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# Exploring the R&D Disclosure Environment

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**SYNOPSIS:** In this exploratory study, a series of interviews with analysts and firm executives, supplemented with an analysis of annual report disclosures, is used to provide insights into the research and development (R&D) disclosure environment within which technology-intensive firms operate. The interviews cover questions of interest to both professional and academic accounting audiences, including the types of R&D information which firms reveal and analysts use, managers' concerns with revealing proprietary or bad news R&D information, the potential benefits from effective R&D disclosure management, and views on deferring vs. expensing development expenditures. The content analysis provides a description of the quantity, subject matter, and location of the R&D disclosures contained in 113 Toronto Stock Exchange-listed firms' annual reports. Finally, the regression analysis explores the association between six disclosure environment factors (R&D expense proportion, accounting policy for development expenditures, [cross-] listing status, industry, capital structure, and firm size) and the amount of R&D disclosure firms provide.

**Data Availability:** Please contact the author regarding the availability of the study data.

## INTRODUCTION

The announcement by New York University of its Intangibles Research Center (Lev 1997, 136) highlighted the critical importance of understanding the "complex and little understood" issues relating to intangibles' disclosure. The announcement also challenged researchers to develop "feasible and informative new disclosure schemes for intangibles" (Lev 1997, 137). To help provide this understanding, and in response to Lev's (1997) challenge, this exploratory study reports the results from field interviews with technology analysts and firm executives regarding various research and

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development (R&D)[1] disclosure issues. The study also documents and analyzes the R&D disclosures contained within a set of publicly listed firms' annual reports.

The study's results, in particular the description of the types of R&D information provided by firms and used by analysts, should be of interest to standard setters charged with developing relevant disclosure standards for intangible assets. The results should also interest analysts and creditors seeking to evaluate firms' R&D expenditures, executives involved in designing R&D disclosure strategies, and researchers exploring voluntary disclosure.

The paper is organized as follows. Section two describes the interviews with the technology analysts and firm executives. Section three then provides a descriptive analysis of 113 publicly listed firms' R&D disclosures, while Section four provides a statistical analysis of the disclosures. Section five summarizes the study.

## INTERVIEWS WITH ANALYSTS AND FIRM EXECUTIVES

A series of field interviews were carried out in Spring 1995 with 15 of Canada's top technology analysts, and with 21 executives from many of Canada's leading technology-based firms.[2] The analysts included 12 sell-side and three buy-side analysts employed, respectively, in Canada's largest brokerage houses and investment management firms. The analysts' portfolios contained technology hardware (hardware), software development (software), and biotechnology/pharmaceutical (biotech) stocks. The executives, primarily the Vice President-Finance or Corporate Relations, or the Chief Financial Officer, worked in firms engaged in hardware, software, and biotech. Each interview lasted from one to four hours and explored various R&D disclosure issues.[3] Described next are the main findings from the interviews.

### Types of R&D Information Disclosed/Used

The interviews explored the types of information firms disclose to help communicate the value created from their R&D expenditures, and which analysts use to help value such expenditures. The responses of the two groups were quite consistent and can be divided into six main[4] and 18 subcategories,[5] encompassing both quantitative

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[1] The study focuses on R&D for two main reasons: (1) the significant (and increasing) resources devoted to R&D (industrial spending in the United States for 1997 U.S.$133B vs. 1970 U.S.$10.4B [U.S. Department of Commerce 1998, 609]; in Canada for 1997 Cdn$8.6B vs. 1963 Cdn$176M [Statistics Canada 1997, 19]) and, (2) the "expensing bias" levelled at existing R&D accounting standards (e.g., E&Y 1994; Brennan 1992; Nix and Peters 1988; Solomons 1986; Horwitz and Kolodny 1980).

[2] The analysts were all located in Toronto while the firms (all TSE-listed) were located throughout southwestern Ontario.

[3] A semi-structured research instrument, consisting of eight questions for analysts and 14 for executives, was used to guide the interviews. Where necessary for clarification, a question was expanded upon by the researcher. Notes were taken throughout the interview, after which the notes were self-reviewed for completeness and understanding. If additional clarification was deemed necessary, the interviewee was contacted. As an additional reliability check, within two to three days following the interview, the respondents were provided with a typed summary of their responses, and were asked to contact the researcher regarding any inaccuracies or omissions.

[4] Of the six main categories, both the analysts and executives considered "Outputs," "Inputs," and "Accounting/Financial" as most important in communicating the value of the firm's R&D investment. The biotech analysts were also extremely interested in "Financing" information, this interest motivated by the substantial costs and time involved in bringing biotech firms' products to market.

[5] Appendix A provides examples of R&D-type information within these subcategories.

(financial and nonfinancial) and qualitative information.[6]

The first category, "Inputs," is information describing how the firm has invested its R&D expenditures. This information can be subcategorized into: (1) descriptions of the product being researched or developed, (2) the people or parties involved in performing the R&D, and (3) the firm's physical R&D infrastructure. The second category, "Outputs," is information regarding the outcome, both actual and potential, from the R&D expenditures. The relevant subcategories include: (1) actual product development achievements (e.g., numbers of new products developed, development progress being made), (2) actual achievements beyond product development (e.g., revenues, market share), (3) potential achievements (e.g., estimated market size for the product), and (4) timing issues (e.g., proposed date for product launch). The third category, "Future Expenditures," describes the firm's future R&D expenditure plans. This information can be divided into: (1) the estimated dollar spending, and (2) the proposed focus of the spending.

Information in the fourth category, "Financing," is information regarding how the firm finances its R&D. This information can be divided into the financing source for: (1) past and current year's R&D spending, and (2) future spending. The fifth category, "Accounting/Financial," is information having an accounting or financial-analysis orientation. The relevant subcategories include: (1) comparisons of current year's R&D spending to prior years, (2) comparisons of R&D spending to competitors, (3) comparisons of current year's R&D spending to budget, (4) R&D spending ratios (e.g., R&D expense as a percent of revenues), (5) how the R&D spending explains various firm financial results (e.g., R&D expense as major cause of net loss), (6) reasons for changes from prior year's R&D spending, and (7) discussions regarding the firm's R&D accounting policies. The sixth and final category, "Strategy," is R&D information of a highly "strategic" tone.[7]

## Revealing Proprietary R&D Information

The theoretical literature (e.g., Verrecchia 1983) suggests that when making disclosure decisions, firms trade-off the costs of revealing proprietary information (e.g., losing competitive advantage) with the resulting benefits (e.g., a more accurate share price). This study finds empirical evidence of this trade-off within an R&D context.

First, the interviews revealed that 12 executives were "very concerned" about the potential negative effects from their R&D disclosure. This concern was most commonly expressed in terms of competitors using the disclosure to usurp the firm's competitive advantage, an advantage crucial when operating in an environment of short product-life cycles and limited windows of opportunity. Also cited as a concern was the possibility of the firm negatively affecting its customers' competitive advantage, an advantage closely tied to that of the disclosing firm. One executive also expressed concern lest their R&D disclosures violate nondisclosure agreements in place with existing or potential customers, or with joint development partners.

In contrast, nine executives were "not very concerned" with revealing proprietary R&D information. Indeed, two executives firmly believed that such disclosure resulted in a net benefit by enabling other companies to tie their products to the disclosing firm's technology. Three other executives also noted that their firm's strength was in the "application" of its technology. Consequently, it was highly unlikely that their R&D disclosure

[6] Amir and Lev's (1996) study similarly found that within the wireless communications industry, both financial and nonfinancial information is necessary for proper firm valuation.

[7] This information also does not fit neatly into any of the previous five main categories.

would reveal information sufficient to cause negative consequences. Two other executives similarly suggested that their firm need not reveal its "core" technology in order to communicate effectively its R&D message. Additional reasons for a lack of concern included the protection provided by patents, the existence of nondisclosure agreements with receiving parties, the fact technology moves sufficiently fast to overcome any negative effects from disclosure, and that to reveal sufficient information to cause a problem would require "vast and unrealistically large amounts" of disclosure.

### Revealing "Bad News" about R&D

The theoretical literature supports "bad news" disclosure for such reasons as changing market expectations to be consistent with those of the firm (Ajinkya and Gift 1984), reducing the incentive of competitors to enter a firm's market (Dontoh 1989), or as a means of reducing potential legal costs (Skinner 1994). In this study, empirical support for bad news disclosure is provided in that 19 of 21 executives agreed that their firms would reveal bad R&D news to the market.[8] Two other executives also stated that their firms would disclose bad R&D news, but only "if it had to."

When asked why they revealed bad R&D news, nine executives mentioned the need to manage the market's expectations (consistent with Ajinkya and Gift's [1984] conjecture), three executives stated that it helps the firm maintain credibility with outside parties, and two executives stated that such disclosure helps explain the firm's financial performance. Other reasons included an appreciation of firms' honesty by customers or by the investment community, a perceived legal obligation, consistency with accounting conservatism, and, for one biotechnology firm, an ethical responsibility to patients. One executive also supported such disclosure on the grounds that his firm capitalizes some development costs and hence maintains a heightened awareness of the need to reveal relevant bad news.

Some executives also discussed why disclosing bad R&D news might have "minimal" impact on the firm. For example, three executives noted that their firm's R&D projects are not complete "hit or miss" affairs, hence it is highly unlikely they would ever have completely bad news. Indeed, any bad news generally relates to product delays, not to problems with the firm's technology. Other reasons included having initially set realistic expectations, the fact that educated investors recognize that not all R&D will be successful, or that the firm already expenses its R&D for accounting purposes.

### Benefits from "Effective" R&D Disclosure Management

The executives and analysts were also asked to identify the benefits accruing to firms that "effectively" manage their R&D disclosure. The executives listed numerous benefits, the most common being helping the firm to manage outside parties' (e.g., analysts') expectations regarding its future performance.[9] This was followed by having the disclosure communicate the "critical importance" of R&D, showing how the R&D fits within the firm's overall activities, and revealing the firm's strategic vision. Other benefits included communicating the firm's "technology leadership," convincing readers the R&D will lead to profit, revealing that "lots of R&D" is being done, and meeting

[8] Skinner's (1994) study also contained empirical support.

[9] This benefit, operationalized in terms of various properties of analysts' forecasts, has been linked to disclosure "effectiveness" in previous empirical research. See for example, Healy et al. (1998) and Lang and Lundholm (1996).

regulatory reporting requirements. Only one executive expected its R&D disclosure would result in a more accurate stock price.[10]

The analysts also identified numerous benefits from effective R&D disclosure management, the most common being enhancing the firm's credibility or reputation with outside parties, with this credibility, in turn, leading to various other benefits. The second most common benefit was in moderating the "volatility" of the firm's stock price, followed by better managing analysts' expectations. Other benefits mentioned by more than one analyst included a "fairer" stock price, increased analyst coverage, easier access to financing, controlling the release of potentially harmful proprietary information, and increasing the likelihood of outside investment. Two additional benefits were also identified, neither having been mentioned previously in the voluntary disclosure literature. First, the analysts suggested that effective disclosure management could result in "better" analysts following the firm (e.g., the key industry analysts). This contrasts with simply increasing the "number" of analysts following the firm, a benefit commonly examined in the disclosure literature (e.g., Lang and Lundholm 1996). Second, a policy of fully disclosing all R&D information, in particular information on the firm's "R&D failures," can serve as an additional "control" function within the firm by helping to minimize questionable R&D expenditures.

**Monitoring R&D Disclosure Effectiveness**

The executives were also asked how they monitor the effectiveness of their R&D disclosure, with the most common, and most effective method, being face-to-face discussions with outside parties. Second most common, albeit characterized as an "imprecise" method, is through analyzing the firm's stock price; this includes both price movement upon initial disclosure, and absolute stock price. Other monitoring methods included examining the content of analysts' reports, assessing the "stability" of the shareholder base, watching the "body language" of investors at investor presentations, measuring the number and tone of articles written about the firm, and comparing the firm's stock multiples to competitors.

**R&D Disclosure Philosophy**

When next asked to characterize their firm's overall R&D disclosure philosophy, 15, three, and three executives labeled their philosophy as "conservative," "aggressive," and "mid-range," respectively. When asked their reasons, most "conservative" firms pointed to maintaining realistic outsider expectations, while others mentioned maintaining consistency with the firm's overall business philosophy, with industry norms, with the firm's overall accounting policies, or with the disclosure philosophy regarding other firm activities. The "aggressive" firms meanwhile cited the need to educate outside parties about their technology, creating a profile of having the "latest and greatest" products, or the need to remain on par with their "disclosure-oriented" U.S. competitors. Finally, the "mid-range" firms suggested they aggressively promote only their leading-edge products, or that at least some disclosure is necessary for the firm to be more appropriately (and more preferably) viewed as "high-tech" and not as "light manufacturing."

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[10] The biotech executives in particular highlighted a tenuous link between their firms' R&D disclosure and its stock price, noting their stock price is much more heavily influenced by other "leading" biotech firms' product failures or successes.

**Expense or Defer Development Expenditures?**

Finally, both the executives and analysts discussed "expensing" vs. "deferring and amortizing" development expenditures. In total, 17 of 21 executives opposed deferral, each citing numerous reasons. Reasons mentioned more than once included avoiding creating negative perceptions about the firm, the fact that expensing is viewed positively by the investment community, and that no negative impact results from an expense-only policy. Other reasons included avoiding having to manage future write-downs, not wanting to become an industry anomaly, the difficulty in valuing technology sufficient to warrant deferral, cross-listing on a U.S. exchange where deferral is not allowed, a user focus on cash, and a preference for losses now in exchange for higher profits in the future.

In contrast, four executives were unopposed to deferral, each also citing multiple reasons. A "history" of deferral was the only reason mentioned more than once, with other reasons being a preference for matching (due to long-term development benefits), the fact large dollar amounts are invested in the development projects, or, conversely, that the dollar amounts being deferred were relatively immaterial. One firm also noted that deferral provided them the ability to "derive" an R&D expense, which, when calculated as a percentage of current period revenues, signals to the market this expected percentage in the future. Further, and most importantly, the deferral option allowed the firm some "control" over its reported financial results.

The majority of analysts (11 of 15) also opposed deferral. Reasons included a preference for conservative accounting, the possibility of large lump-sum write-offs, an inability of firms to adequately predict the future, the fact that few R&D projects ever come to fruition, an ability to manipulate income, a preference for "quality" earnings, and that expensing helps remind management that the cash outlay has been made. When asked what their actions would be should a firm defer development costs, the analysts mentioned adjusting their investment models, potential arguments with management over EPS predictions, questioning of management's credibility, and (perhaps most seriously) an unwillingness to recommend investing in such firms.

Four analysts meanwhile were unopposed to deferral, but only under certain conditions. These included where the firm has a good R&D track record, where the development expenditure "upgrades" an existing product, where the firm is not considered "development-stage," and where the deferred amount was less than 10 percent of the total R&D investment for the period.

On balance, these findings suggest that managers of R&D-intensive firms, along with the analysts who follow such firms, are not uncomfortable with the existing R&D accounting standards, which tend to favor the immediate expensing of development expenditures. Consequently, the findings should also provide pause for reflection by those parties (e.g., E&Y 1994; Brennan 1992; Solomons 1986) advocating changes to R&D accounting standards.

## ANNUAL REPORT R&D DISCLOSURES—DESCRIPTIVE ANALYSIS

Gibbins et al. (1990) stated that financial reporting regulations prescribe only "minimum" disclosure requirements. Further, these regulations neither restrict managers from voluntarily providing additional disclosure, nor determine the characteristics (e.g., nature, form) of the disclosure. Hence, firms are provided substantial scope for "managing" disclosure, including, in this study, disclosures relating to R&D

expenditures.[11] This section provides some insights into firm's R&D disclosure management practices by describing the results of a content analysis[12] of R&D disclosures contained in the annual reports of 113 Toronto Stock Exchange (TSE) listed firms.[13] In total, 10,025 R&D disclosures[14] are described.

### Quantity of R&D Disclosure

As seen in Table 1, the 113 firms devoted, on average, 89 sentences in their annual reports to describing their R&D expenditures, ranging from a low of 26 sentences for traditional[15] firms to 171 for biotech firms. The maximum number of R&D disclosures by one firm was 350, while three firms (two traditional, one software) had no R&D disclosures in their annual reports.

### Subject Matter of R&D Disclosure

In terms of subject matter, and using the R&D information-type categories described in section two, Table 2 shows that Outputs disclosures dominate, ranging from 63.8 percent of the R&D disclosures for traditional firms to 84.2 percent for software firms. Within the Outputs' subcategories, the disclosures were first on actual achievements either on or beyond product development, next on potential achievements, and finally, at a much lower level, on product timing. The second most common R&D disclosures were Inputs, in particular, product-related information. These were followed by Accounting/Financial disclosures (primarily comparisons of current to prior year's R&D expense), then information regarding Future Expenditures. Financing and Strategy disclosures were least common. The one exception to this overall disclosure pattern was for biotech firms, where financing issues, primarily of future expenditures, were third most common.

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[11] Canadian reporting requirements (OSC 1989; CICA 1978) require TSE-listed firms that expense their R&D to disclose the R&D expense amount. Firms that defer development costs must disclose additional accounting information (e.g., amortization period) regarding the amounts deferred. Descriptions of the projects deferred is not required.

[12] In carrying out the content analysis, a detailed coding protocol was used (and is available from the author). To ensure an "acceptable" level of coding reliability, a graduate accounting student coded eight randomly selected annual reports. The overall agreement rate between the author and student was: for disclosure quantity (73 percent), for subject matter (79 percent), and for location (100 percent). In assessing the "acceptability" of these rates, it must be noted that the content analysis literature provides no minimum recommended reliability levels. Relatedly however, the marketing literature suggests that for "early stage" research, coefficient alpha levels (a commonly used reliability measure) of .50 to .60 suffice (Churchill 1979). It should also be noted that none of the disagreements identified in this study's reliability check were of a systematic nature. Further, in all cases of disagreement, the final agreed-upon coding was consistent with the author's original coding.

[13] The 113 firms are listed in Appendix B and include all firms listed on the TSE at June 1994 that recorded an R&D expense in their latest financial statements, and for which an annual report was available for examination. They include 40 firms with years ending in 1993, 70 in 1994, and three in 1995.

[14] In applying content analysis methodology, the enumeration system is a matter of researcher choice, with no single unit of measurement (e.g., word, sentence, paragraph, theme) either inherently superior, or immune to criticism. Consistent with previous disclosure research (e.g., D'Aveni and MacMillan 1990; Bettman and Weitz 1983), the unit of measure in this study is the *sentence*, defined in the *Concise Oxford Dictionary* (1990, 1103) as "a set of words complete in itself as the expression of a thought." Where individual sentences contained more than one "thought" (i.e., the *sentence* provided information in two or more R&D categories or subcategories), each "thought" was considered a separate disclosure. Of the 10,025 disclosures, 816 (8.1 percent) were multiple disclosure sentences.

[15] "Traditional" firms (refer to Appendix B) are involved in relatively less technology-intensive industries, such as chemical and fertilizers, and household goods.

**TABLE 1**
**Quantity of R&D Disclosure**

| | Traditional (n = 36) | Hardware (n = 42) | Software (n = 17) | Biotech (n = 18) | All (n = 113) |
|---|---|---|---|---|---|
| Total | 945 | 3,794 | 2,202 | 3,084 | 10,025 |
| Average | 26 | 90 | 130 | 171 | 89 |
| Median | 23 | 83 | 109 | 147 | 64 |
| Percentile (<25%) | 10 | 41 | 56 | 101 | 27 |
| Percentile (<75%) | 40 | 130 | 166 | 259 | 130 |
| Range | 0–91 | 4–217 | 0–350 | 26–338 | 0–350 |

**TABLE 2**
**Subject Matter of R&D Disclosure**
**(as a percentage of total R&D disclosure)**

| Categories and Subcategories | Traditional (n = 36) | Hardware (n = 42) | Software (n = 17) | Biotech (n = 18) | All (n = 113) |
|---|---|---|---|---|---|
| **Inputs** | **18.6%** | **11.7%** | **5.5%** | **15.3%** | **12.1%** |
| Product | 13.3 | 7.6 | 4.9 | 10.0 | 8.3 |
| People | 4.5 | 3.2 | 0.5 | 4.6 | 3.1 |
| Infrastructure | 0.8 | 0.9 | 0.2 | 0.7 | 0.7 |
| **Outputs** | **63.8** | **76.3** | **84.2** | **68.0** | **74.3** |
| Actual Achievements (Product Development) | 24.1 | 24.4 | 26.2 | 23.0 | 24.4 |
| Actual Achievements (Beyond Product Development) | 23.3 | 33.5 | 32.8 | 15.5 | 26.9 |
| Potential Achievements | 12.2 | 15.5 | 23.4 | 25.2 | 19.9 |
| Product Timing | 4.2 | 2.9 | 1.8 | 4.3 | 3.1 |
| **Future Expenditures** | **3.3** | **3.0** | **2.8** | **5.5** | **3.7** |
| Dollar Amount | 1.4 | 0.9 | 0.7 | 1.3 | 1.0 |
| Focus | 1.9 | 2.1 | 2.1 | 4.2 | 2.7 |
| **Financing** | **0.9** | **1.9** | **1.1** | **7.1** | **3.3** |
| Source—Past/Present | 0.7 | 1.1 | 0.6 | 2.1 | 1.3 |
| Source—Future | 0.2 | 0.8 | 0.5 | 5.0 | 2.0 |
| **Accounting/Financial** | **9.2** | **5.2** | **5.8** | **3.5** | **5.1** |
| Comparisons—Prior Years | 5.2 | 2.5 | 2.1 | 1.7 | 2.4 |
| Comparisons—Competition | 0.2 | 0.1 | 0.0 | 0.0 | 0.1 |
| Comparisons—Budget | 0.0 | 0.2 | 0.2 | 0.1 | 0.1 |
| R&D Ratios | 0.8 | 1.0 | 1.2 | 0.1 | 0.8 |
| R&D as Explanator | 0.6 | 0.7 | 0.4 | 1.1 | 0.7 |
| Explaining R&D Change | 1.4 | 0.3 | 0.7 | 0.4 | 0.5 |
| Accounting Policy | 1.0 | 0.4 | 1.2 | 0.1 | 0.5 |
| **Strategy** | **4.2** | **1.9** | **0.6** | **0.6** | **1.5** |
| Total | 100% | 100% | 100% | 100% | 100% |

### Location of R&D Disclosure

In analyzing the location of the R&D disclosures, each report was divided into five parts: the audited financial statements, the management discussion and analysis (MDA), a separate R&D section, a signed letters section (e.g., Chairman's and/or President's letter), and the corporate overview (i.e., the remainder of the report). Table 3 shows that consistent across all four groups, the most common location for R&D disclosure is the corporate overview, containing just over half the disclosures (50.8 percent), and ranging from a low of 46.0 percent for traditional firms to 57.9 percent for hardware firms. Second most common is the MDA, ranging from 17.3 percent for hardware firms to 28.3 percent for software firms. Third most common was the signed letters portion, averaging 18.9 percent of the firms' disclosures. Thirty-seven of the 113 firms also had a separate section in their annual report devoted solely to R&D. On average, each such section contained 18 disclosures, ranging from 2.0 percent of total R&D disclosures for software firms to 18.2 percent for traditional firms. Finally, and of particular note for standard setters, only 1 percent of firms' voluntary R&D disclosures (less than one sentence per annual report) were found within the audited financial statements.

## ANNUAL REPORT R&D DISCLOSURES—STATISTICAL ANALYSIS

Consistent with prior disclosure studies (e.g., Kasznik and Lev 1995; Lang and Lundholm 1993), this study assumes that firms' R&D disclosures are linked to various environmental factors. In this section, six[16] factors are examined, using regression analysis[17] with two factors: current year's R&D expense amount as a percentage of total operating expenditures, and accounting policy for development expenditures of specific interest. Table 4 provides the descriptive statistics for these six factors. The remainder of this section describes the factors and presents the regression results.

[16] A seventh factor, absolute R&D expense amount, was removed due to its high correlation (r = .963) with firm size.

[17] The regression analysis focuses on the "quantity" of R&D disclosure provided.

**TABLE 3**
**Location of R&D Disclosures**
**(as a percentage of total R&D disclosure)**

| Annual Report Location | Traditional (n = 36) | Hardware (n = 42) | Software (n = 17) | Biotech (n = 18) | All (n = 113) |
|---|---|---|---|---|---|
| Financial Statements | 1.2% | 0.5% | 0.6% | 1.3% | 1.0% |
| MDA[a] | 22.0 | 17.3 | 28.3 | 25.6 | 22.7 |
| Separate R&D Section[b] | 18.2 | 7.0 | 2.0 | 6.1 | 6.6 |
| Signed Letters[c] | 12.6 | 17.3 | 22.7 | 20.2 | 18.9 |
| Corporate Overview[d] | 46.0 | 57.9 | 46.4 | 46.8 | 50.8 |

[a] Fourteen firms (9 hardware, 4 software, 1 traditional) had no MDA section in their annual report. Ten of these 14 met specific stock exchange exemption limits (OSC 1989, Part I, para. 5).

[b] Thirty-seven firms (12 traditional, 15 hardware, 4 software, 6 biotech) had a separate R&D section. There is no formal regulatory requirement for such a section.

[c] Two firms' annual reports (1 hardware, 1 software) had no signed letters section.

[d] One software firm's annual report had no corporate overview.

**Environmental Factors**

Critics of existing R&D accounting standards (e.g., Brennan 1992; Solomons 1986) point to an inherent "expensing bias"[18] in the standards, claiming they result in financial statements that fail to communicate the value created from a firm's R&D investment. This study explores whether R&D disclosure is used to help compensate for this bias, and expects such disclosure to increase as the proportion of the firm's operating expenditures devoted to R&D increases.

In Canada, firms that defer development expenditures signal to the market that their development has met five restrictive criteria, including establishing the product's technical feasibility, having a clearly defined market, and having adequate resources to complete the development (CICA 1978). Concurrently, management also signals that the "value" of the development is at least as great as the deferred amount, otherwise a write-down would be required. This study explores whether the firm's decision to defer affects its R&D disclosure. However, whether the effect is to increase (i.e., the need to justify the deferral) or decrease (i.e., a reduced need for further information) disclosure is, *a priori*, not clear.

Listing status (i.e., cross-listing on a U.S. exchange) is included as a factor as evidence exists that Canadian firms cross-listed on a U.S. exchange perceive higher potential litigation costs than noncross-listed firms (Core 1997). Relatedly, Skinner (1994) found evidence that firms increase disclosure to help mitigate (i.e., preempt) potential legal costs. Hence, cross-listing should be associated with increased R&D disclosure. Industry is included as a factor as firms operating in the same industry are considered to face similar operating and institutional environments and, hence, are subject to similar disclosure pressures (Craswell and Taylor 1992; Givoly and Palmon 1982). Capital structure is included as researchers (e.g., Smith and Warner 1979; Jensen and Meckling 1976) have suggested that firms with higher debt may increase disclosure as a means of reducing agency costs. Finally, firm size is included because the disclosure literature (e.g., Kasznik and Lev 1995; Scott 1994) has found it to be consistently positively associated with increased disclosure, an association often explained in terms of economies of scale in information production and dissemination (e.g., Lang and Lundholm 1993).

**Regression Results**

Table 5 shows the regression equation and reports the regression results.[19] An adjusted $R^2$ of .505 ($p < .000$) suggests the overall model possesses reasonably strong explanatory power. Of specific interest and not surprisingly, the results indicate that management significantly increases its R&D disclosure as the proportion of its expenditures devoted to R&D increases, possibly to compensate for the "expensing bias." In contrast, the results fail to find a significant association between the firm's accounting policy for development expenditures and the quantity of R&D disclosure provided, suggesting that managers may view the "deferral" accounting policy decision as a sufficient signal to the market.

[18] The R&D accounting standards in Canada (Section 3450, CICA 1978) and the United States (SFAS No. 2, FASB 1974; SFAS No. 86, FASB 1985), require all operating expenditures on research to be expensed immediately, while development-type expenditures can be capitalized, but only under restrictive conditions. These latter conditions are more severe in the United States as the capitalization option extends only to computer software; in Canada, any development cost is potentially capitalizeable.

[19] The Pearson correlation coefficients and variance inflation factors (see, Judge et al. 1988) for each independent variable suggested minimal collinearity and multicollinearity concerns, respectively. Also, as a robustness check on the overall statistical tests, both regressions (for the 113 and 77 firms [see footnote 20]) were recalculated assuming a Poisson distribution for the dependent (count) variable (see, Miller 1998; Greene 1997). The original results held.

**TABLE 4**
**R&D Disclosure Environment Factors**

| Variable | Categories | Traditional (n = 36) | Hardware (n = 42) | Software (n = 17) | Biotech (n = 18) | All Firms (n = 113) |
|---|---|---|---|---|---|---|
| Current Year's R&D Expense Amount[a] as a Percentage of Total Current Operating Expenses[b] | Avg. | 1.8 | 11.0 | 16.0 | 41.0 | 14.0 |
| | Max. | 11.0 | 44.0 | 51.0 | 100.0 | 100.0 |
| | Min. | 0.1 | 0.3 | 0.6 | 1.2 | 0.1 |
| Accounting Policy for Development Expenditures | Expense | n = 29 | n = 27 | n = 4 | n = 18 | n = 78 |
| | Defer | n = 7 | n = 15 | n = 13 | n = 0 | n = 35 |
| Listing Status | Cdn Only | n = 27 | n = 30 | n = 9 | n = 9 | n = 75 |
| | Cross-Listed[c] | n = 9 | n = 12 | n = 8 | n = 9 | n = 38 |
| Capital Structure[d] | Avg. | 27% | 18% | 17% | 23% | 23% |
| | Max. | 58% | 63% | 50% | 65% | 65% |
| | No LTD | n = 4 | n = 18 | n = 10 | n = 10 | n = 42 |
| | < or = 20% | n = 12 | n = 16 | n = 5 | n = 4 | n = 37 |
| | > 20% | n = 20 | n = 8 | n = 2 | n = 4 | n = 34 |
| Firm Size (Total Assets in Cdn$) | Avg. | $2.7B | $1.7B | $55.0M | $72.0M | $1.5B |
| | Max. | $54.0B | $56.0B | $178.0M | $720.0M | $56.0B |
| | Min. | $5.6M | $2.0M | $1.5M | $2.4M | $1.5M |

[a] This amount excludes the amortization of previously deferred development costs.
[b] Total current operating expenses exclude taxes, unusual and extraordinary items, minority interest, and equity losses.
[c] Cross-listed firms are listed on both the Toronto Stock Exchange and one of the following U.S. exchanges: New York Stock Exchange, American Stock Exchange, NASDAQ.
[d] Measured as the ratio of long-term debt to long-term debt plus shareholders' equity.

Of the four remaining environmental factors, the results indicate that listing status strongly affects the amount of R&D disclosure firms provide, with cross-listed firms providing significantly more disclosure. This finding may, as Skinner (1994) posited, result from the firm's desire to use disclosure to preempt potential litigation costs. The findings

also provide partial support for industry disclosure norms.[20] Finally, the results fail to find any significant association between either the firm's capital structure or its size, and the amount of R&D disclosure provided; the size result in notable contrast to most empirical disclosure research findings.

## SUMMARY

In this study, field interviews and an annual report analysis were used to provide exploratory insights into the R&D disclosure environment within which technology-based firms operate. One such insight is that the types of information that firms reveal to help communicate the value of their R&D expenditures, and that analysts use to help value such expenditures, can be divided into six main categories and 18 subcategories, encompassing both quantitative and qualitative components.

The field interviews also revealed the following: (1) that cost/benefit analyses are made prior to deciding on R&D disclosure (as predicted in the literature), (2) that multiple benefits can result from properly managing R&D disclosure (most notably ensuring realistic expectations, and enhanced management credibility), (3) that face-to-face discussions are the primary means by which firms monitor the effectiveness of their R&D disclosures, and (4) that both executives and analysts tend to oppose deferring development expenditures. This latter finding should be of particular interest to accounting standard setters, and suggests that disclosure may be the preferred means for communicating relevant R&D information.

The annual report analysis, meanwhile, revealed that biotech firms provide by far the greatest amount of R&D disclosure, averaging 171 sentences per annual report. Biotech firms were followed by software (130 sentences), hardware (90), and traditional (26) firms. Half of the firms' R&D disclosures were contained within the corporate overview section of the annual report, with the majority describing the actual and potential outputs resulting from the R&D expenditures.

Finally, the regression analysis revealed that two environmental factors: the current year's R&D expense as a percentage of total current operating expenses, and (cross-) listing status, help explain the amount of R&D disclosure provided by technology-based firms. Industry affiliation also provided a partial explanation. Conversely, the firm's accounting policy for development expenditures, its capital structure, and its size, had no significant association with R&D disclosure.

Future research could test the R&D information categories against the views of other technology analysts, other user groups, and other firm managers. Such research should also extend beyond the Canadian setting. Research could also analyze R&D disclosures contained within other communication media.[21] Finally, the research might fruitfully extend to measuring the impact (e.g., stock price effect, analyst following) resulting from adopting various R&D disclosure strategies (e.g., disclosing information encompassing one or more categories or subcategories).

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[20] The "traditional" firms, as seen in Table 1, provide far less R&D disclosure than any of the three groups of "technology-intensive" firms. When the regressions were recalculated excluding the 36 traditional firms, the industry effect disappeared ($p = .139$; $p = .388$).

[21] The executive interviews revealed that firms use a multitude of media, both print-based (27 types, e.g., annual reports, press releases) and nonprint-based (14 types, e.g., conference calls, analysts' meetings) to disclose R&D information. Similarly, the analysts identified 52 different sources they use to obtain information regarding firms' R&D expenditures. These include sources controlled (e.g., annual reports, press releases, prospectuses) and not controlled (e.g., trade press, customers, competitors, former employees) by the firm.

**TABLE 5**
**Regression Results**

| Variable | Unstandardized Coefficient | t-statistic | Significance Level |
|---|---|---|---|
| **RDprop** | 155.2 | 3.8 | **.000** |
| **Accpol** | 21.1 | 1.5 | .143 |
| **XList** | 46.5 | 3.8 | **.000** |
| **Ind1** | 43.3 | 2.9 | **.004** |
| **Ind2** | 58.3 | 2.7 | **.008** |
| **Ind3** | 77.1 | 3.4 | **.001** |
| **Capst1** | 9.4 | .65 | .521 |
| **Capst2** | –5.7 | –.35 | .729 |
| **Size** | 7.2E-10 | .93 | .356 |
| **Constant** | –40.6 | NA | NA |

**Adjusted $R^2$ (.505) F (13.7) Significance Level (.000)**

The regression equation is as follows:

$$\text{Disc} = \alpha_0 + \beta_1\text{RDprop} + \beta_2\text{Accpol} + \beta_3\text{XList} + \beta_4\text{Ind1} + \beta_5\text{Ind2} + \beta_6\text{Ind3} + \beta_7\text{Capst1} + \beta_8\text{Capst2} + \beta_9\text{Size} + \varepsilon$$

where:

| | | |
|---|---|---|
| Disc | = | total quantity (number of sentences) of R&D disclosure in the annual report. |
| RDprop | = | current year's R&D expense as a percentage of the firm's total current operating expenses. |
| Accpol | = | dummy variable equal to 1 if the firm's accounting policy for development expenditures is to defer, and 0 to expense. |
| XList | = | dummy variable coded as 1 if cross-listed on a U.S. exchange, and 0 if not cross-listed. |
| Ind1 | = | dummy variable coded as 1 if hardware, and 0 if software, biotech, or traditional. |
| Ind2 | = | dummy variable coded as 1 if software, and 0 if hardware, biotech, or traditional. |
| Ind3 | = | dummy variable coded as 1 if biotech, and 0 if software, hardware, or traditional. |
| Capst1 | = | dummy variable coded as 1 if the ratio of long-term debt to long-term debt plus shareholders' equity is greater than 0 percent and less than or equal to 20 percent, and 0 if greater than 20 percent, or no long-term debt. |
| Capst2 | = | dummy variable coded as 1 if the ratio of long-term debt to long-term debt plus shareholders' equity is greater than 20 percent, and 0 if greater than 0 percent and less than or equal to 20 percent, or no long-term debt. |
| Size | = | firm's total assets. |

## Appendix A
### Types of R&D Information

| Main and Subcategories | Examples (taken from annual reports) |
|---|---|
| **Inputs** | |
| Product | "Alcan has invested $100 million over ten years in its aluminum vehicle technology (AVT)." (Alcan Aluminum Limited, 1994, 8) |
| People | "The research group, comprised of 50 highly skilled technicians, technologists and professional employees, including 12 with Ph.D.s, carries out large numbers of studies during a year." (Cominco Ltd, 1994, 19) |
| Physical Infrastructure | "The company invested $4.3 million in fixed assets in the year, which was comprised primarily of tools and related equipment for its researchers." (ABL Canada Inc., 1993, 6) |
| **Outputs** | |
| Actual Achievements (Product Development) | "In April 1994, Sony announced the development of a 1.35 -inch, 16:9 LCD device with 514,000 pixels." (Sony Corporation, 1994, 5) |
| Actual Achievements (Beyond Product Development) | "The large increase in MouseStick sales is the result of the new version of the MouseStick II that was introduced in January 1993" (Advanced Gravis Computer Technology Inc., 1994, 8) |
| Potential Achievements | "In North America alone, AlphaNet sees the initial market for InnFax service as being 530,000 rooms in twenty first class hotel chains and high-end independents." (AlphaNet Telecom Inc., 1994, 13) |
| Timing Issues | "New versions of DMR Architecture, not offered commercially before, and of DMR Productivity Plus will be launched in the first half of the year." (DMR Group Inc., 1994, p.9) |
| **Future Expenditures** | |
| Dollar Amount | "Research and development expenses are assumed to increase from US$0.6 million (11.9% of revenue) to US$1.1 million (7.3% of revenue)." (AlphaNet Telecom Inc., 1994, 12) |
| Focus | "The initial development project with CIBA Vision will be a clinical study of QLT's second-generation compound, Benzoporphyrin derivative (BPD) as a potential treatment for Age-Related Macular Degeneration (AMD)." (Quadra Logic Technologies Inc., 1994, 4) |
| **Financing** | |
| Source—Past/Current | "Grants received from government and industry reached $276,000, an increase of $92,000 from the previous year." (Scintrex Limited, 1993, 5) |
| Source—Future | "The company will be able to meet its financial obligations and continue its R&D projects through internally generated funds and borrowings." (DMR Group Inc., 1994, 17) |

## Appendix A (Continued)

| Main and Subcategories | Examples (taken from annual reports) |
|---|---|
| **Accounting/Financial** | |
| Comparisons—Prior Years | "Gross Research and Development expenditures surpassed 1992 by $187,000 to $1,251,000." (Scintrex Limited, 1993, 5) |
| Comparisons—Competition | "Inco is a nickel industry leader in research and development." (Inco Limited, 1993, 13) |
| Comparisons—Budget | "R&D expenses were $640 thousand greater than forecast." (AIT Advanced Information Technologies Inc., 1994, 13) |
| Ratios | "Research & Development: 3.1% of Revenues." (Advanced Gravis Computer Technology Inc., 1994, 9) |
| R&D as Explanator | "Operating results for 1993 reflect the heavy commitment to research and development and the costs of introducing new products." (ABL Canada Inc., 1993, 3) |
| Explaining R&D Change | "The increase (in R&D) was primarily due to costs incurred to enhance Moore's proprietary digitized signature recognition hardware and software." (Moore Corporation Limited, 1994, 20) |
| Accounting Policies | "Management concluded in June 1991 that the continued deferral of tool development costs was no longer warranted given the existing conditions in the energy services industry." (Computalog Ltd., 1993, 19) |
| **Strategy** | "Inco's research programs are closely aligned with business objectives in order to support the Company's strategic direction." (Inco Limited, 1993, 13) |

## Appendix B
## Industry Group and Company Name

| Industry | Company Name | |
|---|---|---|
| **Technology Hardware "Hardware" (n=42)** | ABL Canada Inc. | Memotec Communications Inc. |
| | Advanced Gravis Computer Technology Inc. | Mitel Corporation |
| | AIT Advanced Information Technologies Corporation | Mosaid Technologies Incorporated |
| | AlphaNet Telecom Inc. | National Hav-Info Communications Inc. |
| | Arrowlink Corp. | Newbridge Networks Corporation |
| | ATI Technologies Inc. | NII Norsat International Inc. |
| | CAE Inc. | Northern Telecom Limited |
| | Calian Technology Ltd. | Offshore Systems International Ltd. |
| | Canadian Marconi Company | Plaintree Systems Inc. |
| | C-MAC Industries Inc. | QSound Labs, Inc. |
| | Develcon Electronic Ltd. | Sidus Systems Inc. |
| | Disys Corporation | Sony Corporation |
| | DY 4 Systems Inc. | Spar Aerospace Limited |
| | Eicon Technology Corporation | Spectrum Signal Processing Inc. |
| | Epic Data International Inc. | SR Telecom Inc. |
| | Gandalf Technologies Inc. | Tee-Comm Electronics Inc. |
| | Gennum Corporation | Telepanel Systems Inc. |
| | Global Election Systems Inc. | TIE/Telecommunications Canada Limited |
| | International Verifact Inc. | Triple Crown Electronics Inc. |
| | ISG Technologies Inc. | TSB International Inc. |
| | LSI Logic Corporation of Canada Inc. | Xillix Technologies Corporation |
| **Software Development "Software" (n = 17)** | Accugraph Corporation | Intera Information Technologies Corporation |
| | BMB Compuscience Canada Ltd. | International Retail Systems Inc. |
| | Cableshare Inc. | Microstar Software Limited |
| | Cognos Incorporated | Modatech Systems Inc. |
| | Corel Corporation | OCS Technologies Corp. |
| | Delrina Corporation | Promis Systems Corporation Ltd. |
| | Geac Computer Corporation Limited | The Quartex Corporation |
| | Hummingbird Communications Ltd. | Softkey International Inc. |
| | | Speedware Corporation Inc. |
| **Biotechnology/ Pharmaceutical "Biotech" (n = 18)** | Allelix Biopharmaceuticals Inc. | Deprenyl Research Limited |
| | Alta Genetics Inc. | Dusa Pharmaceuticals, Inc. |
| | Biochem Pharma Inc. | Glyko Biomedical Ltd. |
| | Biomira Inc. | Hemosol Inc. |
| | Bioniche Inc. | Imutec Corporation |
| | Biovail Corporation International | International Murex Technologies Corporation |
| | Cangene Corporation | MDS Health Group Limited |
| | Continental Pharma Cryosan Inc. | Microbix Biosystems Inc. |
| | Deprenyl Animal Health Inc. | Quadra Logic Technologies Inc. |

## Appendix B (Continued)

| Industry | Company Name | |
|---|---|---|
| **"Traditional" Firms (n = 36)** | | |
| Chemicals & Fertilizers (7) | Celanese Canada Inc.<br>D.A. Stuart Ltd.<br>DuPont Canada Inc.<br>Potash Corporation of Saskatchewan Inc. | Sherritt Inc.<br>Sico Inc.<br>Synergistics Industries Limited |
| Household Goods (7) | Camco Inc.<br>Canstar Sports Inc.<br>CCL Industries Inc.<br>Cinram Ltd. | Dorel Industries Inc.<br>GSW Inc.<br>Scott Paper Limited |
| Fabricating & Engineering (3) | Haley Industries Limited<br>Shaw Industries Ltd. | SNC LAVALIN Group Inc. |
| Electrical & Electronic Products (3) | Autrex Inc.<br>Electrohome Limited | Scintrex Limited |
| Integrated Mines (3) | Alcan Aluminum Limited<br>Cominco Ltd. | Inco Limited |
| Business Services (2) | DMR Group Inc. | Moore Corporation Limited |
| Specialty Industries (2) | H.E.R.O. Industries Ltd. | Unican Security Systems Ltd. |
| Telephone Utilities (2) | Quebec Telephone | Teleglobe Inc. |
| Building Materials (1) | Lafarge Corporation | |
| Nonbase Metal Mines (1) | Cameco Corporation | |
| Oil & Gas, Mining, or Forest Services (1) | Computalog Ltd. | |
| Machinery & Structural Steel (1) | Varity Corporation | |
| Paper & Forest Products (1) | Domtar Inc. | |
| Tobacco (1) | Imasco Limited | |
| Transportation Equipment (1) | Foremost Industries Inc. | |

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