
- i. 2010 Score = 2003 Score

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Table 8.2 Wilcoxon Signed Rank test for Quality of External Capital in 2003, 2006 and 2010

		N	Mean Rank	Sum of Ranks	Z	Significance
2006 Score - 2003 Score	Negative Ranks	14 ^a	14.68	205.50	-1.59	0.111
	Positive Ranks	10 ^b	9.45	94.50		
	Ties	4 ^c				
	Total	28				
2010 Score - 2006 Score	Negative Ranks	10 ^d	15.00	150.00	0.00	1.000
	Positive Ranks	14 ^e	10.71	150.00		
	Ties	4 ^f				
	Total	28				
2010 Score - 2003 Score	Negative Ranks	19 ^g	15.00	285.00	-1.88	0.061
	Positive Ranks	9 ^h	13.44	121.00		
	Ties	0 ⁱ				
	Total	28				

- a. 2006 Score < 2003 Score
- b. 2006 Score > 2003 Score
- c. 2006 Score = 2003 Score
- d. 2010 Score < 2006 Score
- e. 2010 Score > 2006 Score
- f. 2010 Score = 2006 Score
- g. 2010 Score < 2003 Score
- h. 2010 Score > 2003 Score
- i. 2010 Score = 2003 Score

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Table 8.3 Wilcoxon Signed Rank test for Quality of Human Capital in 2003, 2006 and 2010

	N	Mean Rank	Sum of Ranks	Z	Significance
2006 Score - 2003 Score	Negative Ranks	10 ^a	8.30	-8.4	0.400
	Positive Ranks	6 ^b	8.83		
	Ties	12 ^c			
	Total	28			
2010 Score - 2006 Score	Negative Ranks	4 ^d	5.25	-0.18	0.855
	Positive Ranks	5 ^e	4.80		
	Ties	19 ^f			
	Total	28			
2010 Score - 2003 Score	Negative Ranks	9 ^g	8.00	-0.78	0.439
	Positive Ranks	6 ^h	8.00		
	Ties	13 ⁱ			
	Total	28			

- a. 2006 Score < 2003 Score
- b. 2006 Score > 2003 Score
- c. 2006 Score = 2003 Score
- d. 2010 Score < 2006 Score
- e. 2010 Score > 2006 Score
- f. 2010 Score = 2006 Score
- g. 2010 Score < 2003 Score
- h. 2010 Score > 2003 Score
- i. 2010 Score = 2003 Score

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Table 9.1 2003 Location of IC disclosure

	Vision/ Strategy	Director's Report	Business/ Operational	Financial	Chairman's letter	CEO's letter	Others	Sum
Internal capital								
Count	2	70	57	42	25	11	67	274
Percentage %	0.73	25.55	20.80	15.33	9.12	4.01	24.45	100
External capital								
Count	0	99	122	17	55	34	60	387
Percentage %	0	25.58	31.52	4.39	14.21	8.79	15.50	100
Human capital								
Count	0	51	19	0	6	8	12	96
Percentage %	0	53.123	19.79	0	6.25	8.33	12.50	100
All IC disclosure								
Sum	2	220	198	59	86	53	139	757
Percentage %	0.26	29.06	26.16	7.79	11.36	7.00	18.36	100

Table 9.2 2006 Location of IC disclosure

	Vision/ Strategy	Director's Report	Business/ Operational	Financial	Chairman's letter	CEO's letter	Others	Sum
Internal capital								
Count	5	89	71	19	16	6	35	241
Percentage %	2.07	36.93	29.46	7.88	6.64	2.49	14.52	100
External capital								
Count	0	113	107	12	44	43	52	371
Percentage %	0	30.46	28.84	3.23	11.86	11.59	14.02	100
Human capital								
Count	0	77	22	0	8	3	6	116
Percentage %	0	66.38	18.97	0	6.90	2.59	5.17	100
All IC disclosure								
Sum	5	279	200	31	68	52	93	728
Percentage %	0.69	38.32	27.47	4.26	9.34	7.14	12.77	100

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in the Biotechnology Industry, 2003-10

Table 9.3 2010 Location of IC disclosure

	Vision/ Strategy	Director's Report	Business/ Operational	Financial	Chairman's letter	CEO's letter	Others	Sum
Internal capital								
Count	1	86	20	20	26	1	121	275
Percentage %	0.36	31.27	7.27	7.27	9.45	0.36	44.00	100
External capital								
Count	0	58	54	28	80	10	39	269
Percentage %	0	21.56	20.07	10.41	29.74	3.72	14.50	100
Human capital								
Count	0	62	9	0	8	0	9	88
Percentage %	0	70.45	10.23	0	9.09	0	10.23	100
All IC disclosure								
Sum	1	206	83	48	114	11	169	632
Percentage %	0.16	32.59	13.13	7.59	18.04	1.74	26.74	100