



Canadian Photonics Consortium

Update to “Making Light Work for Canada”

A report prepared for the Canadian Institute for Photonic Innovations
(CIPI)

Michael Davies & Mike Scott
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EXECUTIVE SUMMARY

This report describes the findings of a brief study to highlight the trends in Canada's photonic sector since the publication of "Making Light Work for Canada in 2008".

Data and opinions were collected by a combination of an on line survey and telephone and face-to-face interviews. In total reliable data was obtained from 90 companies to review the changes from 2008 to 2012.

The main findings are as follows;

- Three-quarters of photonics companies have increased revenues during the period with an average compound annual growth rate (CAGR) of 7%. A few have shown stellar CAGR of over 50%.
- Dependence on export revenues from the US has decreased, revenues from Asia and Europe are now greater than the US.
- Employment has increased concomitantly with revenues. We identified a net growth of over 1,000 jobs (net growth of 15%) in the sampled companies.
- The percentage of R&D jobs has increased with a slight fall in the percentage of manufacturing jobs as companies continue to outsource manufacturing but retain and grow the product development function.
- More than two thirds of firms continue to position themselves at the higher end of the value chain, focussing on sub-systems or stand-alone products
- There has been significant diversification in end-user market sector. Life Sciences & Healthcare and Defence & Security are the biggest growth areas, followed by Energy & Lighting and Manufacturing.
- The Communications sector is robust and possesses some of the fastest growing companies.
- Despite the economic climate, including the recession of 2009, a significant number of companies have raised capital.

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INTRODUCTION

In 2007 to 2008 the Canadian Photonics Consortium (CPC) undertook a one year long multi-client study of the status and impact of photonics in Canada. The findings were published in late 2008 as the document “Making Light Work for Canada” and in early 2009 as an abridged version “Illuminating a World of Opportunity”. These documents were circulated widely among decision makers in industry, government and academia and the abridged version was used for publicity and investment purposes at Trade Shows such as Photonics West (California) and Laser (Munich).

Some key findings of the 2008 report were:

- There were approximately 370 companies in Canada, whose business was primarily dependent on photonic technologies or services;
- Half of the companies had less than 50 employees and annual revenues less than \$10M;
- With the exception of Consumer, all major industry end-user sectors were addressed, with a notable shift away from the Communications sector which dominated at the start of the Century;
- Two thirds of companies produced subsystems or stand-alone products;
- Revenues were in excess of \$4.5B per annum;
- 85% of the revenues accrued from exports with 50% from the US.

CIPI, the Canadian Institute for Photonic Innovations, was established by the National Sciences and Engineering Research Council (NSERC) as a Network Centre of Excellence (NCE) to financially support university researchers working on projects jointly with the Canadian photonics industry. During the last 14 years CIPI has supported a number of successful projects and established a broad industry-academia network across Canada. CIPI will be closing its activities as an NCE research network on March 31, 2012 and is required to report on the impact of its various research projects on Canadian industry. Whilst CIPI will be contacting its various affiliates to gain information on the impact of specific projects it also wishes to understand the general changes that have occurred in the photonics industry in Canada during the last 7 years.

This report summarizes the findings of a brief (1 month) study to identify the trends in the photonics industry in Canada since 2008.

METHODOLOGY

Given the short time scales it was not possible to conduct a detailed study as in 2008 which used a combination of surveys, interviews and workshops. For the current study the following approaches were used;

1. A brief on-line survey was set up on Survey Monkey asking 7 questions about revenues, staffing, investment, products and markets. An opportunity was also provided for freeform comments. The questionnaire is attached in Appendix 1. Participants were invited by email which was sent to the following distribution lists:
 - Réseau Photonique du Québec (RPQ)
 - CIPI
 - OCE/OPIN (which includes some non-Ontario companies)
 - Selected recipients identified by IRAP

The total estimated number of recipients is over 400. All survey responses were read before aggregating the data in order to delete obvious duplications and invalid or bogus responses. A number of respondents replied anonymously. After sanitizing we obtained reliable responses from >60 recipients.

2. In order to get more detailed information and perspectives interviews were conducted with senior executives from 34 companies, some face-to-face but mostly by telephone.

The criteria for selection of candidates for interview were as follows:

- The 11 companies profiled in “Making Light Work for Canada”
- Companies that had participated in workshops or interviews for the 2008 survey
- Individuals personally known to the authors
- A few who had indicated in the survey that they wished to discuss further
- Companies in Western Canada recommended by IRAP

In addition we interviewed executives from the following organizations:

- Alberta Centre for Advanced MNT Products (ACAMP)
- Canadian Photonics Fabrication Facility (CPFC)
- Institut National d’Optique (INO)
- Réseau Photonique du Québec (RPQ)

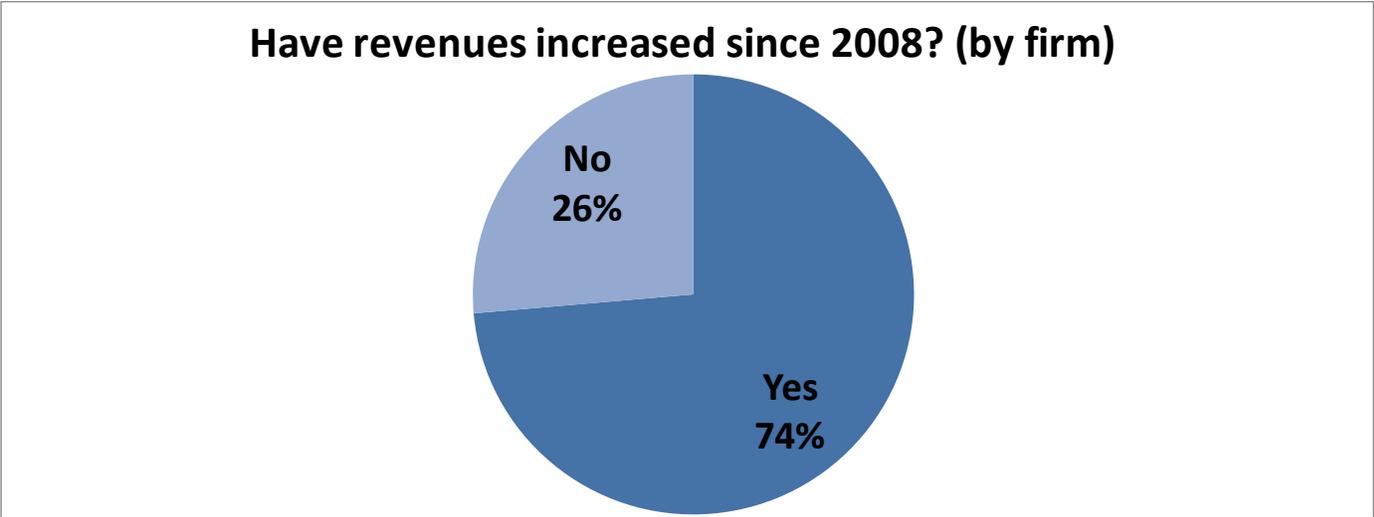
In total, therefore, by a combination of survey and interview we received input from 90 companies and 4 organizations. Though every attempt was made to ensure a good spread of geography and industry sector we cannot guarantee that this is a statistically sound sample. However, given the number and consistency of responses we believe that the trends we report in the following section are representative of the sector as a whole.

RESULTS

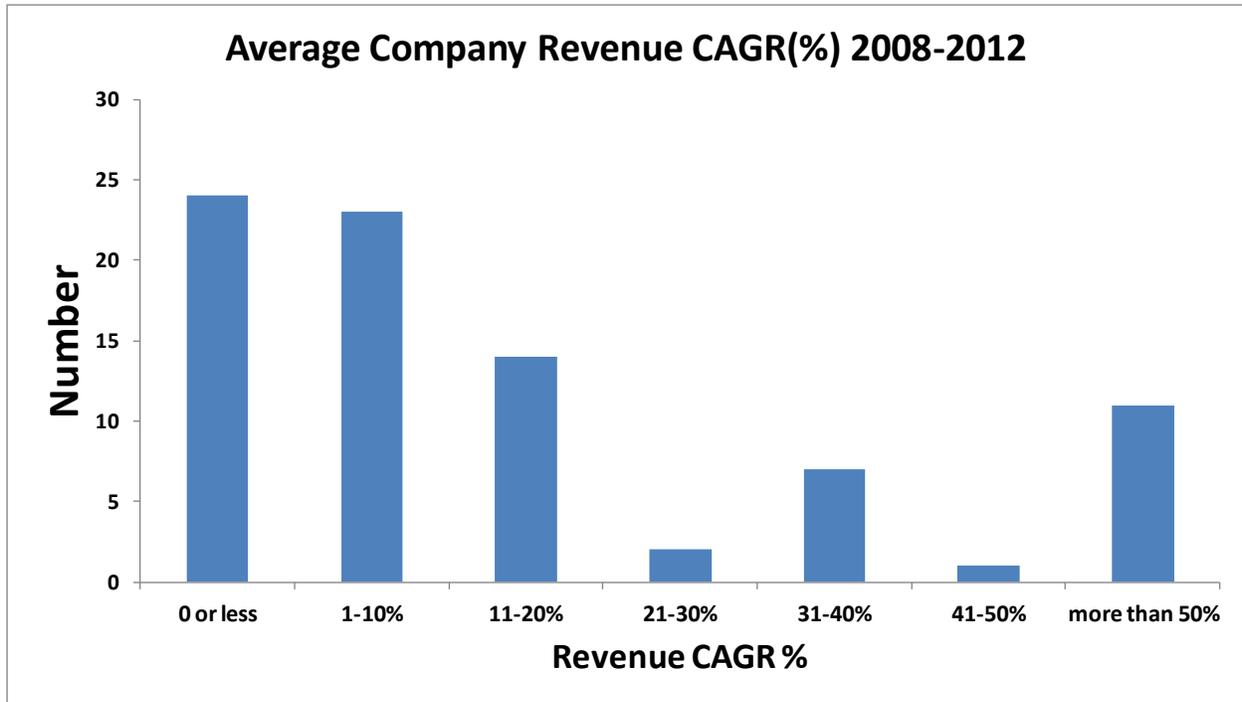
Revenues

74% of companies reported an increase in revenues during the last fiscal year compared to 2008

Very few companies reported a net decrease in revenues over the period though a number commented that trading had been difficult during 2009 and 2010 but was now recovering strongly. Of the companies reporting decrease in revenues, in many cases this was due to divestiture of a business unit or deliberate exit from a market sector¹.



¹ Divestitures within the sampled companies did not necessarily result in a net loss in jobs or total revenues as the divested entities continued operations under different ownership.



Of the 74% of companies reporting revenue growth most are in the range 0 to 20% CAGR, though there are 10 companies growing at more than 50% annually.

Some of these are companies that had zero or very low revenues in 2008. Compound growth rates >10%, demonstrated by many of the sampled companies, are encouraging given that the period includes the 12 to 18 months of global recession of 2009. A number of companies have been spectacularly successful and are poised to reach the \$100M p.a. revenue mark over the next few years. The median CAGR for all companies over the 4 financial years 2008-2009-2010-2011 was 7%. Considering this data set contains a significant number of small companies that have yet to get revenue traction, as a group, these photonics-based companies are significantly outperforming the overall Canadian economy on a growth basis, which only has an average annualised GDP CAGR over the same period of 0.8%².

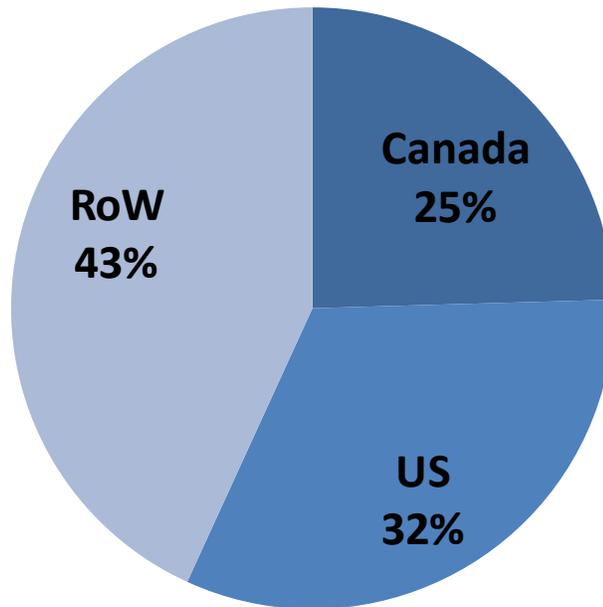
² Canadian GDP growth was +0.4% 2008; -2.5% 2009; +3.1% 2010; +2.2% 2011 or 4 year average of 0.8%.

Canadian Photonics companies remain strong exporters but with less dependence (since 2008) on the US and increased focus on Asia and the EU

Reviewing the geographic source of revenue on a company basis, there is a clear diversification away from the US towards Asia and Europe. The percentage of companies selling into Canada appears to have increased slightly. However, these are mainly small companies selling into niche markets, such as oil and gas or manufacturing and the total revenues accrued from Canada remains small.

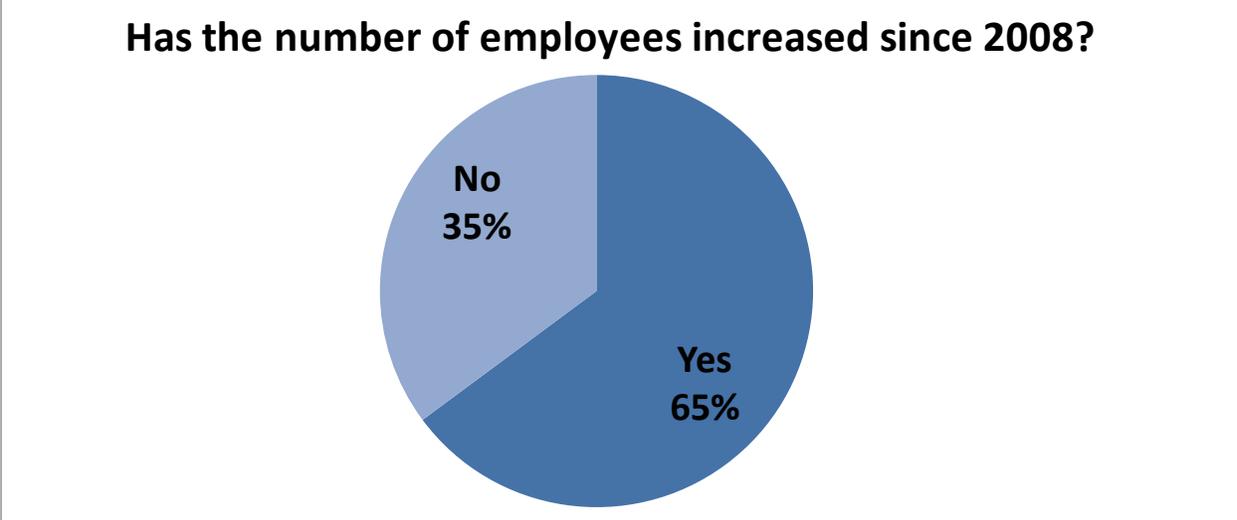
Exports to the US, as a share of revenues, have fallen significantly below exports to the rest of the world. Unlike in 2008, many companies are now **selling into China**. The European market remains sluggish due to the recession and the ongoing Eurozone issues but Germany is particularly seen as an attractive market especially for firms targeting healthcare and life science markets.

Revenue Source by Region (by firm)



Employment

65% of companies have added employees since 2008



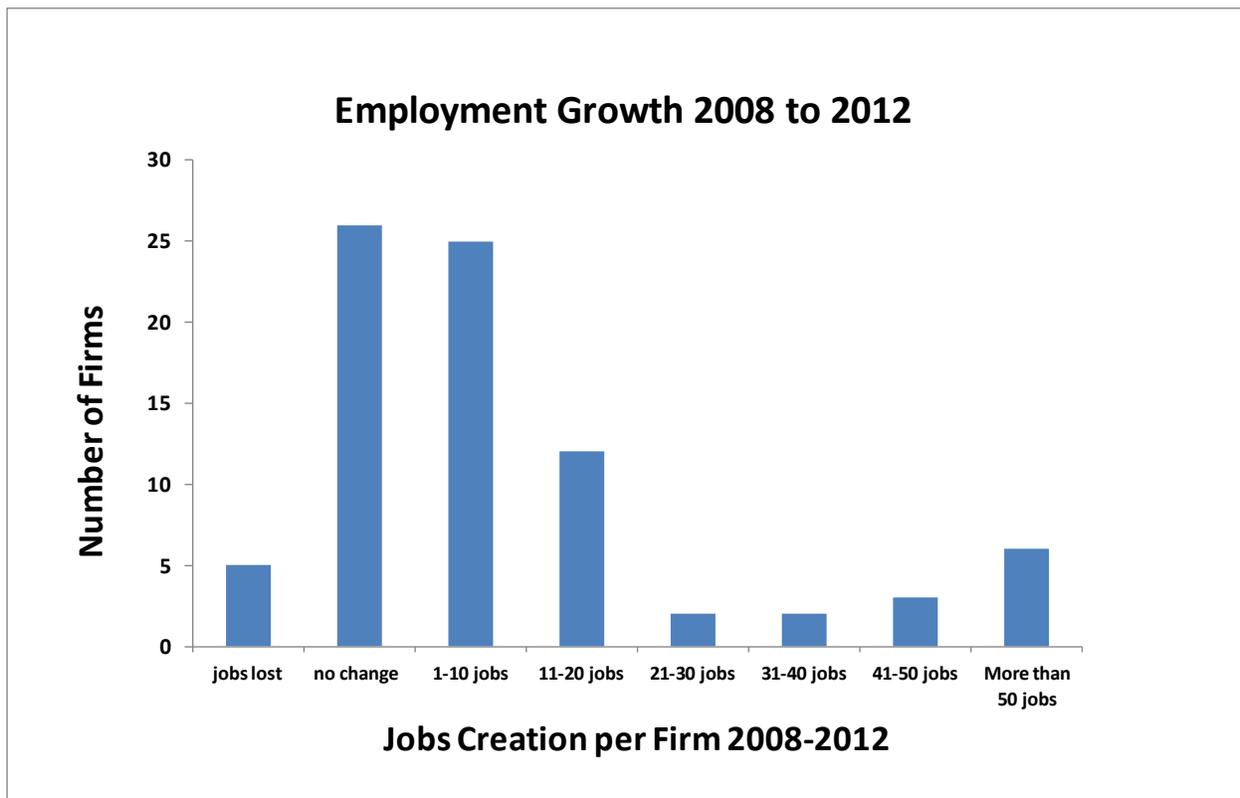
Of the >90 companies, 26 companies indicated no change in the number of employees. Only 5 reported a decrease in employment. 2 of these were a consequence of a divestiture. But we believe the jobs were not actually “lost” since the divested entities were not captured in the survey.

*Two-thirds of companies have added jobs.
Overall, the surveyed companies added >1,000 jobs (net)*

Looking at the jobs created per firm over 2008-2012 we see that most firms have added between 1-10 jobs. However, of the total jobs created the handful of firms that created more than 30 jobs over the period assessed are responsible for the majority of the job growth.

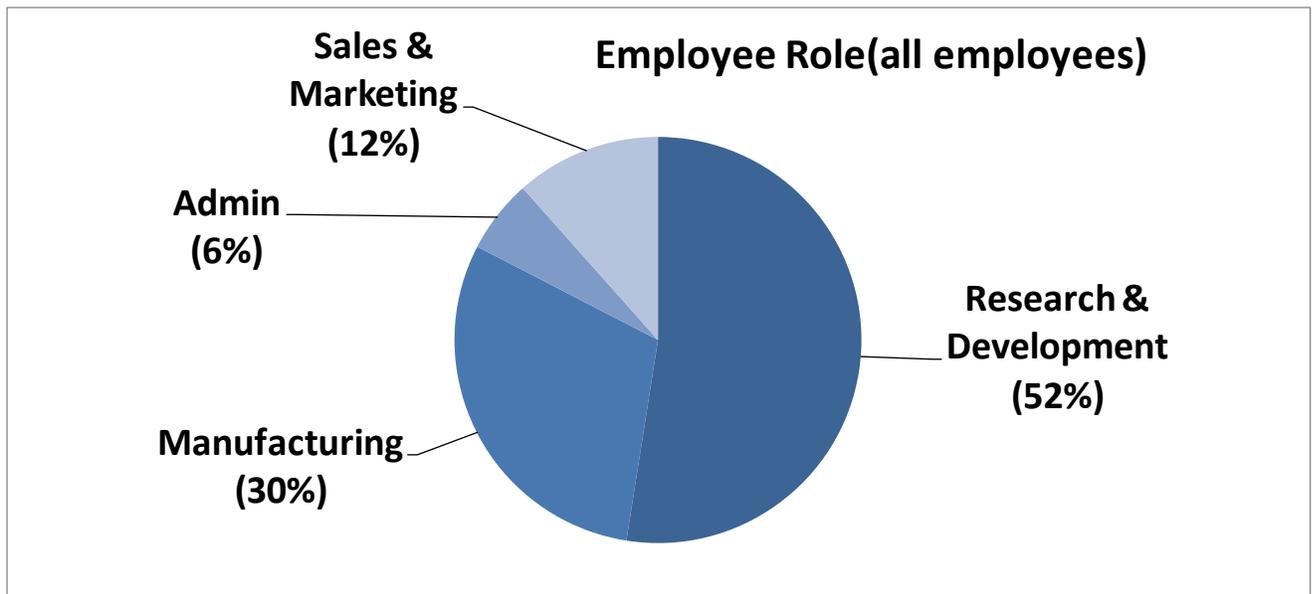
Similar to the revenue CAGR data, within the sample of firms reviewed there are a significant number high growth firms:-firms that have significant impact on overall job growth. This illustrates clearly the importance of photonics expertise being leveraged in high growth firms in Canada.

Were this level of job growth from the survey sample to be replicated across the sector as a whole (population), it is estimated that close to 3,000 photonics jobs will have been added during the last 4 years. Given the breakdown of jobs by function below, it is clear that majority of these are highly skilled technical, well-paid positions.



There is a significant increase in R&D jobs offset by a loss of manufacturing jobs in Canada

Over 50% of jobs are in Research & Development or other technical areas such as applications engineering. This is a major shift since 2008 when only 40% of jobs were in these areas. It is offset by a fall in the percentage of manufacturing jobs. Sales, marketing and admin remain at 18%, typical values for high technology companies.



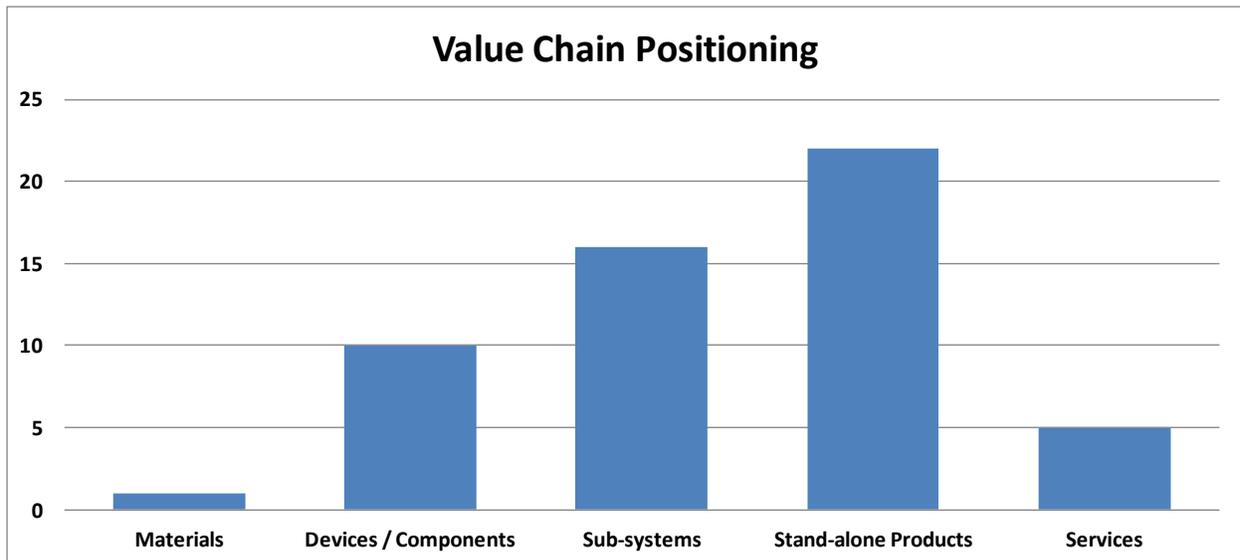
These changes have two possible explanations, both of which we believe to be partially responsible. On one hand there is a continuing move to offshore manufacture; on the other the survey may contain a disproportionate number of small companies that are particularly R&D intensive.

The move to offshore manufacturing was borne out in our interviews; a number noted that they had moved some manufacturing to China or in the case of newer companies noted that they had always planned to do so. What is impressive is that firms have managed their growth effectively and have ensured that they remain globally competitive by a focus on R&D to produce differentiated products and have leveraged low-cost labour in Asia when appropriate. It would appear that the relative loss in manufacturing jobs is the price to be paid for maintaining high-value R&D jobs. It should also be mentioned that many firms are constantly reviewing outsourced manufacturing practices as offshore costs increase and productivity, quality & IP issues arise in China.

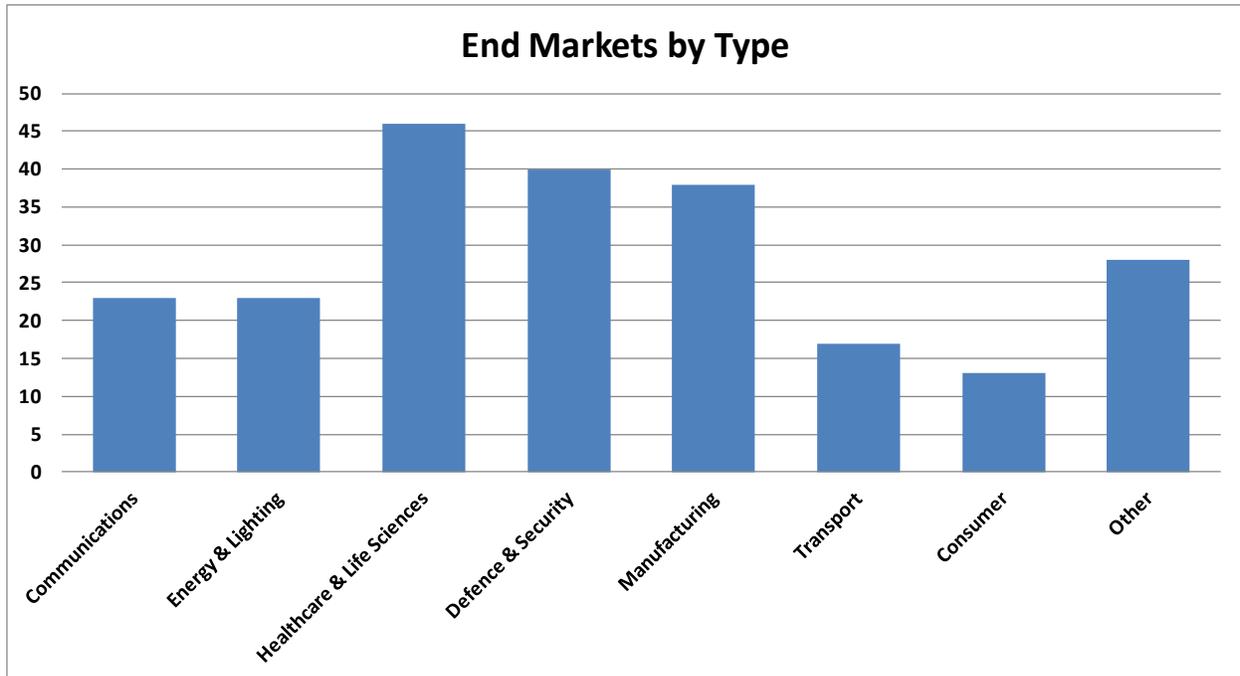
End Markets

Canadian companies remain primarily system integrators

Two thirds of the companies interviewed offer sub-systems or stand-alone systems as their end products. Only a quarter sell devices or components. A handful offer photonics based services such as surveying or imaging. The service number would likely be much higher if the significant number of laser welding and cutting shops was included. The distribution of companies in the supply chain is increasingly trending towards higher levels of integration and value. One firm sells a consumable material in combination with a stand-alone product.



Diversification of the end-market sector continues



Canadian photonic companies are moving aggressively into new market sectors. In particular, the nascent activity of 2008 in healthcare and defence & security has now matured. Over 40% of the companies surveyed claimed to be addressing the healthcare and life sciences sector and over a third the defence and security sector. These are significant increases over the percentages in 2008 (13% and 12% respectively). In the bio-photonics sector it was clear that many companies have moved beyond laboratory prototypes to real products that are generating real revenues. If this trend continues it is not unrealistic to expect that within a few years Canada will have several serious players in this space.

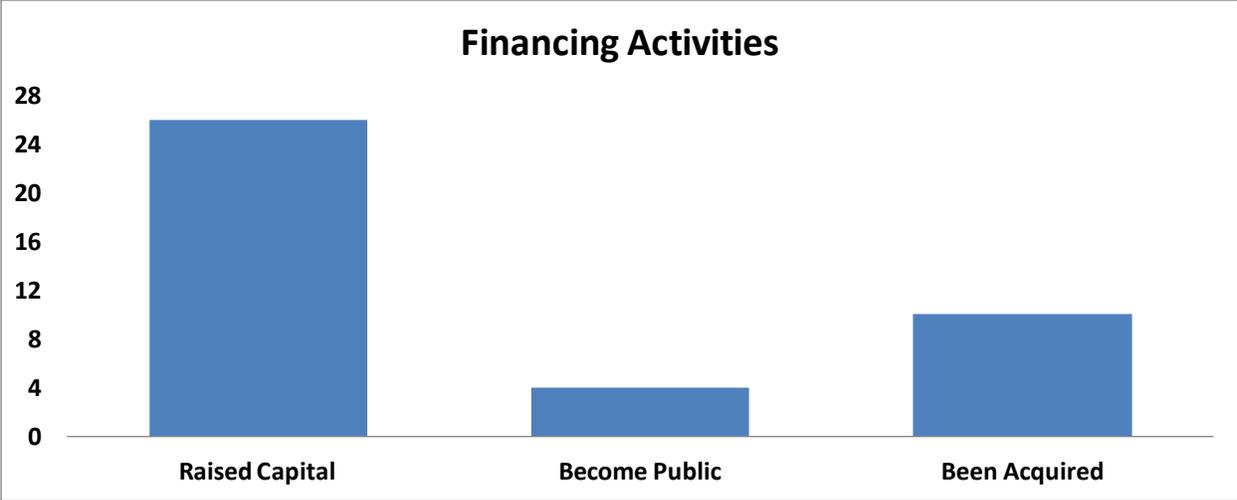
There is some growth in the number of companies addressing the energy and lighting sector, primarily oil and gas monitoring and solar PV. These areas are ripe for growth in the next few years.

An increasing number of companies are offering photonic based tools in manufacturing, which are essential to improve manufacturing productivity. Unlike in 2008 we identified several companies selling into transportation markets.

As in 2008 no companies in the survey are directly addressing the highly competitive and Asian dominated consumer market, with the exception of those providing optical inspection equipment for manufacturing of LCDs etc. We now find some firms selling indirectly into consumer markets through OEMs.

Financing Activities

Despite the tough global economic conditions, companies continue to raise capital



26 of the surveyed companies had raised capital during the last four years. In particular, many in Quebec participated in small rounds (seed/angel). However, there were some large rounds (>\$10M) from Tier 1 VCs too.

There was some M&A activity. 9 companies had been acquired, notably all by US acquirers though in all cases there has been no decrease in Canadian activity or employment. Two of these were major players – the acquisition of Nortel’s Metro Enterprise Unit by Ciena and of Dalsa by Teledyne. Four companies became public. Encouragingly, the traffic is not all one way. A number of the Canadian companies have themselves made small international acquisitions to gain access to markets or acquire skills or strengthen their supply chain.

We are aware of very few companies that have ceased trading since 2008.

OBSERVATIONS

Photonics-based firms are high growth, resilient and diversified

Currently, photonics-base firms in Canada are responsible for about ~\$6B in revenues (or >0.4% of GDP; ~\$5B in exports of which about 43% go to the US and 57% go to the rest of the world.

These firms have shown themselves to be outperforming the general economy in terms of growth-and they are particularly resilient, likely due to their diversification, against recession.

The Communications sector is healthy

Driven by the triple factors of (i) bandwidth hungry applications such as Netflix and i-Player; (ii) Wifi everywhere; and (iii) associated optical back-haul and capex replacement, the communications equipment market is growing annually at a double digit rate. This continues to be good news for those Canadian companies addressing this market sector.

In fact this sector contains some of the fastest growing companies. Three companies in Ottawa have grown revenues at over 30% annually and between them have added 250 jobs (though it should be noted that many of these have been filled by people moving within the sector). One company has raised over \$50M in financing.

Despite the gloomy press around the demise of Nortel the acquisition of its MEN business by Ciena has been good news for Canada. Though total revenues for the division are fractionally down, largely a result of price erosion, its losses have decreased and are largely driven by the acquisition costs. Ciena employs about 1550 people in Ottawa and Montreal, slightly up on the number employed by MEN in 2008.

There has also been inward investment in Ottawa by Huawei and Infinera, both of whom have established R&D facilities there.

China is a mixed blessing

Asia, and China in particular, has become a far more important factor in many of the companies' business. Besides the continuing trend to transferring manufacturing to the region, a significant number of companies now identify China as a market for their products.

There are still a number of concerns however;

- As a seller, a number of companies identified uneven business practices and predatory pricing as a problem
- As a buyer, falling quality of both product and service levels is seen by many as an issue

Very few companies identified IPR theft or imitation as an issue. Most companies believe that at present their products are too sophisticated for forgery. However, firms constantly monitor and undertake preventative measures to avoid suppliers having full access to an end-product.

The US \$ exchange rate is less of an issue

In 2008 many companies complained about the then relatively recent challenge of Canadian–US dollar parity. While still a challenge, most firms have now come to terms with US exchange rate risk.

There are fewer large Canadian owned photonics companies

With the acquisitions of Nortel MEN and Dalsa there are fewer Canadian owned photonic companies with more than 1,000 employees. Moreover, the most common “exit” route for Canadian photonics start-ups and SMEs continues to be acquisition by US enterprise.

Regional Strengths continue, but only Quebec now formally recognises the value of photonics

Quebec

Photonics continues to thrive in Quebec, which is now the only province to actively recognise the sector and encourage investment in it. This is in part due to the efforts of the Quebec Photonic Network (Réseau Photonique du Québec) which is now the only formal cluster organization in Canada. Quebec companies cover virtually every market sector and benefit strongly from the presence of INO which continues to spawn new ventures. Quebec, through MDEIE, has also introduced several programs³ to support the establishment and growth of firms.

Ontario

It is disappointing to see the demise of the province wide Ontario Photonics Industry Network (OPIN) and the re-organization of Ontario Centres of Excellence that has led to termination of the Centre for Photonics. As a result there is no specific organization driving investment in photonics at the provincial level. Nevertheless the industry remains strong in Ottawa and in the Toronto-Hamilton-Waterloo triangle. In Ottawa there is a rebound of the communications sector and a burgeoning bio-photonics community. The CPFC continues to play a key role in driving this cluster. In the South West imaging remains strong, anchored by Teledyne-Dalsa, and there are a number bio-photonics companies clustered around the University Health Network. Ontario is also seeing the growth of a number of solar photovoltaic companies from devices to system integrators. This sector is likely to grow given the Province's favourable attitude to green technologies and the NSERC funded Centre of Excellence centred at McMaster University which brings together a number of companies and universities

British Columbia

Though there is no formal cluster organization in BC and the region is likely under represented in this survey we are aware of at least 30 companies in the Vancouver area. The energy and lighting sector predominates. A challenge for the new CPIC organization will be to engage this community in its activities.

³ <http://www.mdeie.gouv.qc.ca/objectifs/exporter/programmes-daide/programme-exportation/>

One of the recommendations in “Making Light Work” was to establish formal clusters in Western Canada. NINT and ACAMP are strong catalysts in Alberta, and Edmonton in particular, where there are a number of companies addressing the oil and gas sector. ACAMP has a significant number of such companies in its client base. CPIC should consider working with ACAMP to establish a more formal Alberta/Edmonton cluster.

Companies make widespread use of government support and tax incentives

There is widespread usage of SRED which is widely positively regarded; only one respondent “did not bother with SRED”. Photonics companies are tech savvy and have good project/product development procedures which are readily compatible with SRED. There is considerable nervousness about the outcomes of reforms to the SRED process.

IRAP received mixed reviews, with a number of comments that the application process was burdensome and that it was not always worth the upfront effort. IRAP is seen to be very helpful in the early stages but the combination of SRED reduction, small project size (\$) combined with the sunk cost of application, causes firms to often prefer to allocate resources to other activities.

A number of companies noted that whilst support for R&D was forthcoming it was the lack support of other aspects such as marketing and trade shows that is a greater concern. Frequently respondents noted that overall government support for development is good but is lacking in driving sales growth. Considering that these firms are export driven it is recommended therefore that CPIC continues to work with DFAIT to help SMEs gain a strong presence at trade shows.

Government supported R & D labs continue to be important anchors

INO and CPFC continue to play important roles in the development of the Canadian photonics eco-system. ACAMP is increasingly doing so.

Although INO attracts about 21% of its revenues internationally, hitherto its influence in Canada has been largely limited to Quebec but conscious efforts have been made to expand this to other provinces with the opening of offices in Hamilton (Ontario) and Edmonton (Alberta). INO continues to stimulate new companies and has identified bio-photonics, energy and environment as growth areas.

CPFC has increased its revenues and is moving increasingly from proto-typing to a fuller support of its clients' product development and revenue generation. The client base is still heavily communications oriented. A number of interviewees expressed concern at the continuing government commitment to CPFC and the planned budget cuts at NRC.

ACAMP was just started in 2008, but has now grown to be an important part of the high tech eco-system in Alberta. Its mission is to help start-up companies go from concept to product, by providing both technical, design and commercial support. It can provide packaging expertise from chip level up to fully engineered systems. Its facilities include two large clean room in Edmonton and Calgary; laser packaging facilities (TO cans, butterfly); and the first low temperature, co-fired, ceramic (LTCC) line in Canada. Among its clients are a number of optical companies. ACAMP has the potential to be a powerful incubator for a photonics cluster in the Edmonton area and to provide packaging support across the country.

APPENDIX 1: Interview and Survey Questionnaire

(1) Have your company revenues increased since 2008?

Yes.....No.....

If Yes by what percentage.....

(2) Has your company increased the number of employees since 2008?

Yes.....No.....

If Yes, by how many?.....

Current breakdown of employees:

R&D

Manufacturing:

Admin

Sales, marketing and business development

(3) Which of the following market sectors do you address with your products?

Please tick all that apply.

2008

Now

Communications

Energy and Lighting

Healthcare and Life Sciences

Defence and Security

Manufacturing

Transport

Consumer

Other

- (4) Offered products:
- | | 2008 | Now |
|---------------------|------|-----|
| Materials | | |
| Devices/components | | |
| Sub-systems | | |
| Standalone products | | |
| Services | | |
- (5) What is the approximate geographic breakdown of your company's revenues
- | | | |
|---------------|--------|--|
| Canada |% | |
| US |% | |
| Rest-of-world |% | |
- (6) Has your company:
- (a) Raised additional capital (venture capital or private equity) since 2008?
- Yes.....No.....
- (b) Become public through IPO or RTO?
- Yes.....No.....
- (c) Been acquired?
- Yes.....No.....
- (d) If your company has raised additional capital, how much?
- (7) Current challenges/issues
- Financial
 - Market
 - Technology
 - Qualified staff
 - Other
- (8) Any other comments?