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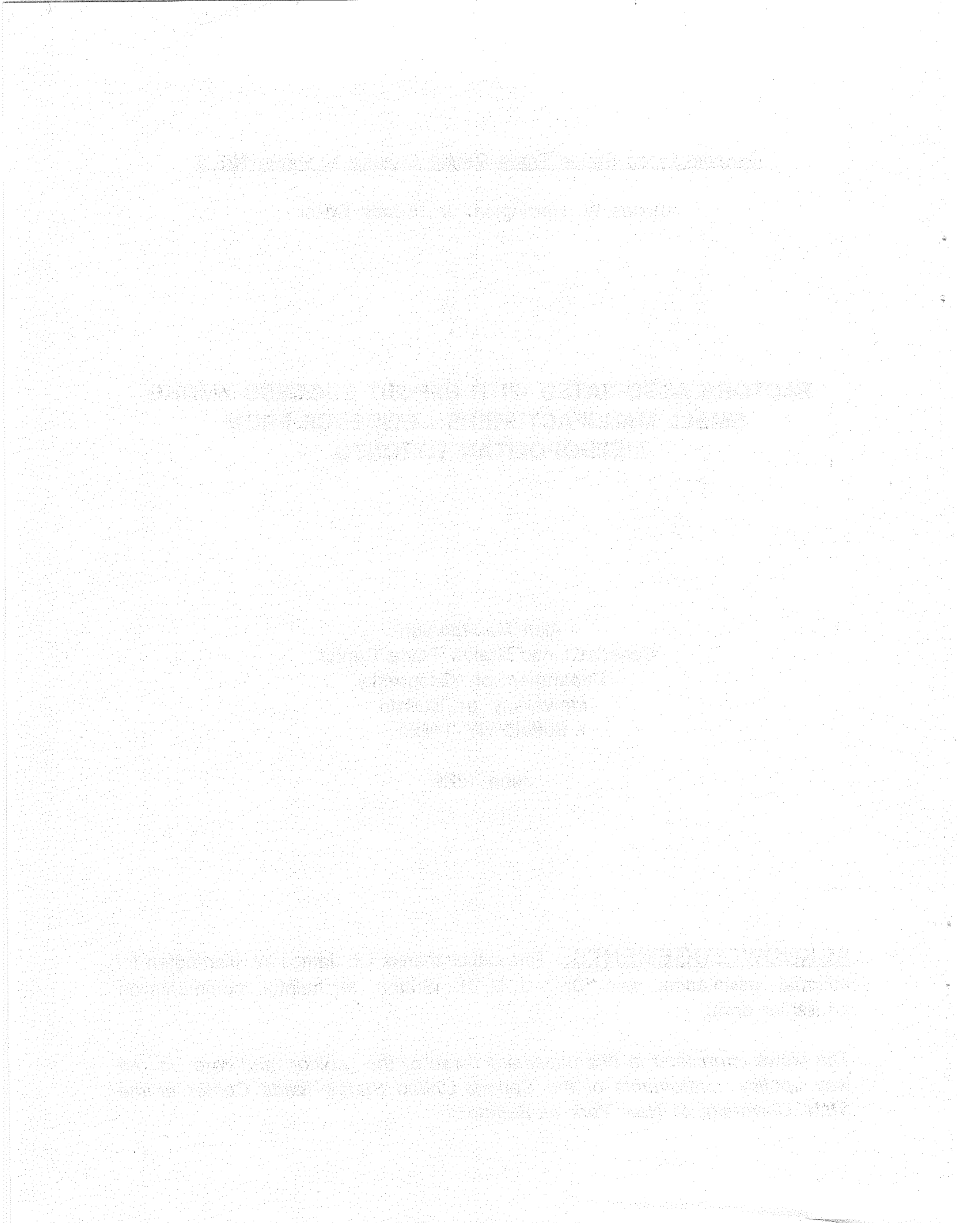
**FACTORS ASSOCIATED WITH EXPORT SUCCESS AMONG
SMALL MANUFACTURERS: EVIDENCE FROM
METROPOLITAN TORONTO**

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ABSTRACT

This paper examines the contribution of specialized technical services to the export and product development efforts of small Toronto manufacturers. Data from a survey of 109 Toronto industrial firms are presented which indicate a positive role for external consultants. Specifically, the results indicate a significant relationship between export success and willingness to invest in external technical knowledge. The results also suggest a close relationship between export success and frequency of new product development. The broader implications behind the survey results are sketched in terms of possible policy opportunities for Canadian government departments with an interest in export development. The paper also considers the main transactional obstacles to successful use of external information services.

INTRODUCTION

The purpose of this paper is to demonstrate that small manufacturing firms (SMFs) can reap significant benefits by subcontracting specialized technical work to external consultants. The empirical context derives from a wide body of international research which links innovative activity at the small firm level with intelligent use of external know-how (Rothwell and Bessant, 1987). While the geographical focus of the paper is restricted to Toronto, it should be noted that some of the findings may have wider implications for small manufacturers in other cities, regions, and countries. In attempting to illustrate the role of consultant linkages, survey data from Toronto are presented which indicate a series of associations between various measures of SMF business performance and the presence of backward links to consultants outside manufacturing. Prior to an examination of these data, however, it is appropriate to consider the general environmental context from which recent innovation research has sprung.

Empirical evidence from Europe and North America reveals a synergistic relationship between technical consultants in the service sector and innovative firms in manufacturing (Carter and Williams, 1957;

Cohn, 1980; Hatch, 1985; Marquis and Myers, 1969; Rothwell, 1977, 1987). A recurrent theme in this literature is that quick access to current technological information is an important factor in successful product innovation. A related theme is that continuous product development is fundamental to the commercial viability of modern industrial firms, especially those that produce for export (Ong and Pearson, 1982; Rothwell and Bessant, 1987). Complementary work by industrial geographers suggests a distinctive economic role for small manufacturing firms and specialist units in the producer services (Britton, 1988; MacPherson, 1988)¹. When locationally clustered in major urban centers, market-linked networks of consultants and SMFs are believed to have the potential to revitalize local economies (Britton, 1988; Hatch, 1985). This augers well for the developed OECD nations because full-time employment in these sectors has been expanding rapidly for some time (Howells, 1988).

Survey evidence from the United Kingdom suggests that rapid technological change has compelled a growing number of small firms to seek periodic help from professional experts, notably in production-related fields like laboratory testing, industrial engineering, and research (Rothwell, 1977, 1987; Design Council, 1983). A

popular explanation for this trend is that small firms typically generate insufficient sales to maintain permanent in-house hiring across a comprehensive mix of scientific, technical, and management occupations. In addition to industrial inputs, of course, a growing number of small firms require external market information to support strategic decision-making (Czinkota and Johnston, 1983; Kleinschmidt and Ross, 1984; Naor and Cavusgil, 1981). Unlike large multilocational enterprises, small and medium-sized firms are often internally deficient in terms of management resources, technological skills, research capacity, and investment capital (Rothwell and Zegveld, 1982, 1985). As a group, moreover, small firms are rarely in a position to generate all of the relevant information and knowledge they need. While it would be misleading to suggest that every small firm requires formal inputs of information from external sources, a theme which emerges from Rothwell's work is that companies with well-developed external linkages innovate more frequently than those which opt for a 'self-contained' path. Indeed, a rather important thrust in the recent literature is that fast access to external information is a crucial factor in sustained competitive success. High-quality technological information is essential for the development of new products and processes (Design

Council, 1983), while market information can support sales expansion (Czinkota and Johnston, 1983).

In this regard, it is interesting to note that Canada's fast-growing producer services consist primarily of firms that either create, process or distribute information -- business information in particular (Hepworth, 1986). By 1981, roughly 10% of Canada's labor force was employed in the producer services, compared to only 6% in 1971. Over the same period, moreover, relative employment decline in the manufacturing sector was to some extent cushioned by new industrial growth at the SMF scale (Department of Regional Industrial Expansion, 1987; Economic Council of Canada, 1988). These two directions of change are not entirely unrelated. Indeed, as shall be seen later, some of the fastest growing segments of the producer services may actually be market-dependent on the SMF sector.

Growth of this nature has stimulated a fresh surge of academic research in most of the major industrial countries, such that, by now, there is good empirical evidence that strong technological linkages between SMFs and external consultants can foster new waves of innovative product design, employment growth, and exports (Rothwell, 1987).

In Canada, however, very little substantive work has been carried out on the techno-economic significance of service-to-manufacturing linkages. At the same time, Canadian research into the product development process has often neglected the possible export-related opportunities afforded by successful innovation.

This is unfortunate because export expansion is often a major commercial priority among small firms which operate in small economies (Kleinschmidt and Ross, 1984). Since Canada's domestic market is roughly ten times smaller than that of its principal trading partner (the United States), Canadian SMFs that wish to optimize their growth potential are more likely to require export markets than comparably-sized firms south of the border (Economic Council of Canada, 1988). While this is obviously not true for all Canadian firms in the small business category, the strategic importance of foreign export markets is difficult to deny (Economic Council of Canada, 1983).

Set against this context, two major questions are addressed in the analysis which follows.

First, to what extent have small Toronto manufacturers forged significant backward links to consultants in the service sector?

Second, are external informational linkages important to the

export efforts of local SMFs?

In suggesting answers to these questions, attention is focussed on the results of a mailed questionnaire survey of over 100 Toronto SMFs in five industries: office and household furniture, fabricated structural metal, auto-parts, electrical industrial equipment, and scientific instruments. All five of these industries contain substantial numbers of small single-plant firms, and all five face major adjustment challenges as a result of import competition.

SURVEY METHOD AND SUMMARY OF MAIN RESULTS

Although methodological aspects of the survey design are discussed elsewhere (MacPherson, 1988), a brief synopsis of the sampling procedure is warranted here -- at least for contextual purposes. In order to assess the extent of local informational linkages, 200 questionnaires were mailed to a randomly selected sample of Canadian single-plant SMFs: forty questionnaires per industry group, proportionately stratified by establishment size.

A major goal of the survey was to assess the relative contribution of external technical services to new product development and exports: (see Table 1 for the inventory of producer

service categories employed in the questionnaire).

The survey instrument was designed to capture five main dimensions of variation: (1) Export/innovation performance: (percentage of sales for export, frequency of successful new product development). (2) Sources of technical inputs: (in-house versus external sources). (3) Industry characteristics: (age, origins, product line). (4) Market focus: (customer segments, speed of market entry). (5) Technical goals: (R&D, product/process improvement). Respondents were asked: to rate their profit performance with regard to competitors in comparable product markets; to estimate their annual sales (including export sales); to specify the location, nature, frequency, cost, and technical importance of their external consultant linkages; to specify the nature, frequency, and market significance of recent product development activity; and, finally, to assess the contribution of external technical knowledge to in-house marketing and product development activity. Overall, the goal of the survey was to test the hypothesis that external technical linkages make a significant contribution to small-firm innovation.

The sampling frame was restricted to Canadian-owned firms with 200 employees or less. While the first mailing and follow-up produced

Table 1. A typology of high-order producer service functions and sources

- hospital research units	I N F O R M A T I O N	Public sector
- universities/colleges		
- database and software firms	I N F O R M A T I O N	Private sector
- management/marketing firms		
- advertising agents		

- industrial design firms	P R O D U C T I O N	Private sector
- production-engineering firms		
- testing laboratories	P R O D U C T I O N	Public sector
- other manufacturing firms *		
- R&D establishments		
- research organizations	P R O D U C T I O N	Public sector
- technology centers		

* While not officially part of the producer services sector, this category nevertheless represents a useful source of technical services for a wide range of firms.

Note: The categories listed above are not mutually exclusive. The typology is for analytic convenience only.

a response rate of 54% (Table 2), giving a total sample size of 109 firms, subsequent mailings failed to generate additional returns. Nevertheless, the final response level was deemed adequate for exploratory purpose. For a detailed review of the survey method, including criteria for questionnaire design, industry selection, and bias estimation, see MacPherson, 1988, pp.73-812.

Of the 109 firms in the sample, 73 (67%) sell some of their output to foreign customers, 44 (40%) employ at least one full-time research and development (R&D) officer, 80 (73%) subcontract to external consultants and 62 (57%) introduced significant product innovations over the study period (see Figure 1 and Table 2)³.

While these characteristics are unevenly distributed across the 5 industries, a direct and statistically significant relationship emerged between export-intensity and frequency of producer service contact (Table 3).

Of the 73 firms with export markets, 60 (82%) delegate specialized technical work to consultants outside manufacturing, compared to only 26 (55%) for the non-exporting group. Table 3 suggests a direct relationship between export-intensity and frequency of producer service contact, and the same holds true for new product

EXPORTS AS A PERCENT OF SALES,
1984-1985
(n = 73)

1 - 10	*****
11- 20	*****
21- 30	*****
31- 40	* *
41- 50	* * *
51- 60	* * *
61- 70	* *
71- 80	*
81- 90	* * *
> 90	*

AVERAGE NUMBER
OF INNOVATIONS,
1982-1985
(n = 62)

1	*****
2	*****
3	*****
4	*****
5	***
6	*****
7	*
8	*
9	*
10	****
> 10	**

PRODUCER SERVICE EXPENDITURES,
1982-1985
(n = 72)
(annual average, Canadian dollars)

\$ 1 - 5000	*****
5001 - 10000	*****
10001 - 15000	*****
15001 - 20000	*****
20001 - 25000	**
25001 - 30000	***
>30000	*****

Note: Seventy two firms have measurable service expenditures - that is, specialized inputs are obtained on a fee-for-service basis. However, 8 firms obtained formal technical assistance (free of charge) from the engineering departments of larger manufacturers in the Toronto area. As a result, tables which depict frequency of external contact (n = 80) capture a more complete picture of local linkage arrangements.

Figure 1.
Frequency distributions for exports,
innovation and producer service expenditures

Table 2. Summary statistics for the sample

Industry	n	response rate (%)	average size (employment)	average service expenditures *
Scientific Eq.	28	70%	39.0	\$17,549
Electrical Eq.	31	78%	55.8	\$13,346
Autoparts	20	50%	75.7	\$ 7,207
Metal fab.	14	35%	44.1	\$13,913
Furniture	16	40%	22.4	\$ 1,875

* = average annual expenditures on producer services (1983-85)

Table 2 (continued). Summary statistics for the sample

Industry	external contact frequency **	% with exports	% with U.S. exports	% with R&D ***
Scientific Eq.	4.45	89	89	57
Electrical Eq.	3.52	67	67	48
Autoparts	2.40	35	30	50
Metal fab.	14.28	42	38	14
Furniture	0.84	19	16	6

** = average number of external service contracts (1983-85).

*** = % with at least one full-time R&D officer.

Table 2 (continued). Summary statistics for the sample

Industry	% with customers in manufacturing	% with rapid market entry	% with innovations
Scientific Eq.	57 ****	71 *****	82
Electrical Eq.	54	55	71
Autoparts	60	40	70
Metal fab.	35	50	71
Furniture	6	31	19

**** = firms which principally cater to the demands of other manufacturing companies.

***** = firms which perceive themselves as fast entrants to new markets.

Table 3. Export-intensity and product innovation by frequency of producer service contact

Contact frequency *		Zero	Low	High	Total
Exports **	Zero	16	11	9	36
	Low	12	16	30	58
	High	1	3	11	15
Innovation ***	Zero	21	12	14	47
	Low	2	12	11	25
	High	6	6	25	37
Total		29	30	50	109

Chi-square for exports by contact frequency = 14.05 p = .0071

- - - - innovation by contact frequency = 22.58 p = .0002

* Low = 1-3 service contracts per annum: High = >4

** Low = 1-30% of sales for export: High = >30%

*** Low = 1-2 new products over the study period: High = >2

Table 4. Export-orientation, product innovation and frequency of producer service contact by the incidence of full-time research and development (R&D) personnel

R&D Personnel		No	Yes	Total
Exports	Zero	31	5	36
	Low	29	29	58
	High	5	10	15
Innovation	Zero	38	9	47
	Low	12	13	25
	High	15	22	37
Contact frequency	Zero	22	7	29
	Low	22	8	30
	High	21	29	50
Total		65	44	109

Note: Chi-square for exports by R&D = 17.03 p = .0002

- - - - innovation by R&D = 15.79 p = .0004

- - external contact by R&D = 11.07 p = .0050

development. Of the 62 firms that introduced commercially significant innovations over the study period (1982-1985), 54 (87%) have consultant linkages, compared to only 26 (55%) for the non-innovating group⁴. Positive associations also emerged between innovation/export performance and the presence of full-time R&D personnel (Table 4). Thirty-nine (88%) of the 44 R&D-performing firms have export markets, and 35 (79%) introduced new products over the study period. On the linkage side, moreover, a positive relationship emerged between in-house R&D activity and frequency of external contact. These data suggest that export activity and product innovation can be attributed to particular blends of internal and external expertise. In proportional terms, SMFs with full-time research personnel are more likely to subcontract to consultants than comparably-sized firms which operate without in-house R&D. An interesting conjecture here is that R&D-performing firms may be in a stronger position to access the kinds of external inputs they require. A further implication, and one which will be dealt with later, is that non-R&D-performing firms may have lower technological requirements than their more research-oriented counterparts.

While internal expertise is a major precondition for export

success (see Ong and Pearson, 1982), the remainder of this paper assesses the contribution of external inputs. With this focus in mind, Table 5 presents a disaggregated picture of the linkage characteristics of the sample. These data reveal a series of relationships between export-intensity and backward links to: (a) production-related services in the public sector, and (b) information-based services in the private sector. The former most notably include Ortech (formerly the Ontario Research Foundation [ORF], Mississauga), the Ontario Centre for Advanced Manufacturing (OCAM, Toronto) and the National Research Centre (NRC, Ottawa)⁴. Private information services consist primarily of computer consultants and database vendors (for example, I.P. Sharp Associates). Firms with links to these kinds of specialists typically seek commercial "intelligence" to enhance management decision-making. This may explain why frequency of new product development is not directly associated with backward links to database consultants. On the innovation side, however, positive associations emerged for private and public production-related services, as well as for public information sources such as university and college departments. Private production-related services most notably include industrial design consultants, engineering specialists, and laboratory testing This page

Table 5. Product innovation by type of producer service link

Type of contact:		Public Sector				Private Sector			
		Production:		Information:		Production:		Information:	
		Yes	No	Yes	No	Yes	No	Yes	No
Innovation	Zero	3	44	2	45	20	27	12	35
	Low	8	17	6	19	18	7	11	14
	High	11	26	8	29	24	13	16	21
Chi-square =		9.81		7.23		7.22		3.78	
p =		0.01		0.05		0.05		----	
Total		22	87	16	93	62	47	39	70

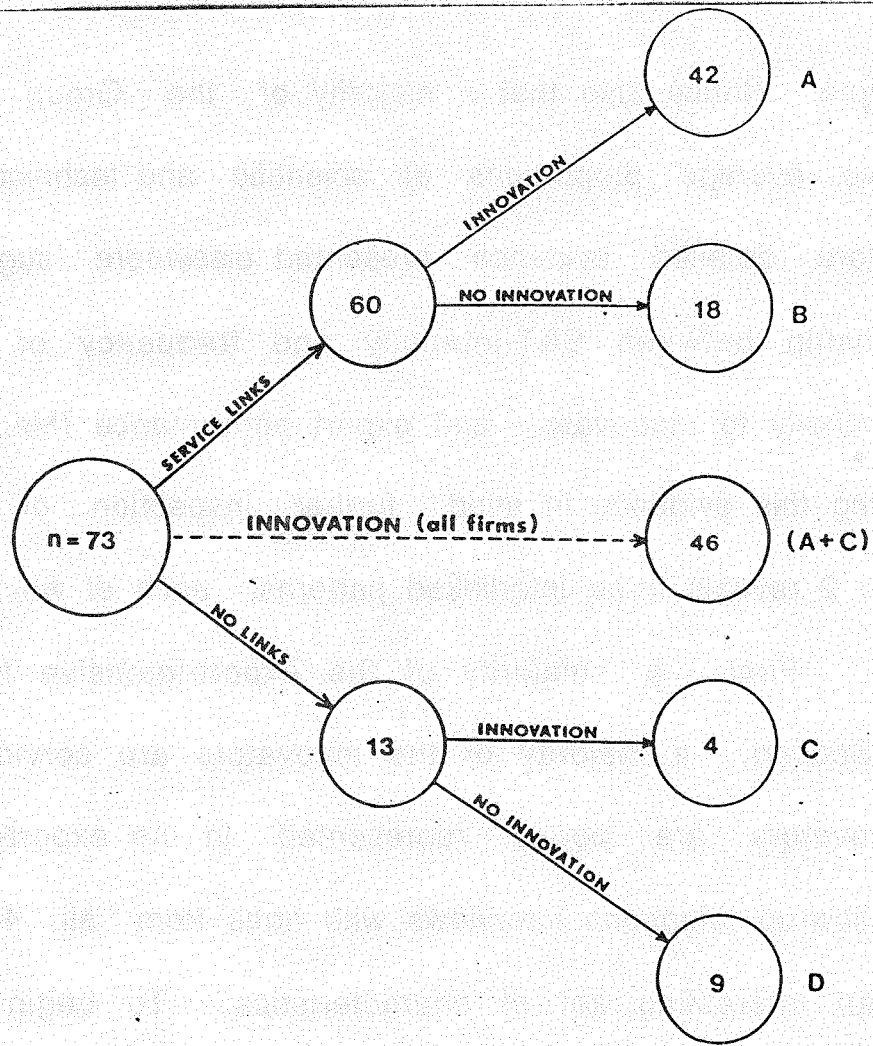
Table 6. Export-orientation by type of producer service link

Type of contact:		Public Sector				Private Sector			
		Production:		Information:		Production:		Information:	
		Yes	No	Yes	No	Yes	No	Yes	No
Exports	Zero	3	33	3	33	18	18	8	28
	Low	10	48	8	50	34	24	19	39
	High	9	6	5	10	10	5	12	3
Chi-square =		18.21		5.36		1.35		15.87	
p =		0.0001		----		----		0.0004	
Total		22	87	16	93	62	47	39	70

establishments.

Interestingly, survey evidence from a sample of 88 export-oriented SMFs in Britain's electrical industrial equipment sector suggests a positive relationship between innovative technological behavior and export performance (Ong and Pearson, 1982). Using a stepwise discriminant model based on export-intensity (high versus low), Ong and Pearson reveal that product innovation is an important discriminating variable in export success. Following from this evidence, it is reasonable to propose that service inputs which assist product innovation may at the same time act as indirect inputs to export capability. This is a logical proposition because export markets provide opportunities for cost recovery and sales expansion -- both of which justify innovation investment.

Figure 2 summarizes this proposition in an empirically testable form. Here, two groups of innovators can be discerned, only one of which operates with producer service linkages (Group A). This latter group is distinct from the other 3 groups in a number of important ways. For example, Group A consists primarily of export-intensive firms that serve industrial markets. Most of the firms in this group exhibit above average sales, and a majority attach considerable importance to their



Group averages for selected characteristics: exporting firms only

Groups	R&D *	Sales	Exports	Industrial Markets**	Importance of Services Inputs ***
A	5.79	6.56	31.95	83.3	High
B	1.30	6.73	22.94	33.3	Medium
C	10.09	2.42	26.25	25.0	Low
D	0.84	4.62	11.55	33.3	Low
All	4.31	6.14	26.90	61.6	Medium/High

- * Average % of full-time R&D personnel.
- ** % of firms that cater primarily to industrial customers.
- *** measured on an attitude scale, where Low = not important at all; Medium = moderately important; High = critically important.

Figure 2.
Innovation and Service Linkages

external linkages. Notice also that a majority of the Group A firms employ above average proportions of scientific and technical (S&T) personnel. More detailed evidence presented elsewhere suggests a direct relationship between S&T-intensity and frequency of external contact, propensity to innovate, and export performance (MacPherson, 1988). Keeping this evidence in mind, further inspection of the 73 firms in Figure 2 reveals three interlinked patterns, each of which tells a logical story. First, a majority of the export-intensive firms are innovators. Second, a majority of the innovators are service-linked. Third, non-innovators are poorly represented in the export-intensive category. Follow-up telephone interviews with firms from all 4 groups uncovered an interesting set of characteristics. To begin with, a majority of the innovating firms in Group A are market-linked to larger industrial companies in the United States (notably the northeast). A variety of CEOs stated that innovation is frequently driven by explicit customer demand. Thirty-nine of the 46 export-oriented innovators introduced new products in response to client specifications. In doing so, a majority obtained specialized technical support from external organizations (Table 6). Public research establishments and private design specialists were among the most

notable of these, closely followed by management, marketing and database consultants. Members of Group C stand out as exceptions to this pattern. Innovating firms in this category conduct almost all of their technical activity in-house, despite having below average sales. All of these firms manufacture end-products for a wide range of industrial and non-industrial markets. By way of contrast, many of the Group A firms produce intermediate goods for larger manufacturers. Firms from Groups B and D have the most diverse product-market characteristics. Interestingly, however, Group B contains a number of export-intensive firms that exhibit substantial consultant expenditures, yet none of these firms introduced product innovations over the study period.

Nevertheless, for many of the latter, producer service inputs were generally perceived to play a useful technical role, particularly for the resolution of process-related problems, testing, quality control, inventory management, and incremental product improvement.

In attempting to make sense of these patterns, two general observations appear pertinent. First, firms which operate without producer service linkages are either: (a) research-intensive and innovative, or (b) research-deficient and non-innovative. This suggests, among other things, that research-deficient firms in the

non-innovating category might benefit significantly from external support. Second, a majority of the service-linked innovators are market-dependent on larger industrial firms in the United States. This suggests that users (customers) may play a significant role in the innovation process. Evidence from Rothwell (1986, 1987) and Von Hippel (1978) suggests that explicit user requirements frequently represent the main initiating impulse behind small firm innovation. Taken together, then, these two thrusts imply an important role for backward links to consultants and forward links to particular market segments (Figure 3).

DISCUSSION

Although directions of causality cannot be inferred from the survey data on hand, service-assisted innovation would appear to make a positive contribution to SMF export activity. Follow-up telephone inquiries and personal interviews revealed that consultants are usually hired on a problem-specific basis. Technical inputs (for example, industrial engineering advice) are commonly used to support new product development and/or process improvement, while management and marketing inputs (for example, commercial data) are used to assist

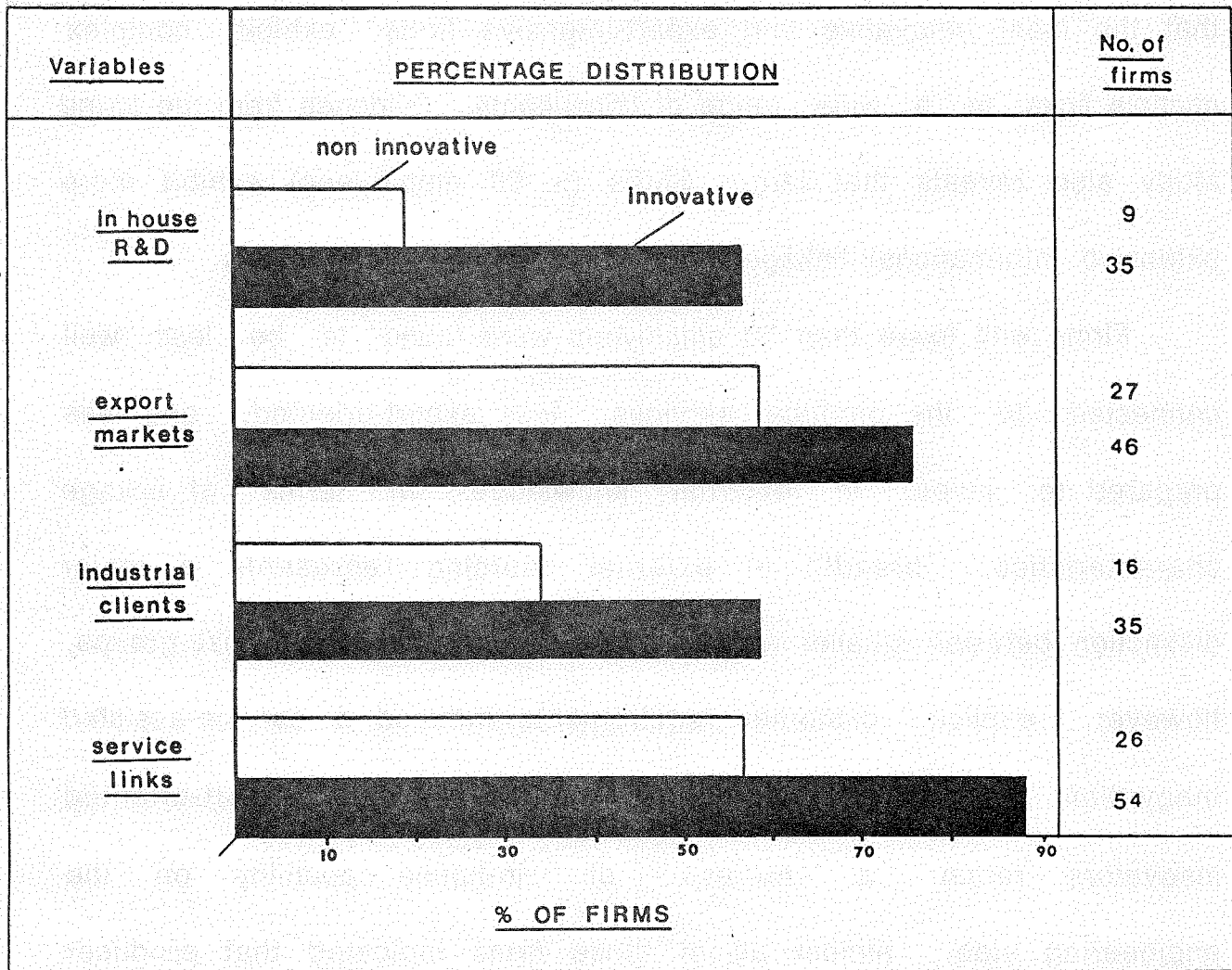


Figure 3.
Selected characteristics of innovating versus non-innovating firms.

strategic decision-making. Both types of external expertise this page contribute to the export viability of clients, if only because high-quality manufactured products have to reach the marketplace somehow. Evidence documented elsewhere (MacPherson, 1988) suggests that the most innovative and export-intensive firms exhibit complex multiple links to a wide range of consultants. Evidence from the same study also reveals that larger SMFs (> 50 employees) exhibit more extensive informational linkages than their smaller counterparts.

Firms with fewer than 50 employees were found to be less well connected to the producer services, less export-oriented, and less prepared to invest in external knowledge. In terms of linkage characteristics, breadth of external sourcing represents a major distinction between smaller and larger SMFs. For both size-groups, however, explicit customer requirements induced a service-assisted innovation response. Although a majority of the export-oriented innovators retain a nucleus of in-house capability on the engineering side, almost all of these firms indicated that producer service inputs are important from either a technical or marketing point of view.

Follow-up inquiries also revealed that many small firms

subcontract to consultants primarily because in-house staff cannot be easily diverted from ongoing tasks in production and/or management. When workloads exceed a critical threshold, in fact, acquisition of external help is clearly the most sensible path to follow. This does not mean that small exporting firms lack basic technical resources -- rather, the implication is that periodic upswings in workload stimulate specialized waves of subcontracting activity in which external support is sought on a temporary basis. On other occasions, of course, consultant inputs are purchased in response to internal deficiencies in particular branches of science, engineering and design. In general, however, the dominant pattern is one of demand management -- and, in this sense, external expertise should be regarded as a complement to in-house skills rather than a substitute.

In contrast to some of the findings listed above, recent data from a survey of 85 export-oriented SMFs in Ontario's "high-technology" sector suggest a rather minor role for external information in small firm export activity (Kleinschmidt and Ross, 1984). Indeed, of the 85 firms surveyed, a majority indicated that external sources of information play only a peripheral role in export-marketing decisions. Set against this context, it is possible that Tables 3-6 capture little

more than spurious statistical associations in which causality cannot be confidently inferred. After all, simple chi-squared statistics tell us nothing about the underlying nature of statistical relationships.

Having noted this, however, follow-up interviews revealed a number of factors which explain, in part, why some of the results of the present study diverge from those mentioned by Kleinschmidt and Ross (1984). First, rapid techno-market change has forced a majority of small exporting firms to purchase growing quantities of foreign and domestic market information for management purposes. Database vendors with quick access to international computer networks can now provide a wide variety of clients with 'present day' information on foreign market conditions, domestic and overseas competitors, local and non-local input suppliers, potential customers, and a host of other informational inputs which reside within globally dispersed computer banks. Several CEOs indicated that timely infusions of market information support a broad range of decision-making functions. Such fast electronic access to relevant and reasonably-priced business information has only been possible over the last few years.

Second, firms that regularly obtain external information often do so for product-related reasons -- more specifically, innovation. Herein

lies the underlying connection between small firm export activity and backward links to consultants. In order to survive and/or expand in the export business, small firms of all types require periodic inputs of external information to support new product development, product re-design, process improvement, and marketing. While the links between product innovation and export success are more complex than has been suggested here, the evidence on hand implies a significant role for technical consultants. At the same time, while use of management and marketing services does not guarantee export success, the evidence again points to a positive relationship between the two.

This has favorable implications for Toronto's SMF population, if only because the potential for service-assisted innovation is much greater today than before. An implication here is that policy efforts to stimulate improved service-to-manufacturing linkages might be worth pursuing. Such efforts have already emerged among member countries of the European Community. In the United Kingdom, for example, a central policy goal behind the recently established "Enterprise Initiative" (EI) is to connect innovative small firms with appropriate consultants in the private sector. This particular initiative is based on a process of

government-managed user/ vendor mate-matching. The ultimate objective of the EI programme is to prepare innovative SMFs for European market integration in 1992. In light of the potential export opportunities afforded by the Canada-United States Free Trade Agreement (FTA), initiatives like Britain's EI might usefully be developed in Canada.

Data presented earlier suggest a significant and positive relationship between in-house R&D activity and the volume and frequency of producer service contact (Table 4). One possible explanation for this pattern is that small technology-intensive firms are in a potentially stronger position to specify the kinds of consultant inputs they require. A further possibility is that non-R&D-performing firms may have lower technological requirements than their more research-oriented counterparts. Telephone interviews revealed that R&D-performing firms actively seek consultant inputs on a systematic basis, whereas non-R&D-performing firms tend to be more restricted in their breadth of information search.

Following from this evidence, it is tempting to infer that a firm's propensity to forge external technical linkages depends on its relative location in the product life cycle. Data from this sample indicate that

R&D-performing firms are more prevalent in the scientific instruments and electrical industrial equipment sectors than in auto-parts, fabricated structural metal and furniture. The latter are also less likely to innovate for export markets, and many exhibit only weak external linkages. However, lest the analysis become too simplistic, it is interesting to note that a significant proportion of the non-R&D-performing firms in auto-parts and fabricated structural metal did introduce new products for export markets over the study period -- and, in achieving this, a majority obtained technical assistance from professional consultants. Here, of course, size of firm is an important part of the story as well. SMFs with more than 50 employees tend to be the most export-oriented, the most innovative (in terms of frequency of new product development), and the most externally connected. While the survey data are unsuitably distributed for a multiple correlation or regression analysis, the evidence on hand suggests a series of links between export activity, in-house R&D, company size, and propensity to use external sources of expertise. As noted earlier, moreover, forward links to customers in the industrial sector would also appear to be important. Previous work by Ondrack (1980), Rothwell (1986) and Von Hippel (1978), among others, suggests a clear role for

customers in transmitting innovation initiatives to suppliers. In this regard, it is reasonable to propose that technologically demanding users in the manufacturing sector are more likely to generate new product suggestions than non-industrial customers at the retail end of the market. In other words, whom you serve may be an important factor in how often you innovate. How often you innovate, in turn, may be an important factor in how well you export. It is also worth mentioning that firms which operate without consultant linkages may, in fact, be more "externally oriented" than the survey data imply. A majority of the innovative but non-service-linked firms regularly obtain useful technical inputs from other industrial companies in the Toronto area, often through informal channels. Follow-up interviews revealed that "informal channels" typically consist of non-market associations between individuals who know each other on either a professional or social basis. Interaction of this sort was found to be a popular mode of information retrieval, guided in most instances by the unwritten principle of "mutual assistance for mutual gain". To an extent, then, technical services are also "traded" inside the industrial sector.

While the present study was not designed to evaluate the importance of intra-sectoral information exchange, this kind of

interaction would clearly be a useful focus for future research. One potentially interesting line of inquiry would be to assess the relative importance of intra versus inter-sectoral information "trade". Are some types of technical services generated exclusively within manufacturing? What proportion of total service consumption derives from informal interaction? Can non-market service delivery within manufacturing compensate for weak external links to professional consultants? At present, rather little is known about the operational details of the local information market. This is unfortunate because efficient interventionist planning, especially on the supply-side, requires a sound understanding of the market/non-market informational transactions between firms. How are these transactions initiated and organized? Do particular modes of interaction imply distinct spatial signatures? How do linkage arrangements vary over time? These are just some of the research questions which might usefully be tackled in the future.

Finally, it is worth repeating that some of the results presented earlier converge with a wider stream of international evidence on the export potential of innovative SMFs (Ong and Pearson, 1982; Rothwell and Bessant, 1987). To ignore the thrust of this literature is to miss the point

when it comes to the links between foreign export performance, product innovation, and external technical know-how -- especially at the small firm level. This implies, among other things, that a conservative "wait and see" attitude on the part of Canadian policy-makers and business enterprises will not pay respectable dividends as America moves towards a more integrated continental market.

Furthermore, as European policy analysts suggest (Sweeney, 1987), lack of preparation for regional market integration is a risk which no sensible government or business executive can afford. For Canada in general, and southern Ontario in particular, the 1990s promise a decade replete with commercial opportunities and threats, and the same can be said for U.S. states with border locations on the 49th parallel. With this thought in mind, the task which looms up for Canadian public policy is to support industrial export development through commercially legitimate channels. Selective informational assistance to the private sector might be a good starting point.

CONCLUSION

While factors associated with export success are complex and varied, inputs of external information would appear to make a positive

contribution. This is encouraging because information-based services are expanding faster than most other parts of the Canadian economy. On the negative side, evidence from the sample reveals that inter-sectoral linkages are not as extensively developed as they could be. The problem may be due to imperfections in the operation of the local information market. For example, non-R&D-performing firms with limited export sales may be unaware of the types of export-related services that are available. At the same time, uncertainty over outcomes may dissuade many small firms from investing in external knowledge.

An implication here, and one which merits further empirical treatment, is that policy initiatives to generate stronger inter-firm communications might be worth pursuing. Detailed research into those factors which discourage linkage development would also be useful. New micro-level work of this nature ought ideally to be situated within the wider strategic context of Canadian trade policy. As the 1990s unfold, for example, incremental adoption of the Canada/United States Free Trade Agreement will restrict the scope for direct policy intervention in a number of export-related areas. This implies that future export-assistance programs will have to employ more subtle

commercial instruments than before. One possible option might be to subsidize the informational requirements of young SMFs that demonstrate a clear need for external support. Another option might be to establish a centralized information network to link potential buyers and sellers together. If we accept, for the moment, that high-quality consultant inputs can improve the business performance of Canadian SMFs, then export-related programs to integrate small manufacturers with specialized producer services might be worth considering.

Endnotes

1. Despite the growth of interest in the economic potential of small firms, there is no consensus on what actually constitutes a "small" firm. In Canada, the Federation of Independent Business (CFIB) uses a cut-off point of 50 employees, while the Ontario Research Foundation (ORF) sets the upper limit at 200. In the U.K., the Confederation of British Industry would consider a 500 employee firm to be "small". For the purposes of this project, the upper limit has been set at 200, in line with the definition used by the ORF.
2. In order to estimate the amount of non-response bias in the sample, late versus early respondents were compared using difference of means tests for export-intensity, occupational composition (% of S&T workers), frequency of product innovation, linkage expenditures, and volume of sales. Here, it was assumed that late respondents would be more similar to non-respondents. While difference of means tests did not uncover serious non-response bias for the sample as a whole, late respondents in the furniture sample were found to exhibit significantly higher levels of S&T-intensity than early respondents. Interpretation of the survey findings must proceed with this reservation in mind.
3. Product innovation is defined as the introduction and successful development of a new or substantially improved product. Respondents were asked to specify the nature and technical significance of their innovation, including its current and prospective market importance.
4. The Ontario Research Foundation (ORF) is a large public sector organization that conducts applied industrial research and testing on a fee-for-service basis. With annual operating revenues of approximately C\$20 million, this organization is one of the largest producer service establishments in the province, serving over 2000 industrial clients per annum (half of which are SMEs). The Ontario Centre for Advanced Manufacturing (OCAM) is the administrative body

responsible for the strategic management of the Peterborough Robotics Centre and the Cambridge CAD/CAM Centre. The latter are public organizations with a mandate to promote technology transfer on a fee-for-service basis. These centers, in common with the ORF, provide problem-specific consultations as well as general business advice in spheres that relate to technology acquisition, plant modernization and product development. For a more detailed review of the activities of these institutions, see the Annual Reports listed in the bibliography.

5. The firm-specific studies referred to in the text are documented in the author's PhD dissertation (MacPherson, 1988).

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