

# Business R&D: Describing the context for R&D measures in New Zealand firms

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## **JEL Classification**

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C14 Semiparametric and Nonparametric Methods  
L25 Firm Performance: Size, Diversification, and Scope

## **Keywords**

Research and Development, Quantitative Methods, Nonparametric Methods, Firm Behaviour, Firm Profit, Firm Size

*The views expressed in this paper are those of the author only and do not necessarily represent the views of the Ministry of Research, Science and Technology.  
Any errors are due entirely to the author.*

## ABSTRACT

New Zealand collects national statistics about business research and development (R&D). The survey method follows the OECD Frascati manual in that the definition of R&D is consistent with the international standard, and the sampling method and survey questions are carefully designed. Biennial reports are completed with charts showing expenditure breakdowns by size and industry classification etc.

While we control the definition of R&D and the survey methodology, little is known about the practices used by firms to report on their R&D activity. This problem was identified in the 1950s when R&D surveys were first set up. At that time, both the United States Bureau of Census and National Science Foundation believed that only better accounting practices could correct the measurement errors caused by firms.

To investigate the quality of reporting in New Zealand firms, MoRST commissioned three complementary surveys in 2008. Techniques borrowed from evaluation were used to investigate to what extent firms were able to quantify and describe their R&D programmes. Non-parametric statistical techniques were used to analyse results.

The surveys' results built up a picture of how well firms were organised to report R&D. A follow-up study of 13 individual firms verified that the survey findings were reliable. The results provide valuable insights into business R&D practices, particularly the relationship between the level of firm commitment to R&D and other measures of R&D management.

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## 1 INTRODUCTION

New Zealand has collected official statistics about expenditure on research and development (R&D) as part of its national accounting for the economy since 1994. The Ministry of Research Science, and Technology (MoRST), and Statistics New Zealand (Statistics NZ) collaborate on the national biennial Research and Development in New Zealand survey (R&D survey).<sup>1</sup> Government agencies use the statistics for policy and budget decision-making and social science and economics researchers also use the data. The OECD includes New Zealand R&D statistics in its Science, Technology and Industry reports.<sup>2</sup>

Early attempts to measure annual expenditure on science began just prior to WWII in the UK and USA. These studies reported considerable margins for error as the definition of R&D was arbitrary, methods were inconsistent, and accounting practices were divergent. In the early 1950s, US accountant, RN Anthony, author of the Harvard Business School survey, believed that accounting practices could result in variations of up to 20 percent for industrial R&D numbers. Both the US Bureau of Census and the National Science Foundation believed that only better accounting practices could correct such errors.<sup>3</sup>

Chris Freeman, a British Economist, developed the first international methodology for R&D statistics almost 50 years ago in 1962. At that time, R&D was believed to be 'systematic' where it was carried out in 'organised' research facilities. As these laboratories kept separate accounts, this distinction aided statistics collection. This was the age of modernism.

The methodology, published by the OECD, is known as the Frascati manual has done a great deal to standardise the definition of R&D and the survey methodology. The manual cannot however, control the accounting practices of firms.<sup>4</sup>

Assumptions about firm behaviour colour our interpretation of business R&D data, including international comparisons. However, if we know little about firm behaviour – what is in the 'black box' – it is very hard to interpret shifts in national R&D statistics.

There are long-held assumptions about the quality of R&D management in firms. Management is assumed to be better in larger than smaller firms,<sup>5</sup> in manufacturing than service firms, and in firms where research is the core business.<sup>6</sup>

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<sup>1</sup> [www.morst.govt.nz/publications/statistics](http://www.morst.govt.nz/publications/statistics) or <http://www.stats.govt.nz/economy/innovation-and-science/researchanddevelopment.htm>

<sup>2</sup> E.g. [http://www.oecd.org/document/36/0,3343,en\\_2649\\_34273\\_41546660\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/36/0,3343,en_2649_34273_41546660_1_1_1_1,00.html)

<sup>3</sup> Benoit, G. (2008) The making of statistical standards: The OECD and the Frascati Manual, 1962-2002. Project on the History and Sociology of STI Statistics Working Paper No. 39 <http://www.csiic.ca/>

<sup>4</sup> *Ibid.*

<sup>5</sup> Schumpeter's Hypothesis

[http://books.google.co.nz/books?id=iNCzHP2a0YcC&pg=PA244&lpg=PA244&dq=economics++Schumpeter++R%26D+%22firm+size%22+theory&source=bl&ots=HHF6z0qbPD&sig=egy3q58Lg4Em1MZ0I\\_9\\_N17maJc&hl=en&ei=YlksSrDVDaa6tAOI2Q3eCg&sa=X&oi=book\\_result&ct=result&resnum=9](http://books.google.co.nz/books?id=iNCzHP2a0YcC&pg=PA244&lpg=PA244&dq=economics++Schumpeter++R%26D+%22firm+size%22+theory&source=bl&ots=HHF6z0qbPD&sig=egy3q58Lg4Em1MZ0I_9_N17maJc&hl=en&ei=YlksSrDVDaa6tAOI2Q3eCg&sa=X&oi=book_result&ct=result&resnum=9)

<sup>6</sup> Ministry of Research, Science and Technology (2006) *The development of a time series of Business Enterprise R&D Statistics: Methodology of Research and Development in New Zealand – A Decade in Review*. <http://www.morst.govt.nz/publications/a-z/r/decade-in-review/methodology/>

This paper first identifies the New Zealand context for national business R&D statistics then reports on recent studies of the quality of R&D management in firms.

## 2 New Zealand Context

This New Zealand context for measuring R&D in firms is described in this section under the headings: R&D definition, survey methodology and accounting practices.

### R&D Definition

The Frascati definition of R&D<sup>7</sup> has been consistently applied in all New Zealand R&D surveys. The wording and presentation has been modified over the years to better relate to local firms. Variation in respondents' understanding of the definition of R&D and of the survey questions contribute to measurement errors in R&D surveys. The impact of these errors is unknown.

Outside of the R&D survey, firms are unlikely to come across the Frascati definition. New Zealand has not had an R&D tax credit, except for 2008/09, and so firms have had little previous incentive to develop a formal understanding of R&D.

### Survey Methodology<sup>8</sup>

The completion and return of the New Zealand R&D survey is a compulsory requirement under the Statistics Act 1975. The response rate for businesses is 85 percent or better. This high response rate should mean that there is a low non-response bias in results.

Data in the survey is protected by the Statistics Act 1975 (section 37) and must only be used for statistical purposes. Data must not be related in any way that identifies individual firm information. This requirement goes further than confidentiality and Statistics NZ checks all data outputs from the survey to ensure that they meet requirements.

The survey methodology has developed in stages. New Zealand's first two surveys (1994 and 1996) were a census of known R&D performers. Understandably, a census approach became too unwieldy, and in 1998 and 2000, firms with lower R&D expenditure in the 1996 survey were excluded. The impact of this change on the calculated value of business expenditure on R&D (BERD) was minimal (1%).

In 2002 and 2004, there were major comparability breaks in the survey methodology. The Statistics NZ Business Frame was used to derive the 2002 and later survey populations. In 2004 sampling methodology, all known significant R&D firms, large firms with high turnover and firms in the 'scientific research' industry were selected; medium-size firms had a high probability of selection and smaller firms had a low

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<sup>7</sup> Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.

<sup>8</sup> Ministry of Research, Science and Technology (2006) *The development of a time series of Business Enterprise R&D Statistics: Methodology of Research and Development in New Zealand – A Decade in Review*. <http://www.morst.govt.nz/publications/a-z/r/decade-in-review/methodology/>

probability of selection. Surveys from 2004 include an allowance for other (unknown) firms that conduct R&D.

The 2004 changes in sampling approach meant that the statistics for BERD were higher; there was a step change. This did not mean that the results from the 2004 were wrong; in fact, they may be better. It is impossible to measure the break created by the new methodology precisely.

Typically, between survey years, the language and layout of the survey is reviewed and any modifications undergo cognition testing. For 2008, the survey was updated to use the Australia New Zealand Standard Research Classification (ANZSRC)<sup>9</sup> and Statistics NZ completed a specialised upgrade of the sampling approach to reduce sampling errors.

Sampling errors are much higher for data from firms of fewer than ten employees than for firms with 10–50 employees.<sup>10</sup> The difference in sampling error is a factor of the smaller sample size and larger population of smaller firms compared to larger firms. The impact of non-sampling errors is comparatively larger for smaller-size firms.

Non-sampling errors arise from the strategy for the imputation/estimation of values for non-responding businesses. The error is more significant for larger businesses.

## Accounting practices

Accounting practices aim to provide financial information and to facilitate rational economic decisions for the effective management and control of R&D. Accountants may be familiar with the New Zealand standard for accounting for research and development activities in general purpose financial reports.<sup>11</sup> Formal accounting processes allow firms to report R&D expenditure externally for statistical, funding or other purposes.

The R&D survey reports note that accounting practices of firms will result in measurement errors because many respondents do not keep separate accounts of their R&D expenditure, and firms may include non-R&D scientific and technological services, such as consulting in their expenditure figures. No significant work has been done in New Zealand on the accounting practices of firms for reporting R&D, and so there was no estimate of the impact of firms accounting practices on R&D statistics.<sup>12</sup>

The R&D management practices of New Zealand firms in the 2008 year are important as this year immediately preceded the introduction of the R&D tax credit.<sup>13</sup> Previously,

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<sup>9</sup> ANZSRC 2008 is a collaboration between the Australian Bureau of Statistics and Statistics New Zealand. ANZSRC 2008 meets OECD guidelines and is aligned to the OECD's Frascati Manual, and the 2006 Fields of Science and Technology classification.

<http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/1297.0Media%20Release12008?opendocument&tabname=Summary&prodno=1297.0&issue=2008&num=&view=>

<sup>10</sup> Employment is reported as a rolling mean employment: <http://www2.stats.govt.nz/domino/external/omni/omni.nsf/wwwqslry/Rolling+mean+employment>

<sup>11</sup> Financial Reporting Standard 13 is the accounting standard for R&D. Companies that report to shareholders have a legal requirement to apply FRS-13.

[http://www.nzica.com/AM/Template.cfm?Section=Financial\\_Reporting\\_Standards\\_FRS\\_&Template=/CM/HTMLDisplay.cfm&ContentID=15239](http://www.nzica.com/AM/Template.cfm?Section=Financial_Reporting_Standards_FRS_&Template=/CM/HTMLDisplay.cfm&ContentID=15239)

<sup>12</sup> Madhu Bala (2006) found empirically that accounting practices for R&D expenditure is a factor in firm profitability. [crl.du.ac.in/2006/CHAPTER%2011.pdf](http://www.crl.du.ac.in/2006/CHAPTER%2011.pdf)

<sup>13</sup> The New Zealand R&D tax credit operated for one year only from April 2008 to March 2009.

many firms had little incentive to develop accounting practices for R&D expenditure.  
The 2008 surveys aimed to record practices just prior to the credit.

### 3 PROBLEM DEFINITION

While we control the definition of R&D and the survey methodology in our R&D survey, little is known about the practices used by firms to report on their R&D activity.

The purpose of the studies this paper is based on was to unravel aspects of the management of R&D by firms. This would help us better understand national R&D statistics.

We were seeking a baseline for subsequent comparison studies on:

- 1 How good is the definition of R&D used by firms when reporting R&D?
- 2 How well do firms document their R&D activities?
- 3 How well developed are firms' systems for recording R&D expenditure?
- 4 What difficulties do firms have in externally reporting of R&D?
- 5 What expectations do firms have for their R&D activity in the next financial year?

In addition to providing baseline information, the survey data provided an opportunity to test assumptions, based on economic theory, that MoRST has held about the different capabilities of large and small firms, and of science research firms with respect to their understanding of the Frascati definition of R&D and their record-keeping practices.<sup>14</sup>

- 1 Frascati definition of R&D assumptions:
  - Larger firms have less difficulty than smaller firms
  - Manufacturing firms have less difficulty than service firms
  - Small science research firms have less difficulty than other small firms
  - Larger firms have a greater propensity to perform Frascati R&D rather than market research or cosmetic improvement work.
- 2 Firm record-keeping practices assumptions:
  - firms without specialist R&D units (small firms) would apply 'best guess'
  - firms with 10–50 employees would keep better records than small firms
  - firms with 50+ employees would keep the best records

Questions about measurement errors associated with firm behaviour are not unique to New Zealand. Norway, for example, is questioning whether the possible tendency of under reporting R&D by businesses may be a general phenomenon in their country, and considers that it may be an international challenge within the field of R&D statistics.<sup>15</sup>

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<sup>14</sup> Ministry of Research, Science and Technology (2006) *The development of a time series of Business Enterprise R&D Statistics: Methodology of Research and Development in New Zealand – A Decade in Review*. <http://www.morst.govt.nz/publications/a-z/r/decade-in-review/methodology/>

<sup>15</sup> [www.AVIANA.com/blog/?p=38](http://www.AVIANA.com/blog/?p=38)



## 4 METHOD

MoRST commissioned three complementary surveys of the management of R&D by firms.<sup>16</sup> They ran in the second part of 2008, prior to the global economic crisis and before firms could claim the tax credit.

### Samples

The sample for each study was stratified to provide a particular perspective. The ‘medium–firm study’ was stratified by size, industry and geography to provide a picture that was similar to the national one, but biased toward larger firms. The ‘small–firm study’ focussed on small firms and the ‘national R&D survey’ was drawn from the 2008 R&D survey.<sup>17</sup>

The medium–firm study provided early data (August 2008) on 121 firms and in depth case studies of 13 firms. The case studies verified that self–reporting was sufficiently accurate for our purposes. The small–firm study brought in data from 252 R&D–active smaller firms, which are under–represented in the R&D survey. These studies may have non–response biases. The national study included 500+ R&D active firms. These firms had weighting data that we used to develop a national picture of R&D management.

### Questions

The studies each asked a set of similar evaluative questions about management of R&D. Each question was followed by a set of 3–5 objective ‘descriptors’. Firms chose the descriptor that best described what the firm was doing. This approach is much more robust than the simple 3–5 point Likert item commonly used in questionnaires.<sup>18</sup>

The survey writers tailored the language for their audience and survey tool. For example, the workshop–based medium–firm study used more business language and referred to the R&D tax credit directly. The postal small–firm study was more personal and general, and did not mention the R&D tax credit. The R&D survey used the more neutral and specific language of national surveys (see Table 1 below).

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<sup>16</sup> Reports can be obtained from: <http://www.morst.govt.nz/publications/evaluations/rd-tax-credit/>

<sup>17</sup> Data is embargoed at time of paper submission to conference convenor, and will be supplied later as an annex.

<sup>18</sup> A Likert item consists of two parts: a stem, which is simply a statement of an attitude, and a scale on which people express their agreement with that statement. <http://www.actualanalysis.com/likert.htm>

TABLE 1 EXAMPLE QUESTION

STUDY	QUESTION	DESCRIPTORS
Medium-firm study	Which of the following best describes the systems your firm has to record R&D expenditure?	<ul style="list-style-type: none"> <li>• No formal recording of R&amp;D expenditure</li> <li>• R&amp;D expenditure recorded, but not separately accounted for in financial statements</li> <li>• R&amp;D expenditure recorded and separately accounted for in financial statements</li> </ul>
Small-firm study	Which of the following best describes how you record your R&D expenditure?	<ul style="list-style-type: none"> <li>• I keep separate records of R&amp;D expenditure at each project stage</li> <li>• I keep separate records of R&amp;D expenditure for the overall project, but not at each project stage</li> <li>• I keep no separate records of R&amp;D expenditure, but we have timesheets that can be used to figure out time spent</li> <li>• I keep no records at all that could be used to identify R&amp;D expenses</li> </ul>
National R&D survey	Which of the following best describes the systems this organisation currently has for reporting expenditure on in-house or external R&D?	<ul style="list-style-type: none"> <li>• Separate reporting of expenditure and costing methods at each R&amp;D project stage</li> <li>• Separate reporting of R&amp;D and non-R&amp;D related expenditure</li> <li>• R&amp;D and non-R&amp;D related expenditure recorded together under common expense categories</li> </ul>

## Statistics

Null hypotheses were developed to investigate the assumptions held about the behaviour of firms as described in section 3 above. The statistical test used to test the hypotheses was the non-parametric Pearson's Chi-square test of independence.

Nonparametric statistical procedures are designed for ordinal or nominal data.<sup>19</sup> The Person's Chi-square test for independence tests whether observations from two or more actual samples (in this study size classes or industry types) differ from each other.

The statistical testing used data in the form of counts. The number of degrees of freedom was one and the p value (probability value) was 0.05. This means that there was a five percent chance that a null hypothesis is rejected when it is in fact true.

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<sup>19</sup> Nominal data has only classification e.g. male or female; Ordinal data has classification and order – the classifications can be ranked but not measured e.g. hungry, starving and famished.

## 5 RESULTS – DESCRIPTIVE STATISTICS

### Definition of R&D

Generally, familiarity with a formal definition of R&D was low. This is not surprising. It is worth noting that R&D is defined by the OECD for the purpose of obtaining national statistics rather than for describing creative and purposeful problem solving.<sup>20</sup>

Medium-sized firms were genuinely concerned and confused about the details of a formal definition of R&D. Their greatest concern about reporting R&D figures for the R&D tax credit was identifying what should or should not be included as R&D, and identifying whether the firm sufficiently met the R&D tax credit criteria. This issue was of greater concern to firms than their systems for documentation or reporting expenditure was.

Most small firms had an informal understanding of R&D. Fifty-seven percent of R&D-active small firms reported that they go with their ‘gut feeling’ when deciding whether an activity was R&D or not.

Interestingly, in the small-firm study, 15 percent of the R&D-active firms (n = 57) had done some personal study or had attended a workshop on R&D. The investment in learning had helped them to identify whether their firm engaged in R&D.

### Record keeping

This paper reports on two aspects of R&D record keeping – project documents and expenditure records. These two aspects equate with the 2002 Frascati manual advice that the business criterion of “creative work undertaken on a systematic basis” is fulfilled by a project that has “specific goals” and a “budget”.

Comprehensive project documents were reported by about 15 percent of firms in the medium and small firm studies. About 70 percent of firms had a less systematic approach, involving some formal papers, or an informal system of notes and memos.

Almost 15 percent of firms that reported doing R&D in each of the small- and medium-firm studies kept no written documentation at all. It would be difficult to justify a project as R&D where its ‘specific goals’ were not documented. Twenty-two percent of the medium firms reported that their R&D programme was *ad hoc* and random.

The similarity of results between the two studies is remarkable, indicating that firm size is not a determinant in quality of R&D documentation. Closer analysis of the small-firm data found no difference in the quality of documents between micro and small firms.<sup>21</sup>

Comprehensive expenditure records of R&D by project stage were kept by 26 percent of the medium-firm sample and 13 percent of the small-firm sample. Another 36 percent

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<sup>20</sup> Godin, B. (2008) The Making of Statistical Standards: The OECD and the Frascati Manual, 1962-2002 Project on the History and Sociology of STI Statistics Working Paper No. 39 Page 32

<sup>21</sup> Full time equivalent employees in micro firms < 6; small < 50 staff and medium < 100. EU definition, using head count: micro is < 10; small < 50 and medium is < 250. [europa.eu/rapid/pressReleasesAction.do?reference=IP/03/652&format=PDF&aged=1&language=EN&guiLanguage=en](http://europa.eu/rapid/pressReleasesAction.do?reference=IP/03/652&format=PDF&aged=1&language=EN&guiLanguage=en)

of medium and 22 percent of small-firm study participants kept separate records of R&D at the project level.

Twenty-two percent of the small-firm sample reported keeping timesheets, from which the firms could presumably derive basic records of expenditure, but these alone would provide insufficient evidence that the project had 'a budget'.

Thirty-one percent of the medium and 45 percent of the small-firm samples that reported that they were doing R&D kept no records at all of R&D expenditure. These too would have no evidence that their R&D projects had 'a budget'.

Two-thirds of the medium-firm sample discussed R&D expenditure at senior management level. Just under half of these firms recorded R&D in financial statements, and/or reported formally to senior management.

External reporting of expenditure in the R&D survey has not been very accurate or consistent. Seventeen percent of firms questioned, reported that they had applied the R&D definition provided on the R&D survey. A larger proportion (43 %) said that they adapted their figures to the supplied definition if possible; otherwise, they applied their own definition. The financial reporting standard (FRS-13) was used by 23 percent, and the other 17 reported that they used their own (non-Frascati or FRS-13) definition.

As 57 percent of the small-firm sample had used their 'gut feeling' rather than a formal definition of R&D, there is significant potential for accounting errors.

For the medium and small firm samples, the proportion of firms that were clearly meeting Frascati documentation (specific goals) and expenditure recording (a budget) thresholds at the time of the study was 10 percent. For both samples, a further 30 percent were likely to meet both documentation and expenditure record thresholds with relatively little effort.

## **Barriers**

Participants in the medium-firm identified that their understanding the definition of R&D was the most significant issue faced when reporting R&D activities and expenditure. Next were difficulties with project documentation and the availability of staff time and resources. Difficulties with R&D expenditure systems rated ahead of having no difficulties.

## **Next financial year**

Forty-four percent of the medium- and 65 percent of the small-firm samples expected no change in the amount of R&D they would do or fund in the next financial year.

## 6 RESULTS – NON-PARAMETRIC STATISTICS

The following table presents the null hypothesis and Chi-square results for the small- and medium firm studies. Data from the national R&D survey will be available at the conference.

TABLE 2 NULL HYPOTHESES AND SUMMARY RESULTS

	NULL HYPOTHESIS	CHI-SQUARE RESULT
1	Large and small firms do not differ in their understanding of R&D	Rejected: Small-firm study found that firm size was clearly related to the firm owner-managers' understanding of R&D.
2	Service firms and manufacturing firms do not differ in their understanding of R&D	Generally accepted: In the medium-firm study, there was no overall pattern of industry sector dominance in firm responses. In the small-firm study, "I go with my gut feeling" was more common in the service sector than for manufacturers but there was no difference in the level of personal study to learn about R&D between sectors.
3	Small science research firms do not differ from small non-science research firms in their understanding of R&D	Only tested in national R&D survey, but proxy data from small-firm study suggest that this null hypothesis should be rejected.
4	Large firms and small firms do not differ in the ratio of R&D to related activities	Only tested in national R&D survey
5	Small, medium and large firms do not differ in the quality of their project documents	Accepted: In the small-firm study, small and micro firms did not differ in their quality of R&D documentation
6	Small, medium and large firms do not differ in the quality of their expenditure records	Accepted: In the small-firm study, small and micro firms did not differ in their quality R&D expenditure records

## 7 ADDITIONAL POINTS OF INTEREST FROM THE SMALL-FIRM STUDY

### Level of expenditure on R&D

The level of expenditure on R&D was a better indicator of quality of records than firm size in the small-firm study. While 48 percent of firms with R&D expenditure over \$20,000 kept separate records of their R&D expenses, only 26 percent of firms with \$20,000 or lower R&D expenditure did this.

More than one quarter (28 %) of firms with estimated R&D expenses of over \$20,000 per year kept no records at all for R&D expenses, and another 25 percent of these firms only kept timesheets from which to derive R&D expenses.

### Effects associated with degree of commitment to R&D – proxy for science research firms

There was a clear link between the firm's understanding of R&D and its commitment to undertake R&D. Table 2 below shows that in firms where R&D was an integral part of their firm's work rather than something that was initiated periodically, more respondents had done personal study or had attended an R&D workshop rather than followed their 'gut feeling' to decide what constitutes R&D.

TABLE 3 RELATIONSHIP BETWEEN A FIRMS UNDERSTANDING OF WHAT R&D IS, AND THE FIRM'S LEVEL OF COMMITMENT TO R&D.

Understanding of what R&D is:	R&D is integral and core %	R&D is integral but peripheral %	R&D is periodic/ episodic %
I go with my gut feeling	29	42	58
If our R&D person, technician or contract provider does it, then it is R&D	21	20	12
Our tax accountant or equivalent will tell me	2	2	9
I have done some personal study or attended a workshop	49	39	21

There was a clear link between firm commitment to R&D and the quality of R&D documentation. In the small-firm study, firms where R&D was an integral part of the firm's work, rather than something initiated periodically, were statistically more likely to have formal documentation (The 13 case-studies of firms in the medium-firm study also found that firms with more comprehensive documentation viewed R&D as a core rather than peripheral business activity).

The contrary was also true – where firms initiated R&D on an *ad hoc* basis, documentation was also *ad hoc* or absent. There was also a strong link between the strength of a firm's commitment to R&D and the quality of expenditure recording.

## 8 CONCLUSIONS

The results have provided valuable insights into business R&D practices. This report assists our understanding of the quality of national R&D statistics and identifies that there is great variety in the quality of management of R&D in the private sector. R&D is recorded for projects that are unlikely to have specific goals or a budget (Frascati 2002). Conversely, R&D expenditure records for some firms may omit eligible expenditure.

Statistical analysis shows that some long-held assumptions about how well certain groups of firms understand the Frascati definition of R&D are potentially unfounded, as are assumptions about record keeping. These results serve to remind us of the importance of testing assumptions based on feeble or dated evidence.

On the other hand, small firms where R&D is core to the firms work (possibly science research and R&D intensive firms) have records that are superior to other similar-sized firms that undertake R&D on a more peripheral basis.

Because of the widespread weaknesses in the quality of R&D management, a new management incentive could cause a step change in national statistics without an underlying change in actual R&D activity. Nations with similar ratio of business R&D to GDP may have very different underlying profiles of firm-level R&D management.

This work presents evidence and a methodology that can inform international work on the challenge of the quality of firm R&D management to national R&D statistics.