The Commercial Contract R&D Industry: a Snapshot

This paper was written by the Service Industries and Capital Projects Branch (SICP) of Industry Canada. SICP worked in cooperation with and under the guidance of Statistics Canada in the extraction of the data from the "R&D in Canadian Industry Survey" administered by Statistics Canada. Statistics Canada was also very helpful in the editing stages of the document. Please direct any questions or comments on the document to Misa Palacek of SICP at (613) 941-6797; Internet: palacek.misa@ic.gc.ca.

Contract research in Canada is becoming increasingly important and, as such, SICP has developed this paper to supplement their existing work on the Canadian R&D services industry. The paper focuses on the performance of contract R&D by the Canadian business enterprise sector (BES). The BES includes commercially oriented enterprises, industrial not-for-profit organizations and trade associations. Data on contract R&D performed by the Canadian BES for non-affiliated firms in Canada or abroad, or for the federal government was reviewed.

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Introduction:

Using the 1995 Research and Development in Canadian Industry Survey (Survey), the Service Industries and Capital Projects Branch (SICP), in cooperation with and under the guidance of Statistics Canada, extracted data on the performance of contract R&D by the Canadian business enterprise sector (BES). The BES includes commercially oriented enterprises, industrial not-for-profit organizations and trade associations. Data on contract R&D performed by the Canadian BES for non-affiliated firms in Canada or abroad, or for the federal government[1] was reviewed.

R&D contract work done by the public sector, including provincial research organizations and universities, and by the BES for parties not listed above such as affiliated firms in Canada or abroad has been excluded from the analysis. This is not to suggest that this contract R&D activity is not important or significant, but merely that it goes beyond the scope of this report. These aspects of contract research are of great interest and, as such, will be the topic of future research by SICP.

The purpose of this paper is to present the data extracted in a straight forward and insightful manner (the complete data set has been included as Annex 1) and to support and supplement existing work by SICP on the Canadian R&D services industry. Neither the 1980 Standard Industry Classification (SIC) system nor the recently developed North American Industry Classification System (NAICS) treat R&D services as an industry, but rather categorizes them as an activity[2]. SICP, however, has begun to study the organizations, firms or otherwise, that provide these services as a distinct industry given their increasing numbers and growing importance to the knowledge-based economy.

Research and Development in Canadian Industry Survey:

The primary goal of this survey is to collect data on R&D in the BES in Canada in order to... "assure the availability of pertinent statistical information, to monitor science and technology related activities in Canada and to support the development of science and technology policy"[3]. The Survey is sent out to all business organizations in Canada recognized by Statistics Canada and its partners as performing R&D in Canada. These firms' R&D activities meet strict criteria taken from the OECD's Frascati Manual and used by Statistics Canada and Revenue Canada.

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[1] Contract work for the federal government does not include R&D activities financed through federal government grants or contributions.

[2] The NAICS do however have specific categories for scientific and research and development services; 54171, Research and Development in Physical, Engineering and Life Sciences; and, 54172, Research and Development in Social sciences and Humanities.

[3] Statistics Canada. "Research and development in Canadian industry, 1995 Survey", p. 1.

The OECD defines R&D as... "systematic investigation carried out in the natural and engineering sciences by means of experiment or analysis to achieve a scientific or technological advance." More precisely, "research is original investigation undertaken on a systematic basis to gain new knowledge" while... "development is the application of research findings or other scientific knowledge for the creation of new or significantly improved products or processes." Excluded from these definitional categories are:

1. market research and sales promotion;
2. quality control or routine analysis and testing of materials, devices or products;
3. research in the social sciences or the humanities;
4. prospecting, exploring or drilling for or producing minerals, petroleum or natural gas;
5. commercial production of a new or improved material, device or product or the commercial use of a new or improved process; and,
6. style changes, or routine data collection[4].

All organizations contacted are required by law to provide the necessary information thereby making the Survey the most comprehensive review of R&D activities of the BES. This survey offers an excellent opportunity to review the contract R&D activities of the sector in Canada.

Contract research in the BES:

For the purpose of this study, contract research has been defined as R&D contract work done by the BES for non-affiliated Canadian or foreign firms, or the federal government. Using this definition, 441 firms and non-revenue organizations[5] representing 97 different SIC codes were identified as performing some level of contract research in Canada in 1995. The majority of these organizations, 60 percent, are classified under Major Group 77-Business Service Industries and nearly 30% of them are categorized under SIC 7759, Other Scientific and Technical Services[6].

In 1995, the total value of Canadian contract research carried out by firms and non-revenue organizations amounted to nearly $631 million. This figure represents 8.2% of total intramural R&D expenditures made in Canada that year[7]. Firms alone accounted for the bulk of this

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[4] These are the definitions as they appear in Statistics Canada's Research and development in Canadian industry survey, 1995 Survey.

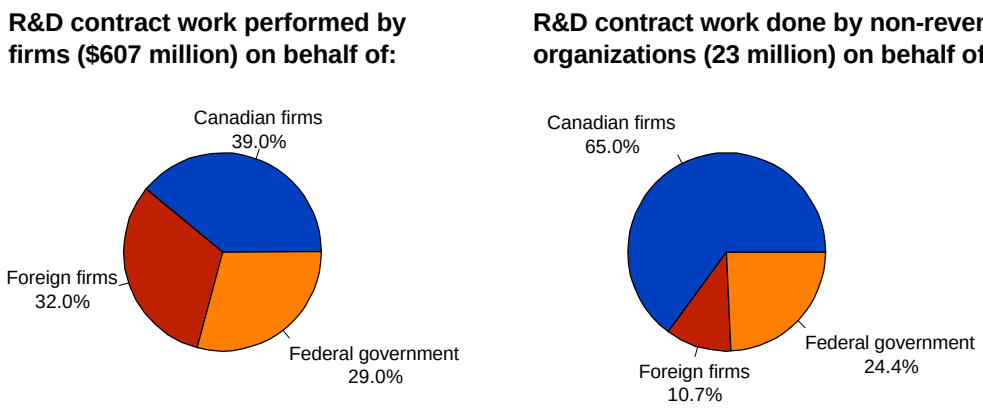
[5] Non-revenue organizations include all organizations that, on the Survey, reported having no revenues in 1995. These included industrial not-for-profit organizations and firms that did not report having any revenues in 1995.

[6] In a number of instances, firms have recorded having performed more contract R&D than stated revenues. While this does not compromise the report's analysis, it has been recognized as needing further investigation.

[7] Statistics Canada. *Industrial Research and Development: 1997 Intentions*, Catalogue No. 88-202, Ottawa, 1997, p. 59.

activity. They performed $607 million worth of R&D contract work while non-revenue organizations performed only $23.4 million worth. Figure 1 shows the distribution of this activity by the source of the contracts (consumer). In general, Canadian firms were the largest source of R&D contracts for both firms and non-revenue organizations.

Figure 1.
R&D Contract Work Performed by Firms and Non-Revenue Organizations, by Contract Source, 1995



Source: Annex 1, Table 5 and Table 9.

Concentration of R&D contract activity:

The BES presents an interesting dichotomy in terms of the composition of the firms performing R&D contract work. The majority of R&D contract work is done by either large firms which derive only a small portion of their total revenues from R&D contracts, or by relatively small firms that specialize in doing contract R&D. Firms that derive less than 10 percent of their revenues from R&D contracts accounted for $161.4 million of all R&D contract work identified while firms that specialize in similar work (those firms that derive 50 percent or more of their revenues from this work) accounted for $291.3 million in 1995. To provide some context, consider that the former group consists of 173 firms whose total revenues are over 150 times greater than that of the 116 firms that comprise the latter group.

Contract Research Organizations:

Contract Research Organizations (CROs) are defined as firms that specialize in contract research, those that derive 50% or more of their revenues from R&D contracts, and all non-revenue organizations carrying out some level of contract R&D. Of the 142 CROs identified, 116 were firms and 26 were non-revenue organizations. While the majority of CROs are classified under SIC's 7721 (Computer Services), 7752 (Offices of Engineers), 7759 (Other Scientific and

Technical Services) and 7771 (Management Consulting services), many other SICs are represented[8]. This suggests that there are niche market opportunities for highly specialized firms operating in a number of different industries to offer R&D contract services to these industries and that this is different from the situation in respect to the firms operating in Major Group 77 where the firms are offering R&D services to a number of different industries.

Sources of contracts:

CROs tend to have a broader base of clients than do firms that do R&D contract work on the side. As a result, CROs are less likely to rely on just a single source for R&D contract work, whether it be other Canadian or foreign companies, or the federal government. It is interesting to note that, while Canadian firms were the most popular source of R&D contracts, more than a quarter of CROs did no work at all for Canadian companies. Fifty-six percent of CROs identified listed the federal government as a source of R&D contracts and 30 percent of those identified listed foreign firms as a source.

Firms:

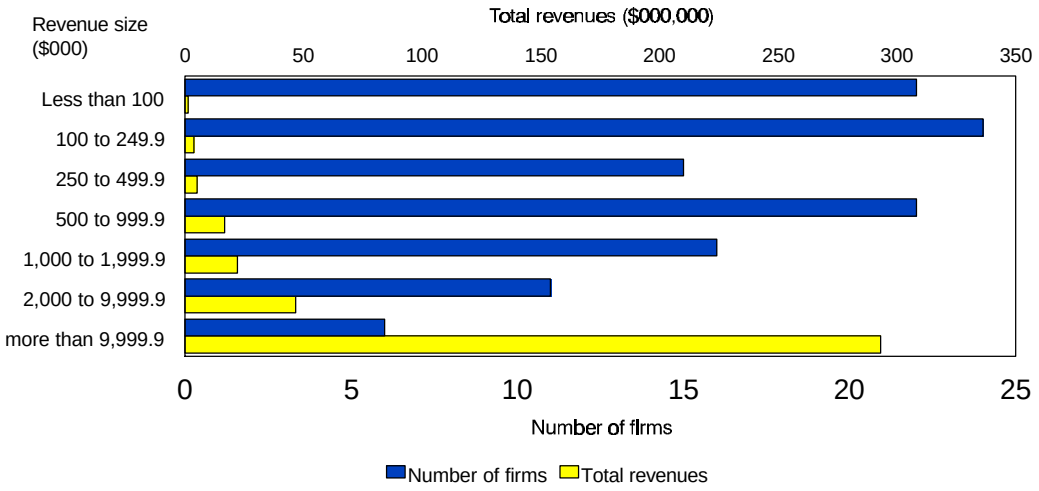
In general, firms that derive 50% or more of their revenues from R&D contract work tend to be small, with over half having revenues less than $1 million. Only six firms had revenues of $10 million or more; however, their total revenues were more than three times greater than that of all other firms together specializing in contract research. Figure 2 demonstrates that the total revenues of this group of firms are concentrated among a small number of larger firms.

The smallest firms tend to rely on federal government contracts for the bulk of their revenues and very little on contracts with unaffiliated foreign firms. As firms' revenues increased, their dependence on federal government contracts decreased and this is off set to a large degree by R&D contract revenues stemming from work done for unaffiliated foreign firms and to a lesser extent unaffiliated Canadian firms. In total, contracts with Canadian firms, foreign firms and the federal government accounted for 50, 34, and 16 percent of the approximately $291 million in R&D contract work performed by these firms.

Figure 2.
Total Revenues and Number of Firms that Derive 50% or More of their Revenues from

[8] This is consistent with the way in which the Frascati Manual (OECD; 1994) suggests data be collected on this type of organization. The manual recommends that firms or institutes whose principle activity is R&D for a specific industry should be categorized in the same SIC as that industry and not in a special CRO category.

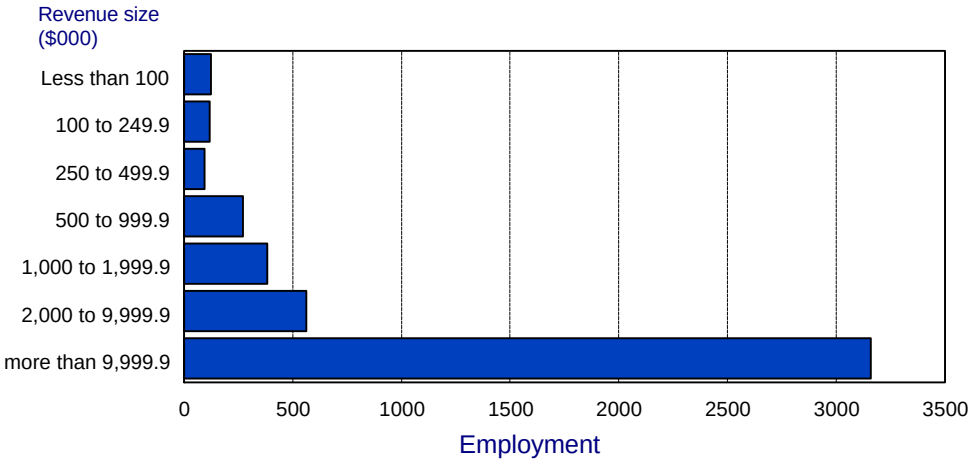
R&D Contracts, by Revenue Size, 1995



Source: Annex 1, Table 5.

The larger firms that specialized in R&D contract work also dominated in terms of employment. Of the 4,707 people employed by firms that specialized in contract R&D in 1995, 67 percent worked for firms whose revenues were equal to or greater than $10 million. Alternatively, the 83 firms that have revenues less than $1 million employed only 605 people. Figure 3 presents the employment figures broken down by firms' revenue size.

Figure 3.
Employment, Firms That Derive 50% or More of their Revenues from R&D Contracts, by Revenue Size, 1995



Source: Annex 1, Table 5.

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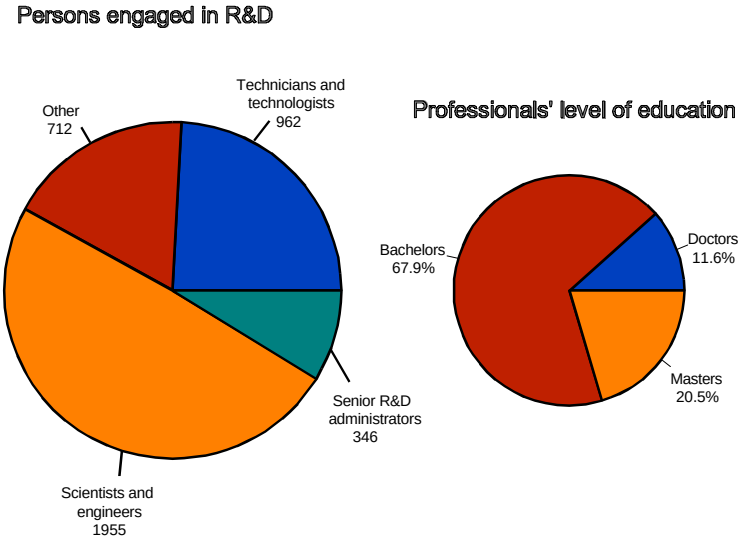
iven that “firm” CROs specialize in the provision of R&D services, it comes as no surprise that the vast majority, 84 percent, of their workforce is engaged in some form of R&D, whether it be contract R&D or R&D for the firm itself. Of this total, about half are scientists or engineers. Interestingly, the composition of the workforce engaged in R&D in different sized firms does not vary considerably when firm size is measured by revenues. However, smaller firms seem to have fewer support staff relative to the number of professionals engaged in R&D when compared to larger firms.

Figure 4 depicts the make up of the workforce engaged in R&D. It shows that of those employees engaged in R&D, the majority of them are university educated professionals.

Figure 4.
Number of Persons Engaged in R&D- Firms that Derive 50% or more of their Revenues from R&D Contracts, by Occupational Category, 1995



Source: Annex 1, Table 4.

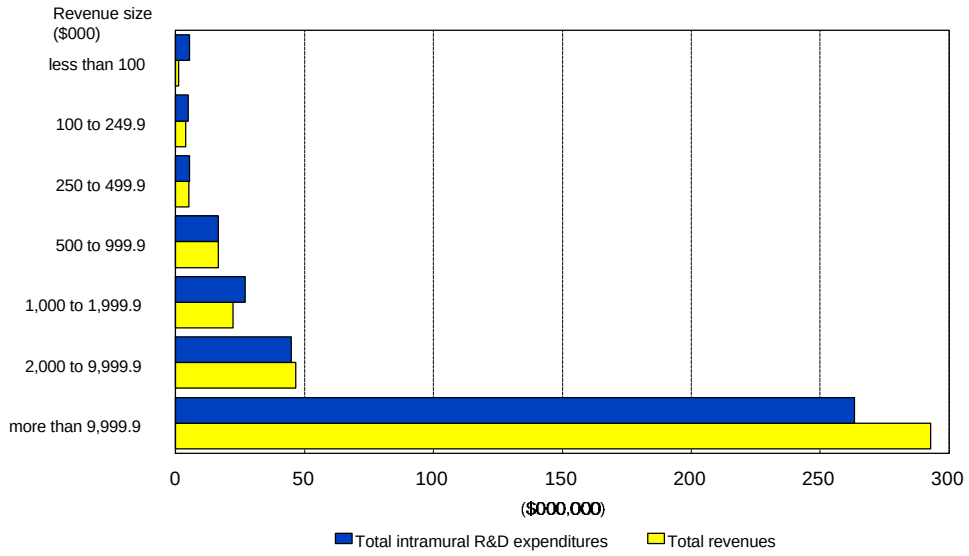
Intramural R&D:

CROs expend a great deal of their resources on R&D. In 1995, firms that specialized in contract research had $368 million in intramural R&D expenditures while non-revenue organizations had $138 million. In both cases, current expenditures such as wages, salaries and operational expenses accounted for the vast majority of these totals. These expenditures include resources spent on R&D for a client as well as R&D for the sake of the organization. In many instances, and especially in the case of smaller firms, intramural R&D expenditures often exceeded firms’ total revenues by a wide margin. Figure 5 compares R&D expenditures to revenues for various firm sizes.

It is interesting to note the degree of outward orientation of firms’ R&D activities, i.e., does a firm do R&D principally on behalf of its clients or is it largely pursuing an R&D agenda of its

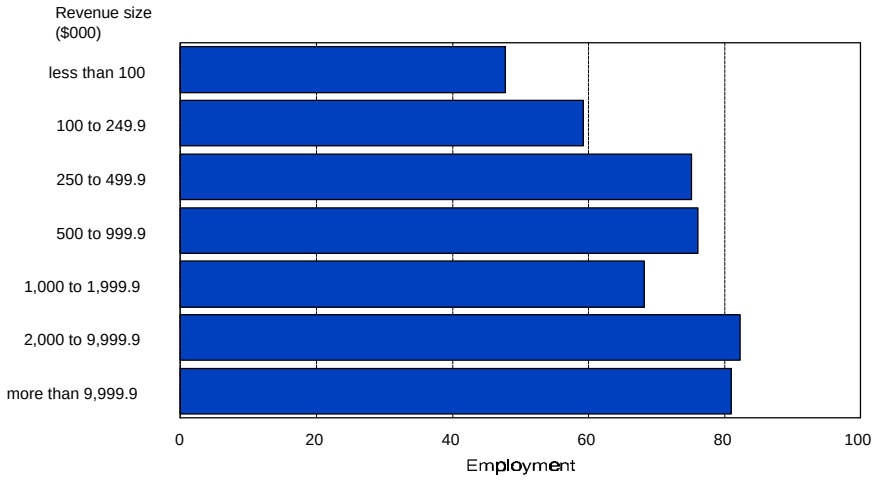
own. The data suggests that, in terms of revenue size, larger CROs' R&D activities are more oriented to the consumer market, while smaller firms tend to conduct the majority of their R&D on their own behalf. Table 6 shows revenues from R&D contracts as a percentage of total intramural R&D expenditures firm of various sizes. One possible explanation for this trend is that in many small firms R&D contract work may act as a transition stage until they can develop and commercialize their own technologies.

Figure 5.
Intramural R&D Expenditures of Firms that Derive 50 percent or more of their Revenues from R&D Contracts, by Revenue Size, 1995



Source : Annex 1, Table 5 and Table 6.

Figure 6.
R&D Contract Work as a Percentage of Total Intramural R&D Expenditures for Firms that Derive 50 percent or more of their Revenues from R&D Contracts, by Revenue size, 1995.



Source: Annex 1, Table 5 and Table 6.

Conclusion:

In April, 1998, SICP, by collaborating with Statistics Canada on an analysis of data extracted from the 1995 Research and Development in Canadian Industry Survey, was given the unique opportunity to study the provision of contract research by the BES. The data collected by the survey offers useful insight into the composition of the firms and non-revenue organizations doing R&D contract work as well as information on the characteristics of these important components of the contract research industry. The data demonstrate that the BES performs a substantial amount of R&D contract work across many industries and that it is carried out by both large firms as a sideline to their core competencies and by relatively smaller firms as their primary activity.

In order to develop a more comprehensive understanding of the industry, however, it is important to also investigate the substantial volume of R&D contract work being done by the BES for affiliated firms at home and abroad and by the public sector including that of the provincial research organizations, universities and colleges. Data on the contract work done by these organizations, however, is both difficult to obtain and analyse due, in large part, to: the nature of the of the relationships between the parties involved; the fact that data on R&D contract work are often mixed together with and inseperable from data on other activities; and, the complex and emerging nature of R&D contract work in some of these sectors.

R&D work involving transfers between parent companies, their subsidiaries or other affiliated firms is a complex issue to review. Arrangements can range from very informal to strict fee for service contractual ones and, as such, special care must be paid when looking into the data. Alternatively, data availability is the most pressing issue in the analysis of the contract research activities of universities and colleges. Anecdotal evidence suggests that R&D contract work carried out by universities is considerable and growing, but for a number of reasons it has not yet been well captured statistically.

In sum, this project can be seen as an excellent example of how Industry Canada can work closely with Statistics Canada to develop more meaningful data in areas which are important to the knowledge-based economy and might otherwise not have been explored. This paper provides a good snapshot of contract research services in the BES and future work will focus on developing a stronger information base on activities not covered by this report but which have been identified as being important contributors to the industry.

References

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Annex 1