



**BUILDING WIRELESS
TECHNOLOGY CLUSTER IN
OTTAWA**

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1 Introduction to Executive Summary

This is an executive summary of the *Building Wireless Technology Cluster in Ottawa* report, which was written by Angelo Santos and Kamal Krishnapillai. The report was prepared as part of their management consulting project for the University of Ottawa's Executive Masters in Business Administration program. It was prepared with the following audience in mind: local wireless executives, investors and workers, global wireless executives and investors, and the Ottawa Center for Research and Innovation's cluster outreach group and Ottawa Capital Network.

Cluster based economy

ICF Consulting, a San Jose, CA based regional development firm, identified that Ottawa has seven clusters and each is at a different stage of its life. In its report, ICF Consulting has suggested a cluster based economic development as a viable option for Ottawa's economic growth. (Choosing a Future: New Economic Vision for Ottawa, ICF Consulting, August 2000)

Motivation for this project

In recognition of the key role high technology clusters play in the Ottawa Region and the growing commercial wireless market, Angelo and Kamal decided to evaluate the feasibility of building a wireless technology cluster in Ottawa. Both Angelo and Kamal are working for leading technology firms in product development and in marketing respectively (More than 1000 man-hours have been spent on this report).

Wireless industry in general

Industry analyst Jagadish Sheth reports that commercial wireless products and services generated approximately \$85 billion in worldwide revenues in 1996, or the equivalent of 8 percent of the total communications market. Sheth estimates that wireless revenues will increase more than \$600 billion, roughly 25 percent of the total communications dollar, by the year 2010. (Jagadish N. Sheth & Rajendra S. Sosodia, *A Strategic Vision of the Wireless Industry: Communications Unbound* (Institute for Communication Research and Education, International Engineering Consortium, 1997)

1.1 Study Objectives and Methodology

We believe it is a usual business practice to develop a business case prior to launching any new initiative. The new initiative here would be to build a wireless cluster in Ottawa. The objectives of this study are:

- Establish a business case for wireless sector and demonstrate the need for Ottawa to focus on a wireless sector
- Demonstrate clusters as viable and successful economic generators and build a business case for Ottawa's wireless cluster



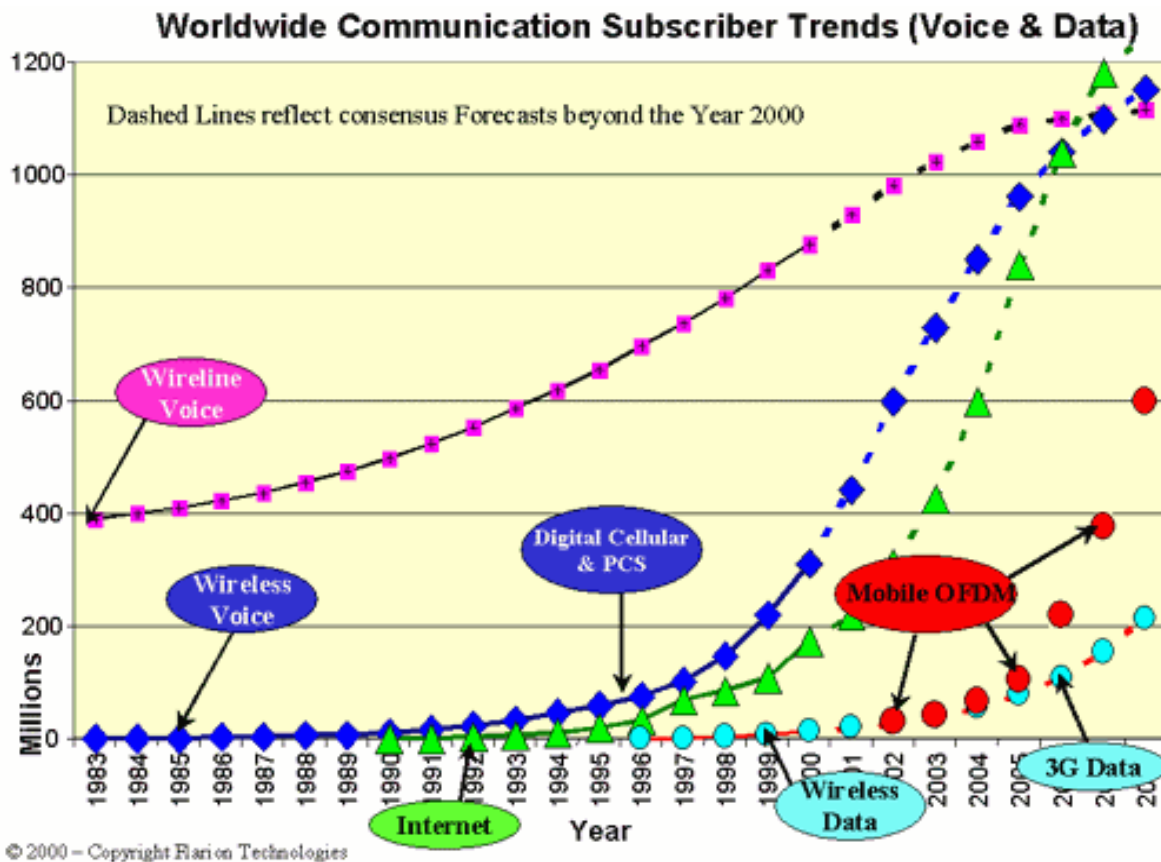
- Provide recommendations to accelerate the growth of Ottawa’s wireless cluster

This study is based on a review of research on cluster development, an analysis of other successful clusters, wireless market and technology reports, and the role of venture capital on cluster development. We also conducted in-depth interviews with over 20 people in and outside of Ottawa. We have interviewed some of Ottawa’s well-known senior executives, and business people. The list includes Denzil Doyle, Leo Lax and Luc Lussier.

1.2 Business Case For Wireless Sector

This section illustrates wireless as the next frontier in the digital economy. The picture is a projection of the worldwide communication subscriber (voice & data) market for the next five years. Perhaps the most compelling argument in favor of the wireless segment can be extracted from the following picture. (Flarion is a spin-off from Lucent Technologies and it develops solutions for 3G mobile markets)

Market



(Source: www.flarion.com)

The graph illustrates that for the next five years the number of mobile subscribers will increase exponentially. There will be over 1 billion subscribers worldwide by 2005.



Furthermore, it is important to note that the mobile handset market is by its nature a recursive market. This means that every year new phone sets with new features will be deployed and there will be a demand for the new devices. We can just ask ourselves how many mobile phone sets we have owned in the last three years? By observing the people around us changing to new mobile phones every time a new feature is added, we can safely predict the market will always be dynamic.

With the above -mentioned points, we can assess the mobile market potential in the following way: Assume that in 2005 the price of a handset is US \$100. According to the graph, there will be 1 billion mobile subscribers worldwide. So, the mobile device market will be \$100 billion (U.S.) or approximately \$155 billion (CAN) worldwide. Suppose Ottawa captures only 5% of the mobile market, in 2005 it will generate around \$8 billion (CAN) in revenues. This is almost half of the current total technology sales. (According to OCRI the advanced technology industry in Ottawa generates annual sales of \$20 billion (CAN) (www.ocri.ca))

Furthermore, a report on Economics of Mobile Wireless Data from Qualcomm suggests that teenagers will be early adopters of wireless data services. The teenagers are expected to use the services for downloading MP3 files, streaming music videos and on-line games. Another interesting feature of the mobile wireless services is active position location such as locating friends or parents locating their teenagers. (www.qualcomm.com - White paper on Economics of mobile wireless data) It is noted that mobile handsets have very small displays and a limited ability to transfer data. This factor can make Internet access through mobile devices a limited market. However, through innovative marketing and new technologies Internet wireless access can increase its subscribers.

Business to Business Sector

Wireless business services improve business processes, such as sales and logistics. The Business-to-business (B2B) wireless market is in its infancy. As for mobile B2B transactions, McKinsey estimates that by 2004 the wireless B2B market will be about 4 percent of the global B2B e-market. The estimated global B2B e-market trading volume is \$3 trillion (U.S.). (The McKinsey Quarterly, 2001 Number1 - Profit in wireless B2B Erkkö Autio, Marcus Hacke, and Vesa Jutila)

Conclusion - Business case

From the Flarion graph it is clear that the wireless sector is going to be a key player in the communications market. In addition, according to McKinsey, 4% of \$3 trillion (U.S.) will have gone into the B2B mobile services market by 2004. Furthermore, SRI Consulting Business Intelligence Center predicts “By 2005, wireless handsets -- that is, mobile phones and handheld computers -- will outnumber notebooks and desktop machines by a remarkable ratio of four to one. And by 2010, 3.5 billion people will have access to mobile phones”. (www.cio.com, September 15, 2000) Therefore, we can state with confidence, that the mobile wireless market will be the next frontier in the digital economy.

(Note: We have used mobile wireless to illustrate the wireless market potential and have not discussed the other segments such as satellite systems, fixed wireless and Wireless LAN in this analysis here.)



1.3 Why does Ottawa need to focus on wireless sector?

For any region that wants to be part of a growing sector like wireless, it should not ask, “why wireless?” but it should ask “**How?**”

Diversification

Ottawa needs to focus on high growth sectors such as wireless. Ottawa has been expanding its high technology sectors on a continuous basis. It started with the telecommunications sector in the early 60's, now it has the microelectronics, software, photonics, semiconductor, and biotech sectors. All of these clusters have their unique position in Ottawa's economy. Wireless should be the new addition to Ottawa. As demonstrated in the previous section, wireless is a growing market, and Ottawa has the potential to make \$8 billion from this market as discussed in the previous section.

Natural choice

Furthermore, the wireless sector is also the natural choice due to its synergy with other local sectors and its enormous growth potential. For example, it is relatively easy for a software company or a semiconductor firm to redirect its business from other telecom segments to wireless than to redirect it to the biotech sector.

1.4 Business case for Ottawa wireless technology cluster

The business case for a wireless cluster is established following these steps:

- Studying the need for a wireless cluster in Ottawa
- Assembling general observations to highlight key points

Why does Ottawa need a wireless cluster?

- Previously, in “Why Ottawa needs to focus on wireless sector?” we have demonstrated the need for Ottawa to focus on a wireless sector. Later, our research into other successful economies, including Ottawa, led us to the conclusion that clusters are considered as viable economic generators.

In addition, we have learned from RTP and Telecom Corridor that success in creating high-tech clusters is now the distinguishing determinant of regional vitality. Ottawa has successfully managed to grow seven clusters.

- Ottawa has been employing a cluster-based approach to economic development. It has been demonstrated as a proven strategy. To capitalize on the wireless market growth Ottawa needs to be globally competitive and innovative. A cluster is the natural step for maintaining global competitiveness and innovative culture.
- Furthermore, most of the wireless technology firms in Ottawa are listed under the telecommunications cluster, and some are grouped in the microelectronics cluster. Also, a few are placed under the software and communications services cluster. Being part of other



technology clusters does not provide the amount of clout that a sector needs to position itself as an emerging sector. Therefore, a cluster is the most viable option for the Ottawa wireless technology sector.

General observations

Currently, Ottawa houses ten global players such as Nokia, Nortel, Alcatel, Siemens and Marconi. In addition, Ottawa has many new ventures developing wireless components, systems, software and content delivery solutions.

Ottawa's current wireless ecosystem consists of wireless players from component makers to content providers and scientists to service providers. An analysis of Ottawa wireless companies shows that most of the companies are focused on developing solutions for emerging wireless markets.

CRC is one of the premier labs in the Ottawa area that is focused on delivering innovative wireless solutions. CRC is a major communications research facility located in the heart of Ottawa's telecommunications centre. With a staff of more than 150 researchers, CRC conducts research in areas such as:

- Broadband networks
- Wireless, mobile and satellite communications
- Advanced TV, sound transmission and processing, including multimedia
- Microwave
- Wireless networks
- Radio propagation and prediction
- Advanced antennas
- Voice processing, and many other communications related areas.

CRC's Innovation Center program helps any Canadian firm trying to develop new communication products or services without major investments in capital equipment and facilities. With CRC's research and Innovation Center program a wireless entrepreneur initially needs only capital to grow a wireless venture. Furthermore, local universities have developed wireless centric engineering programs.

Conclusion – Business case for wireless cluster

All the above mentioned facts strengthen the need for a wireless cluster in Ottawa. However, a few of our interview participants asked us an interesting question. With all these advanced communication technologies do we still need a cluster?

John Seely Brown and Paul Duguid, provide an answer to this question in their “Mysteries of the Region -Knowledge Dynamics In Silicon Valley” article. (John Seely Brown and Paul Duguid 2000 - This paper was in The Silicon Valley Edge; A Habitat for Innovation and Entrepreneurship) They state “At least with the current generation of communications technologies, clusters will continue to exist in exactly those industries where fast-breaking knowledge is at a premium. Consequently, as we have suggested, those wanting to develop a robust knowledge economy need to learn how to develop (and not simply imitate) a robust knowledge ecology.”(John Seely Brown and Paul Duguid)



Based on the facts mentioned above and from opinion of experts (Dugid and Brown) we conclude Ottawa needs to employ a cluster-based approach to build its wireless sector.

1.5 What are the factors that interact to make a cluster?

Previously, governments have employed industry based development policies. Industrial policy makers argued that comparative advantage is based upon cheap inputs and low-cost labor. Perhaps, this approach was true in the old economy. However, RTP and Telecom Corridor have proved that regions must develop their competitive advantage based on the ability to innovate continuously.

Michael Porter refers to the following as the factors that interact to make a cluster: (Michael E. Porter (The Competitive Advantages of Nations, (Porter, 1990))

- **Human Resources and others:** such as a specialized labor pool, specialized infrastructure, and sometimes selective disadvantages that drive innovation
- **Home demand:** local customers who push companies to innovate, especially if their needs or tastes anticipate global or local demand
- **Related and supporting industries:** nationally competitive local supplier industries who create business infrastructure and spur innovation and spin off industries
- **Industry strategy, structure and rivalry:** intense rivalry among local industries that is more motivating than foreign competition and a local culture that influences individual industries’ attitudes toward innovation and competition.

These factors provide insight into a cluster. From our research we found that these factors are intertwined with the following cluster elements: companies, human resources, financing, infrastructure, research labs, schools, incubators, economic development agencies, and media. (For example one factor is innovative culture and it can be measured by taking a snap shot of Ottawa’s research activities and universities).

Furthermore, the above mentioned factors interact to form a cluster. Next we will examine these elements to see where Ottawa stands on these factors. Prior to our examination we will list some of the key success factors that made regions successful wireless leaders. Combining the cluster forming factors and key success factors of becoming a wireless leader will allow us to form our opinion on Ottawa’s current situation.

We observed the following factors and resources as necessary for a community to build a viable wireless technology industry and to become a leader in the wireless arena. These are compiled after carefully reviewing the key factors that made San Diego, Waterloo (Ontario), and Helsinki (Finland).

KSF	Common threads
Labs, Research, and Be the first →	Innovative culture that fuels growth
Funds for start up →	Financing machine (Angels to VCs)
Be part of standard committee →	Competition and co-operation among firms
Skilled workforce →	Highly educated and skilled workforce
Engineers with business acumen →	Entrepreneurship
Relationship with other successful centers →	Linkages among sectors



1.6 Does Ottawa have what it takes?

We examined the wireless community in Ottawa by taking a snap shot of Ottawa and the summary as follows. (See Appendix 1 for Snap Shot of Ottawa)

Elements/ Factors/ KSFs	Comments
Financing	Need more venture capital Not on VC's radar screen as a wireless player; Needs promotion
HR	Quite satisfactory Highly skilled Higher institutions of learning promotes technology
Anchor Company*	No prospective anchor Have 10 global players
Research	Doing very well National and universities lab –NRC and CRC spin-offs (SiGe, SiGEM, AmikaNow)
Media	Supportive Wireless Revolution article by The Ottawa Citizen A follow up to that article on Ottawa Business Journal
Industry awareness	Needs promotion Ottawa entrepreneurs are very aware of wireless but in general it is very poor
Infrastructure	Satisfactory – Needs improvement as the city grows
Industry linkages	Not satisfactory Needs to partner with other successful wireless clusters such as Helsinki and San Diego
Innovation	Satisfactory New companies have emerged with innovative products
Entrepreneurs	It appears that local wireless workers are interested in being wireless entrepreneurs (OCN gets many wireless business proposals for funding)

(*Anchor company – a successful leader in the same field who leads and supports the cluster building activities. This will be discussed in the latter part of the report.)

Ottawa appears to fare reasonably well in some of the cluster factors and some of the key success factors (in becoming a wireless leader). Therefore, Ottawa needs to build on its unique strengths such as research labs and human resources. And Ottawa needs to address issues associated with a few vital factors, such as financing, anchor company and industry promotion (to gain partnership with other wireless centers.)

The following sections will provide a detailed account of Ottawa's wireless strengths, and gaps that need to be addressed (for building the wireless cluster). In addition, these sections provide more information on the elements/factors listed in the above table.



1.7 What are Ottawa wireless sector’s unique strengths?

The following table illustrates the unique characteristics of Ottawa for a building wireless cluster.

Characteristics	Comments
<p>Major telecommunications research centres and universities</p> <p>*Some of the interview participants referred to CRC research as the key element in Ottawa wireless sector.</p>	<ul style="list-style-type: none"> • Communications Research Center (CRC), National Research Council of Canada (NRC), National Capital Institute of Telecommunications (NCIT), Communications and Information Technology Ontario (CITO) • According to OCRI statistics, Ottawa conducts more than four times the research and development per capita of any other Canadian city • Universities are also doing research in wireless. Example Carleton University: <ul style="list-style-type: none"> • The Mobile and Wireless Networks Group conducts research dealing with Mobile Internet Protocols Mobile Operating Systems, Service Location Protocols and Satellite Specific Protocols • Alliance with NCIT to explore the latest wireless, high volume data transfer and multimedia and Internet technology
<p>Outstanding Workforce</p>	<ul style="list-style-type: none"> • More than 30% of the region’s population is university-educated compared to the Canadian 22% and also 7% of Ottawa’s workforce is comprised of scientists and engineers • According to Statistics Canada, Ottawa has the highest educated workforce in Canada. 7.3% of Ottawa’s population is either engineers or scientists • Skills leverage from other major sectors: photonics, telephony, etc
<p>Quality of life</p>	<ul style="list-style-type: none"> • The Corporate Research Group, a Swiss-based management firm, has ranked the Ottawa region sixth in the world in terms of its quality of life. <p>From Siemens website: “Ottawa is the heart of Canada's vital and dynamic advanced-technology and R&D sector. With income and educational levels well above regional and provincial averages, Ottawa offers an excellent quality of life for residential and corporate citizens alike.”</p>



<p>Entrepreneurs have high visibility and trust among investors – compared to other cities in Canada</p>	<ul style="list-style-type: none"> • According to OBJ (June 25, 2001) in the first quarter of 2001, Ottawa alone raised about 40% of venture capital across Canada. (Ottawa is doing much better compared to Montreal and other cities.)
<p>Geographic location and population size</p>	<ul style="list-style-type: none"> • Ottawa is located within a few hours of important Canadian and Eastern US economic centres • Compared to Toronto and Montreal, Ottawa’s population receives the following benefits: <ul style="list-style-type: none"> ○ Less commuting ○ More affordable housing ○ More green space (“Green Belt”) ○ Less pollution ○ Easier infrastructure management
<p>Leverage photonics global visibility and resources</p>	<ul style="list-style-type: none"> • Ottawa could use the photonics success as a showcase of the city’s capacity in generating a strong technology sector. • Ottawa’s wireless sector can leverage photonics resources: workers, office space, etc
<p>Seed wireless cluster</p>	<ul style="list-style-type: none"> • Ottawa already has a small, but vibrant and fast growing wireless industry

1.8 Why is it a seed cluster?

There are a few good reasons to think of Ottawa’s wireless industry as a seed cluster. In this section we illustrate how we came to that conclusion. The reasons for our conclusions are as follows.

In the Choosing a Future: A New Economic Vision for Ottawa report, ICF Consulting cited New Media and Environmental Technologies cluster as seed clusters in Ottawa. Their rationale is as follows. (Choosing a Future: New Economic Vision for Ottawa, ICF Consulting, August 2000)

“There is an increasing evidence of a growing concentration of employment in this cluster, a similar pattern that is being seen in other technology centers in North America. New media is emerging at the “intersection” of several sectors including computer hardware, software, printing and publishing and entertainment.”

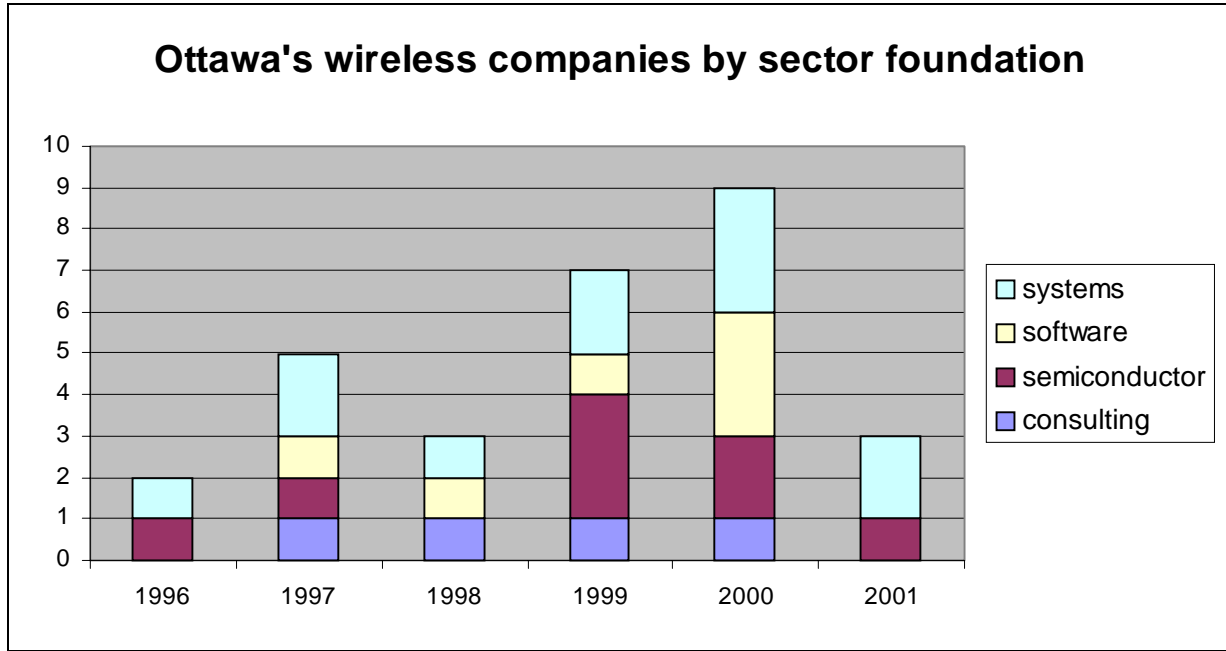
Interestingly, Ottawa wireless sector can be explained using the above terminology that was used by ICF Consulting to explain two sectors in Ottawa. ICF Consulting is an authority in cluster development. In fact they probably are one of the few firms on the globe that does this type of work. We will now try to summarize the Ottawa wireless cluster in the following way.

- There is increasing evidence to show growth in the Ottawa wireless sector in the last few years. Wireless is at the intersection of several sectors such as telecommunications, semiconductor, software and services. The technology development is growing each day. The need for wireless security and smart antenna is growing. The Ottawa based Communication Research Center (CRC) is one the Canada’s best antenna research centres. (Ottawa wireless is a growing sector and there are currently 61 companies and 2872 workers in this sector.) (Refer to Appendix 2 for more information)

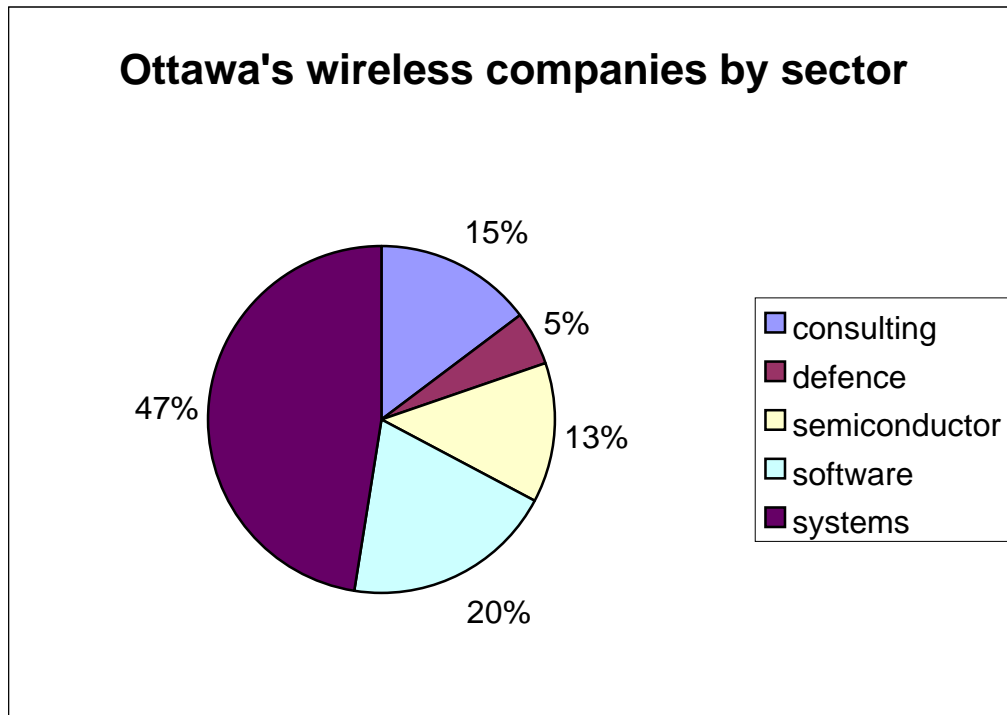


Graphical Illustration

A graphical illustration of a seed wireless cluster is as follows: the bar chart shows that the wireless sector in Ottawa is always in progressive mode. (Yr. 2001 consists Q1 and Q2 numbers only.)

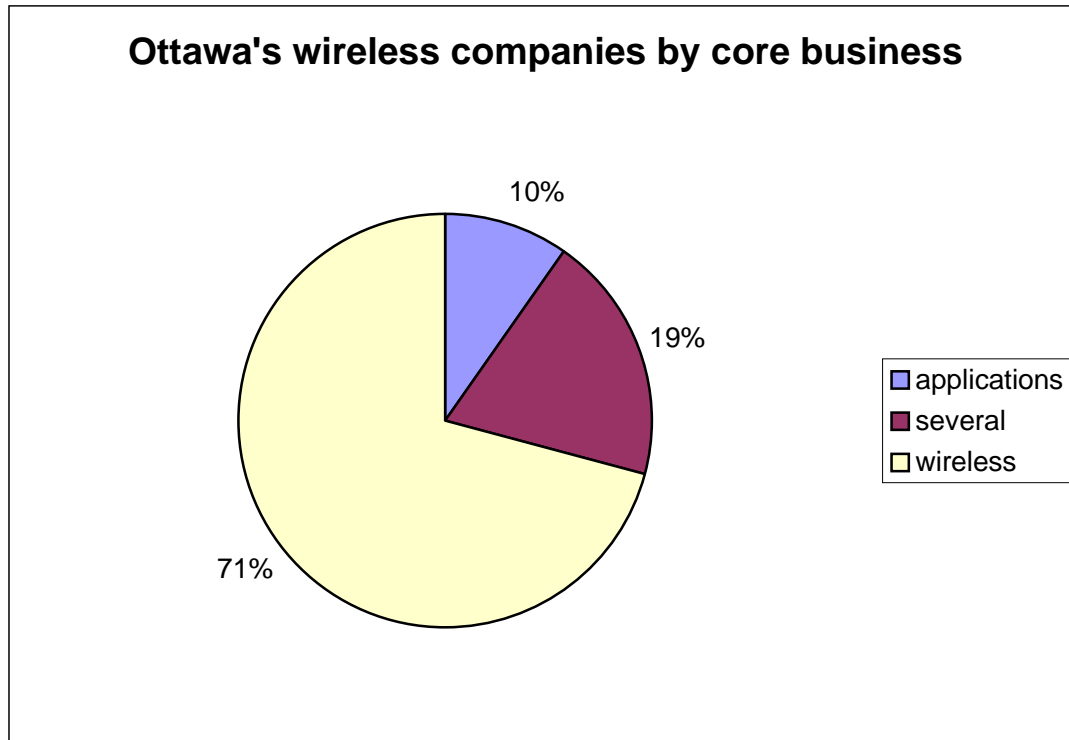


The following pie chart illustrates wireless companies in Ottawa, which span five market sectors. (Sample size of 61 companies.) (For Yr. 2001 the numbers are for Q1 and Q2 only)





The pie chart below shows that 71% of the wireless companies have wireless as their core activity. (Sample size of 61 companies.)



1.9 Where are the gaps?

In the previous sections, we have demonstrated the clusters unique strengths and proved it is a seed cluster. We need to capitalize on the unique strengths to build the cluster. The activities for capitalizing on the unique strengths will be discussed in the next section. In the meantime, we also need to address the gaps so that we can build the seed cluster into an emerging cluster. The gap analysis is discussed below and strategies for addressing the gaps will be discussed in the next section as well.

Key success factors for building Ottawa wireless cluster

We asked Leo Lax, CEO, Skypoint Capital, a premier venture capital firm in Ottawa about the major factors in building a cluster. He stated the following as the key success factors in building a cluster. To his credit, Lax has built two clusters within the last 10 years (Vancouver, Canada and in the UK). He was also instrumental in building all the former Newbridge (now Alcatel) affiliates around the Kanata Technology Park.

- Access to money (Angel, Venture Capital and government grants)
- Presence of a large corporation in a similar business (An anchor company)
- Access to technology and innovation (Access to research labs and universities)

- Availability of quality entrepreneurs

Insights gained from other cluster-based economies

We examined four cluster-based economies to gain knowledge on cluster development.

- Entrepreneurial minded technology workers from Texas Instruments and Collins Radio branched out to create new companies in Telecom corridor (**KSF is entrepreneurship**)
- Among other things the higher education system was the premier factor in the development of Research Triangle Park (RTP) in North Carolina (**KSF is innovation**)
- The revolution of the Internet has increased the demand for bandwidth and fibre optics deployment and was the most viable solution to fulfill the demand. This paved the path for Ottawa photonics cluster
- JDS Uniphase solidified the success of Ottawa’s photonics cluster (**KSF is anchor firm**)
- The “red-hot” photonics market attracted venture capitalists to Ottawa and this made access to capital relatively easy for photonics start-ups in Ottawa (**KSF is venture capital**)
- Co-operation among the firms in Ottawa allowed them to form the Ottawa Photonics Cluster

Based on our study of RTP, Telecom Corridor and Ottawa Photonics clusters and the information provided by the interviewees we regarded the above as key success factors in building a cluster.

Analysis – Ottawa wireless cluster vs KSF for building wireless cluster

The analysis was conducted by choosing a baseline for analysis and comparing the KSFs against on what Ottawa has to offer currently to satisfy the KSFs.

Baseline for analysis

To conduct our analysis we decided to use Ottawa Photonics Cluster and Waterloo’s Wireless sector as the baseline. (Ottawa Photonics is regarded as a very successful cluster in North America and Waterloo wireless is a well-known wireless centre in Canada.) Our discussions with the local business community and people in Waterloo allowed us to develop a guideline for gap analysis. (Refer to Appendix 4 and 5 for key information on Waterloo Wireless and Ottawa Photonics)

Analysis summary

We established the following table after comparing the current Ottawa seed wireless cluster to the Ottawa Photonics Cluster and to the Waterloo emerging wireless cluster.

	Entrepreneurs	Research	VC	Anchor
Ottawa Wireless	Excellent	Excellent	Need more - reach Photonics level	No anchor yet



Discussion and Illustration

Venture capital

Role of venture capital in cluster development

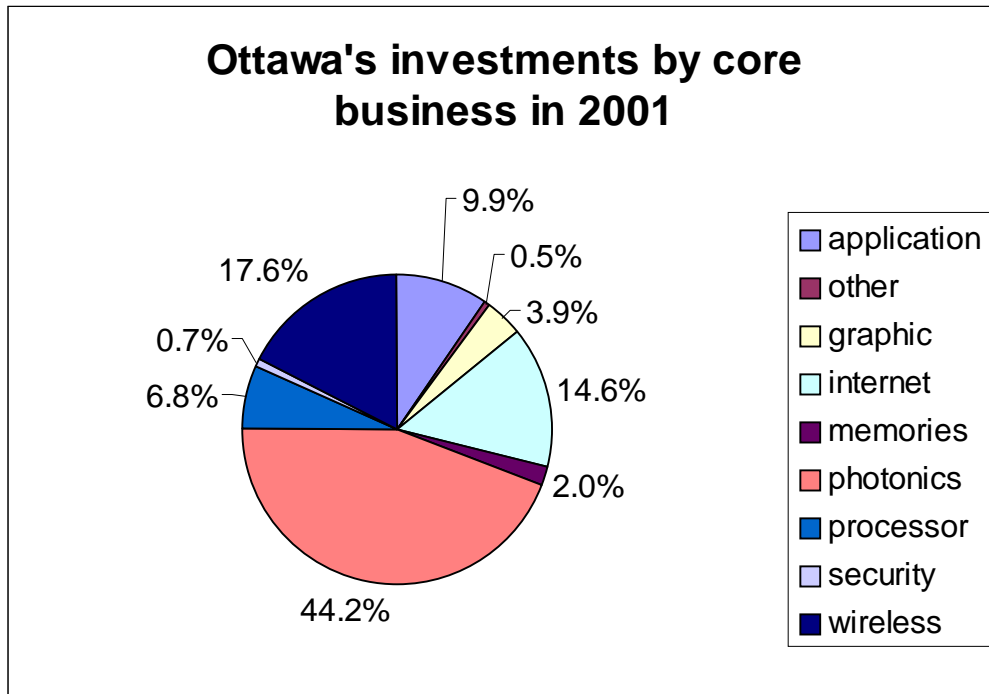
Many entrepreneurs do not have sufficient resources to run their ventures on their own. Traditional sources of capital, e.g. banks, are usually reluctant to provide capital to such ventures because of the high risks involved. Therefore, entrepreneurs rely on venture capital for financing their new ventures. These innovative and industrious entrepreneurs lack the required experience in management, marketing, and financial planning. In this case the entrepreneur has access to the experience and contacts of the venture capitalist.

Denzil Doyle, Chairman of Capital Venture Alliance Inc. a premier venture firm in Ottawa argues that creating a technology cluster is mostly a financing issue rather than a technology issue. Silicon Valley and Boston (Route 128) are two primary examples of access to capital being one of the most important factors in technology cluster development.

Ottawa technology companies have attracted more than \$1.1 billion of venture money in Yr. 2000 reports Ottawa Citizen. (Jan. 2, 2001) This has definitely enhanced the technology clusters development and allowed a number of wireless technology start-ups to mushroom in the National Capital Region. However, we found that Ottawa lacks venture capital inflow for the wireless sector. Some of the reasons are: Ottawa’s image as a prospering photonics center; Ottawa does not appear as a strong wireless player (Not on VC’s radar screen); and lack of promotion to bring U.S. VC’s.

Graphical illustration

The following pie chart provides a graphical view of the investment activity in Ottawa. (June 25, 2001 - Refer to Appendix 3 for more information.)





This shows Ottawa wireless received 17% of the venture funds that was invested in Ottawa in the last six months.

What should Ottawa do now? Our discussion with VCs shows that venture capitalists usually have a very clear mandate. They should be shown that there is a wireless concentration in Ottawa and once they witness that then they will come. We need to attract more venture capital to invest in the Ottawa wireless sector. We also need to convince local investors of the potential of wireless. Solutions for both of these will be discussed in the recommendation section.

Anchor company

An anchor company is a successful firm in the same field that lead and supports the cluster building activities.

Role of an anchor company in an organized cluster development

While OCRI plays the role of a facilitator in the Ottawa wireless cluster, the particular anchor company can play the role of an energizer and cluster manager. We learned from our interviews that an organized cluster needs to have governance, dedicated cluster management, a code of ethics, a communication strategy (positioning and promoting), cluster development, membership development and funds. Among other things, the anchor company can contribute cluster development, fund raising and dedicated cluster management until a formal working group is organized.

Reason for an anchor company

Based on our analysis of other cluster-based economies such as RTP, Telecom Corridor and the Ottawa Photonics, we concluded that an anchor company plays a vital role in cluster development. An anchor company can attract talent, venture capital and help to put the city on the wireless map. It was IBM that placed RTP on the map and JDS Uniphase put Ottawa Photonics on the map.

The people from JDS Uniphase, Newbridge, and Zenastra took the following concrete steps in building the Ottawa Photonics cluster. (<http://www.pro.on.ca/success/story66.htm>)

- Met regularly and work actively on addressing common wireless issues
- Set up a human resources working group to look at setting up a re-skilling program
- Formed a marketing sub-committee. (Positioning, promotion, and education)
- Developed Technology Roadmap Initiative
- Planned a career fair with others
- Organized a venture capital fair with others

Currently, Ottawa does not have a prospective company to become the local wireless anchor. There are ten global players in Ottawa. Nokia, the number one player, in the mobile wireless market has an office in Ottawa. However, Nokia needs to be persuaded to play the role of anchor. To do this we must show that there is strategic value in it for Nokia.



Ottawa has 44 companies that have local headquarters. Perhaps, the other choice for Ottawa is to build an anchor company. According to interview participants, there are few companies on the horizon that can reach that position, it will take time, but Ottawa needs more venture capital inflow to grow those companies.

(The potential companies are Zucotto Wireless, Lumic Electronics, Icefyre, Sigpro, Dragonwave and BitFlash. Refer to Appendix 2 for detail on these companies) Therefore, we must persuade a global player to have a larger presence in Ottawa and play the role of an anchor company. (Having a global player taking initiatives to build the cluster will help Ottawa to get immediate recognition in the global market place.)

1.10 Recommendations for building Ottawa wireless cluster

Previously, we established four key success factors (KSF) for building the Ottawa wireless cluster. These KSFs are entrepreneurship, research, venture capital and anchor tenant. Based on our analysis we concluded that we have two strengths (entrepreneurship and research) to build on and two gaps to address. Therefore, we recommend solutions for:

- Building on key strengths (KSFs)
- Having an anchor company (KSF)
- Increasing venture capital (KSF)

Recommendations are directed at OCRI

Our discussions with executives and entrepreneurs have led us to believe that OCRI is right organization to energize the cluster building activities. Therefore, these recommendations are directed at OCRI's cluster outreach group and Ottawa Capital Network (OCN). Since, OCRI's cluster outreach group and OCN play the premier role in cluster development and venture capital related programs in Ottawa respectively.

OCRI

Promote Ottawa's key strengths – Labs & Human Resources to build awareness.

Industry awareness does not happen over a short period of time. It is developed slowly and steadily over the years. Furthermore, an organization like OCRI has to be the focal point to promote wireless industry awareness. Also, OCRI (cluster outreach group) should play a vital role in convincing a global wireless player to become the anchor company for Ottawa.

- OCRI cluster outreach group needs to develop programs for promoting the Ottawa wireless sector. This will help to bring in venture capital and a more skilled workforce to Ottawa.
- The cluster outreach group should persuade a global wireless player like Nokia to be the anchor tenant in Ottawa.
- The cluster outreach group should also persuade local start-ups to take the leading role in the wireless cluster building activities.



- OCRI's Technology Executive Breakfast (TEB) sessions should be used as a vehicle to educate people on wireless.
- OCRI needs to lobby Ottawa stars like Antoine Paquin, and Terry Matthews to give their attention to the Ottawa wireless cluster. Both of them have investment in wireless companies but it would help if OCRI were to persuade them to lead the wireless cluster initiatives. OCRI should work with the local "stars" and form a wireless advisory committee.
- Form a wireless taskforce with committed volunteers and work with the local wireless executives to build a wireless advisory committee. Both of these groups should work hand in hand in building the wireless cluster.

Implementation plan

- Form an informal task force that consists of volunteers that are committed to the wireless cluster development – Oct. 2001
- Energize the cluster thinking by promoting wireless cluster around Marconi's 100th year celebration. – Nov. 2001
- Develop a partnership/relationship with one key strategic corporate sponsor (Nokia) – Nov. 2001 – Feature Nokia in the Marconi event. (This will enhance Nokia's position in Ottawa and draw attention from VCs and the community)
- Use TEB to promote wireless thinking in Ottawa – ongoing
- Work with the local wireless executives to build an advisory committee – Dec. 2001
- Organize a round table conference with task force, advisory committee and others who have interested in wireless cluster. Perhaps, Nokia can chair the event – Jan. 2002

*Budget for these initiatives is not discussed in this report.

OCN

Develop programs for increasing access to venture capital

From our research we found that access to venture capital is the foremost critical factor in wireless cluster development in Ottawa. Ottawa lacks venture capital inflow for the wireless sector.

Reasons:

- Ottawa's image as a prospering photonics center
- Ottawa does not appear as a strong wireless player (Not in VC's radar screen)
- Lack of promotion to bring U.S. VC's
- Lack of funds available to local venture capitalists (As per interview participants the availability of pension funds for venture investment is limited. (i.e. Canadian pension fund managers allocate a lower ratio of pension funds to be invested in venture capital as opposed to their counterparts in the USA. In the USA a higher portion of pension funds get invested in venture capital.)



Next we will discuss the strategies for increasing the access to venture capital in the Ottawa area. In order to promote the wireless sector and create VC's interest, Ottawa should have an organization. OCN is the premier organization in Ottawa that focuses on providing access venture capital services. Therefore, OCN should extend its focus in providing services to an emerging market like wireless and champion its efforts in building relationships and partnerships with the U.S. and local venture capitalists.

Promote wireless sector through shows and venture fairs

OCN has the ability to balance both referrals and organizing venture fairs. The venture fairs can be used to promote and educate investors and workforce (of wireless potential). This education aspect can also help the VC's to convince pension funds managers (in the Toronto financing community) to allocate more pension funds for venture investments. OCN must bring well-qualified VC ready firms for showcasing. This will help to get the VCs attention and maintain OCN's credibility.

Bring Ottawa wireless sector into the U.S. VC's radar screen

VCs would go where the right deals are. OCN needs to promote a few successfully closed deals such as Philsar (bought by Conexant for \$189 million and Northwood Technologies (bought by Marconi Company for \$38 million). (www.ocri.ca)

OCN should also go through local VCs to approach US VCs. Since local VCs already have an established credibility, they would like to do it because syndicating with U.S. VCs would yield to greater success.

To attract more U.S. VC's who are focused on the wireless sector, OCN needs to do promotional campaigns on a regular basis. OCN should host VC shows in Boston and San Jose every six months. (Once the momentum is built then it can be regular visits to VCs and meeting with VCs. It doesn't have to be venture fairs or shows.) The promotional campaigns should be supplemented with branding materials from the OCRI Cluster Outreach group.

Work with locally established global firms to bring their corporate VCs into Ottawa

OCN can get corporate VC's like Nokia Venture Partners (NVP) and Alcatel Ventures (AV) interested in the Ottawa wireless sector. The corporate VCs like the others look for deal flows, therefore OCN needs to show the current deal flows. Some of the interview participants (corporate VCs) have a keen interest in technology innovation and research, so OCN should work closely with the Cluster Outreach group to develop materials to demonstrate the potential of Ottawa's research and technology innovation. OCN should work through local Nokia and Alcatel business development offices to reach NVP and AV. OCN should also bring Nokia Venture Partners and Alcatel Ventures to the October venture fair. This would be a good start for OCN.



Implementation plan (*Budget for these initiatives is not discussed in this report)

Required Action	Resources Required	Time Scale	Responsible
Showcase good investment grade companies in October 2001 Venture Fair Invite Nokia Venture Partners and Alcatel Ventures to the Venture Fair	TBD by OCN	Oct./2001 Oct./ 2001	KT (Keira Torkko) KT (for Alcatel) Marwan Forzely (for Nokia)
Build relationship with U.S. VCs through local VCs such as Celtic-House and Venture Coaches, Leverage local Kodiak Ventures office to build relationship and to promote Ottawa wireless in Boston and California	TBD	Begin Nov. 2001 (It should be ongoing)	KT
Promote wireless sector as an emerging cluster in local venture fairs	TBD	Ongoing	KT
Organize a venture fair in Boston and California (Showcase wireless deals and investment grade companies to get attention and investment)	TBD	March 2002 (San Jose) May 2002 (Boston)	KT



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Jagdish N. Sheth & Rajendra S. Sosodia, - A Strategic Vision of the Wireless Industry: Communications Unbound (Institute for Communication Research and Education, International Engineering Consortium, 1997)

URL

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www.alcatel.com - Information on wireless markets, technology & venture capital

www.cio.com - Wireless market information

www.communitech.org - Waterloo technology information

www.crc.ca - Information CRC (Ottawa’s premier wireless research center)

www.cwta.ca - Wireless market information

www.ericsson.com - Wireless market information



http://www.flarion.com/technology/tech_intro.html - Wireless market and technology

www.globaltechnology.com - Photonics market information

<http://hkiiit.ee.ust.hk/orgchart/index.htm> - Smart Antenna information

www.nokia.com - Wireless market information

www.nrc.ca - Information on Canada's premier research centre

www.ocri.ca - Ottawa market, technology, and city related information

<http://www.ottawaregion.com/living/index.htm> - Information on living in Ottawa

<http://www.ofdm-forum.com/index.asp?ID=92> - OFDM technology information

<http://www.parc.xerox.com/ops/members/brown/pduguid.html> - Information on Paul Duguid and John Seely Brown

<http://www.pro.on.ca/success/story66.htm> Photonics cluster information

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www.sdrforum.org - Wireless market information

www.siemens.ca - Wireless market information

www.sigem.com - Wireless technology information

www.towergroup.com - CALA market information

<http://www.wcai.com/lmds.htm> - Wireless Market information

www.wi-lan.com - Wireless LAN information



4 Appendices

4.1 Appendix 1 - Snapshot of Ottawa

4.1.1 Introduction

In less than 20 years the Ottawa-Hull region has shifted from a government based economy to a leading high-tech park. Ottawa-Carleton Employment Survey shows that in 1981 the Federal Government sector employed 30% of workers in the region and the advanced technology sector employed only 5%. This year Ottawa has 17% of its workers in the technology sector and 16% in the government. (www.ocri.ca)

Many companies were formed from scratch and grew up to be powerful multinational high-tech firms. The best examples of success stories are Mitel Corporation, Newbridge Networks and JDS Uniphase.

4.1.2 Ottawa's economy

In spite of the downturn in the high-tech sector, the Ottawa region will remain one of the fastest growing metropolitan economies in Canada. According to a study done by The Conference Board of Canada, the region will have a GDP growth rate from 2000 to 2004 at around 16%. This is the highest rate compared to other metropolitan regions in Canada. (www.ottawaregion.com)

The technology sector is shaping the region's economy with seven anchor clusters:

- Telecommunications
- Microelectronics
- Photonics
- Software development
- Life science research
- Tourism
- Professional services

The Ottawa regional economy is currently worth \$30 billion with more than 300 companies developing products and providing services in advanced technology field. (www.ottawacitizen.com)

4.1.3 Ottawa's entrepreneurial evolution

Perhaps the entrepreneurial history of Ottawa goes back to the late 1940's, followed by the launching of Computing Devices Canada Ltd, the creation of Northern Electric's R&D facilities and the vision of a bright man named Denzil Doyle in the late 1950's.



Denzil Doyle built one of the first high technology super corporations in the Ottawa region. It was Digital Equipment Canada. Doyle built it from scratch and it became a \$160 million company. (www.ottawacitizen.com)

Following those early successes, the conditions were in place for a high technology boom.

In the early 1970's Terry Matthews and Michael Cowpland founded Mitel Corp. The company grew steadily and became one of the most important players in telephony industry. After selling Mitel to British Telecom, Matthews and Cowpland followed different paths and founded Newbridge Networks and Corel Corporation.

Many top executives from Newbridge, Mitel, Corel and BNR/Nortel started to launch their own new businesses. The Newbridge strategy to promote the creation of affiliates was also a major reason for the boom of local start-ups. Today's local start-up executives and key employees likely have some kind of connection to the major local companies.

4.1.4 Ottawa's human resources

According to a recent survey the Ottawa region has more than 79,000 people employed by advanced technology companies. (www.ocri.ca)

All critical skills necessary to develop cutting edge technology can be found in the region. More than 30% of the region's population is university-educated compared to the Canadian average of 22% and also 7% of Ottawa's workforce is comprised of scientists and engineers. (www.ocri.ca)

As well, Ottawa's population is growing at a relatively strong pace. Census results show that between 1991 and 1996 the population in the region grew by 7.3% outpacing the rate of the population growth in Ontario and Canada. (www.ocri.ca)

The local universities, colleges and technology research laboratories, are constantly feeding the pool of knowledge.

4.1.5 Ottawa's research laboratories

Ottawa is well served with research laboratories. This fact gives the region an advantage over other metropolitan areas in Canada. It also creates conditions for easy technological transfer, innovation and knowledge.

The most important research laboratories in Ottawa are:

- Communications Research Centre (CRC)
- National Research Council of Canada (NRC)
- National Capital Institute of Telecommunications (NCIT)
- Communications and Information Technology Ontario (CITO)

CRC is a federal government research centre specializing in communications. Its mission is to provide research and technology transfer to the communications sector by engaging in industry partnerships, building technological intelligence and supporting small and medium-size high-tech enterprises. (www.crc.ca)



NRC is a multidisciplinary science and technology research organization. It has several institutes spread out to major Canadian cities. In Ottawa, NRC established the Institute for Information Technology (IIT), which concentrates research in software applications and multimedia technology. (www.nrc.ca)

NCIT provides a pre-competitive telecommunications research and training environment to researchers and post-graduates students. NCIT together with Carleton University is creating the Center for Wireless Systems Research. (www.ncit.ca)

CITO is an Ontario organization that is committed to strengthening information and technology, digital media and communications industries. It was formed in 1997 by a merger of the Information Technology Research Center and the Telecommunications Research Institute of Ontario. CITO's main mandate is to support academic research and build partnerships with the private sector. (www.cito.ca)

4.1.6 Ottawa's colleges and universities

The three local universities that offer courses in engineering are the University of Ottawa, Carleton University and la Cite Collegiale. All three universities are planning major expansions to attend to the demand for professionals.

The University of Ottawa currently has \$100 million worth of construction underway, including a sports complex, a 600-bed residence and an Information Technology and Engineering building.

Carleton and la Cite Collegiale are also planning multimillion-dollar expansions. To further shore up infrastructure, Carleton plans to hire up to 200 staff over the next three to four years.

There are also good colleges in Ottawa. The most famous is the Algonquin College. Other technology colleges in the region are: CDI College of Business and Technology, DeVry Institute of Technology and Willis College.

4.1.7 Ottawa's venture capitalists

It was not too long ago that Ottawa did not have any local venture capitalists. The entrepreneurs had to rely on limited Angels' investments and bank loans. Today in the region there are 15 VC offices, which are either homegrown or branches from VCs with head offices in other cities. This spectacular growth of VC firms is due to the success of the region's high technology sectors and stories like Newbridge Networks and JDS Uniphase. In 2000 the total invested in the region was over \$1 billion. That amount was almost five times what was invested in 1999.

In this report we will describe the profile of five of the most important local VCs. We had interviews with all four firms. They are:

- Business Development Bank of Canada (BDC)
- Capital Alliance Ventures (CAVI)



- Celtic House
- Skypoint Capital Corporation
- Venture Coaches

Business Development Bank of Canada (BDC)

BDC is a federal small business bank that invests in emerging and exporting sectors. It has been helping in the creation of new small and medium-sized business for over 50 years. Among other products and services, BDC offers business counseling, training and mentoring. (www.bdc.ca)

Capital Alliance Ventures

The “archangel of the valley” Denzil Doyle is the chairman of CAVI. It invests mainly in Ontario business, principally in high technology, applied science and service sectors. The investments can take the form of equity or subordinated debt that is convertible into equity. (www.cavi.com)

Celtic House

Terry Matthews is the founder of Celtic House, which started operations in 1994 with the mandate to fund companies that created products that had synergy with Newbridge’s product line. Celtic House invests in early stage companies in high technology in North America and the United Kingdom. Celtic House has more than 40 companies in its portfolio. Major firms acquired a few of those companies and others had successful IPOs. Some examples are Tundra Semiconductor, Orchestream, iMagicTv, Extreme Packet Devices, Fastlane Technology and Skystone. (www.celtic-house.com)

Skypoint Capital Corporation

Leo Lax and Andrew Katz founded Skypoint in 1998. It focuses investments on telecommunications and information technology sectors. Skypoint has invested in 16 early-stage companies in Ottawa, in other parts of North America, the United Kingdom and Israel.

The main strategy of Skypoint’s investments is a proactive approach in building alliances between entrepreneurs and large corporations. Skypoint’s portfolio of companies include BitFlash, Sigpro Wireless, March Networks, Precidia Technology, Solidum Systems and Avantas Networks. (www.skypointcorp.com)

Venture Coaches

Claude Haw founded Venture Coaches, which is a seed and early-stage investor in high technology firms in Ontario and Quebec. Venture Coaches focuses its investments in the wireless and photonics sectors. Investments are made in early stage companies, primarily in the first seed round.

In addition to financing, Venture Coaches gives support in business plan review, manager coaching, office infrastructure and recruitment. Its portfolio includes Edgeflow, Spotwave Wireless, ST Wireless, DragonWave and Camelot Content Technologies. (www.venturecoaches.com)



4.1.8 Ottawa's incubators

In the Ottawa region there are both government-subsidized and private owned incubators.

NRC and CRC have developed incubation programs. Both programs are very successful in creating and supporting new companies. More than 40 firms have emerged from the NRC program since 1946. One example of a private incubator is StartingStartups.com, which claims to provide the start-up culture - ambition and initiative. (www.nrc.ca)

CRC - CRC's Innovation Centre was created in the early 1990's in order to give more support to the industry and to promote intellectual property decentralization. It provides furnished and unfurnished office or laboratory space, but space is not subsidized. Tenants have access to centralized research support services, assistance with government funding programs, and any of more than 200 researchers/experts. (www.crc.ca)

StartingStartups.com - After selling Beduin Communications to Sun Microsystems, John Criswick, one of the founders, used his mentoring experience and contacts to create a high technology incubator program, funded in part with his own money. (www.startingstartups.com)

4.1.9 Ottawa's infrastructure

For many years Ottawa has been ranked as one of the best cities in the world to live. It provides an excellent quality of life with an adequate infrastructure. There are good hospitals and culturally speaking, Ottawa has several museums, theatres, art galleries and seasonal activities.

Although the recent meltdown of the high technology economy has given a break to the "red-hot" construction sector, it is expected that the technology firms will recover with a strong pace. So if the need for roads, buildings and housing is not met, companies may decide to locate and expand their operations elsewhere.

In recent meetings organized by OCRI local business leaders addressed some of the infrastructure issues. (www.ocri.ca)

Some of challenges discussed by the panel were:

- Airport expansion
- Land for development
- Roadway congestion
- Building space
- Attraction and retention of knowledge workers
- High bandwidth Internet access (fibre optics)
- Better public transportation

The most emphasized aspect of the meeting was the region's Quality of Life. Ottawa is situated amongst several parks and wilderness areas with clean lakes, rivers and streams.



4.2 Appendix 2: List of Ottawa's wireless companies

Company	Headquarter	Sector	Core Business	Established	No. of Empl	URL	Address/Contact
5x5 Wireless	local	systems	wireless			http://www.5x5wireless.com/	41 Aleutian, Nepean, K2H 7C7
Alcatel Canada	global	systems	several			http://www.alcatel.ca/	600 March Road, P.O. Box 136000 Kanata K2K 2E6
AmikaNow!	local	software	application	1998	35	http://www.amikanow.com	400-300 March Rd Kanata K2K 2E3
Aprel Laboratories	local	consulting	wireless	1981	15	http://www.aprel.com	51 Spectrum Way Nepean K2R 1E6
BitFlash Graphics	local	software	application	1997	106	http://www.bitflash.com/	1900 City Pk, Ste 202 Ottawa, On K1J 1A3
CAL /EMS Technologies	us-based	systems	wireless	1968	165	http://www.ems-t.com/	1725 Woodward Dr, Ottawa, On K2C 0P9
Catapult Communications	us-based	consulting	wireless	1985		http://www.catapult.com/	39 Robertson, Ste 261 Nepean, K2H 8R2
C-Com Satellite	local	systems	wireless		8	http://www.c-comsat.com/	2574 Sheffield Rd, Ottawa, ON K1B 3V7
Cell Block Canada	us-based	systems	wireless	2000		http://www.cell-block-r.com/	67 Iber Rd, # 103 Stittsville, K2S 1E7
CMC Electronics	local	defence	wireless	1903		http://www.marconi.ca/	415 Legget Dr Kanata, K2K 2B2
CML ATC Technologies	local	defence	wireless	1980		http://www.cmlatc.com/	490 St Joseph Blvd, Ste 200 Hull, QC J8Y 3Y7
Comgate Engineering	local	consulting	several			http://www.comgate.com/	331 Cooper St, Ste 200 Ottawa, ON K2P 0G5
Comverse Networks	global	software	wireless	1985		http://www.comversens.com/	2460 Lancaster, Ste 101 Ottawa, K1B 4S5
Conexant Systems	us-based	semicon	wireless	1999	65	http://www.conexant.com/	146 Colonnade S, Ottawa, On K2E 7Y1
Datacell Wireless	local					http://www.ziebarthelectric.com	1155 Lola, Ste 8 Ottawa, On K1K 4C1

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Dragonwave Inc.	local	systems	wireless	2000	80	http://www.dragonwaveinc.com/	411 Legget Dr, Ste 600 Kanata, K2K 3C9
DSP ONE Systems	local	consulting	wireless	1999	4	http://www.dsponer.com/	148 Colonnade, Ste 201 Nepean, K2E 7R4
Elcombe Systems/ March Networks	local	systems	wireless	2000	55	http://www.elcombe.com	359 Terry Fox Drive Kanata K2K 2P4
Flyscan Technologies	local	software	application	2000		http://www.flyscan.com/	174 Colonnade, Unit 21 Nepean, K2E 3L6
Holohil Systems	local	systems	wireless			http://www.holohil.com/	112 John Cavanagh Rd, Carp, K0A 1L0
Huber & Suhner	global	systems	several	1995	120	http://www.hubersuhner.ca/	50 Hynes Rd, Kanata, On K2K 2M5
IceFyre Semiconductor	local	semicon	wireless	2000	10	http://www.icefyre.com/	200 Elgin, Ste 602 Ottawa, K2P 1L5
Interactive Circuits & Systems (ICS)	local	systems	several	1980	50	http://www.ics-ltd.com	5430 Canotek Road Gloucester K1J 9G2
Instantel	local	systems	wireless	1982	78	http://www.instantel.com	309 Legget Drive Kanata K2K 3A3
Ip Unwired	local	systems	wireless	2001		http://www.ipunwired.com/	3701 Carling Avenue Building 94, 2nd Floor Ottawa K2H 8S2
Lockheed Martin	global	defence	several		250	http://www.lmca.lmco.com	3001 Solandt Road Kanata K2K 2M8
Lumic Electronics	local	semicon	wireless	1999	80	http://www.lumictech.com	200-18 Antares Drive Ottawa K2E 7W6
Maplebrook Consulting	local	consulting	wireless	1998	6	http://www.maplebrook.com/	74 Colonnade Rd N, Nepean, K2E 7L2
Marconi Communications	global	systems	several			http://www.marconi.com	1125 Innovation Drive Kanata K2K 3G8
MySkyWeb	us-based	software	wireless	2000		http://www.myskyweb.com/	733 St Joseph, Ste 400 Hull, PQ J8Y 4B6
NCL Laboratories	local	consulting	wireless	1981	15	http://www.ncl-calibration.com	51 Spectrum Way Nepean K2R 1E6
Nemko Canada	global	consulting	wireless		35	http://www.nemkoca.com/	3325 River Rd, Ottawa, On K1V 1H2

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Nitrosoft	local	software	application			http://www.nitrosoft.com	300-1736 Courtwood Crescent Ottawa K2C 2B5
Nokia	global	systems	wireless	1999	80	http://www.nokia.ca/	555 Legget Dr, Ste 400 Kanata, K2K 2X3
Nortel Networks	global	systems	several			http://www.nortelnetworks.com/	1285 Baseline, Ottawa, On K2C 0A7
Northwood Technologies	local	software	application			http://www.northwoodgeo.com/	43 Auriga Dr, Ottawa, On K2E 7Y8
Peformance Technologies	us-based	systems	wireless	1982	60	http://www.pt.com/	150 Metcalfe, Ste 1300 Ottawa, K2P 1P1
Precidia Technologies	local	systems	several	1999	35	http://www.precidia.com	10A Hearst Way Kanata K2L 2P4
Prospectus Group	local	software	wireless	1988	22	http://www.prospectus.com	902-180 Elgin Street Ottawa K2P 2K3
QNX Software Systems	local	software	application	1980	190	http://www.qnx.com	175 Terrence Mtthews Crescent Kanata K2M 1W8
Research in Motion	local	systems	wireless	1984	65	http://www.rim.net/	600 Terry Fox, Ste 100 Kanata, K2L 4B6
Siemens - TIC	global	systems	wireless	1996	160	http://www.tic.siemens.ca/	505 March Rd, Kanata, K2K 2M5
SiGe Semiconductor	local	semicon	wireless	1996	85	http://www.sige.com/	2680 Queensview, Ottawa, On K2B 8J9
SiGEM	local	systems	wireless	1997	90	http://www.sigem.ca/	84 Hines Rd, Kanata, K2K 3M3
Sigpro Wireless Inc.	local	semicon	wireless	2000	45	http://www.sigprowireless.com/	1701 Woodward Dr, Ottawa, K2C 0R2
Skywave Mobile	local	systems	wireless	1997	25	http://www.skywavemobile.com/	30 Edgewater St, Unit 110 Kanata, K2L 1V8
Soma Networks	us-based	systems	wireless	1998		http://www.somanetworks.com/	110 Clarence St, Ste 6 Ottawa, On K1N 5P6
SpaceBridge	local	semicon	wireless	1997	80	http://www.spacebridge.com/	115 Champlain, Hull, PQ J8X 3R1
Spotwave Wireless	local	systems	wireless	2001	25	http://www.spotwave.com/	3701 Carling, Ottawa, K2H 8S2
Stanford Microdevices	us-based	systems	wireless	1992	11	http://www.stanfordmicro.com/	50 Palladium, Kanata, K2M 2E9
Tality Canada	global	consulting	several	2000	115	http://www.tality.com	105-1130 Morrison Drive Ottawa K2N 9N6

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Taral Networks	local		wireless	2000		http://www.taralnetworks.com/	4048 Carling Ave, Kanata, K2K 1Y1
Tellabs Transport Group	us-based	systems	several		55	http://www.tellabs.com	1420 Blair Place, 3rd Flr Ottawa K1J 9L8
Terrapin Communications	local	systems	wireless		6	http://www.safetyturtle.com	201-4017 Carling Avenue Kanata K2K 2A3
TMI Communications	local	systems	wireless	1988	80	http://www.msat.tmi.ca/	1601 Telesat Crt, Gloucester, K1B 5P4
Ventrada	local	software	wireless	2000	10	http://www.ventrada.com	41 York Street, 4th Floor Ottawa K1N 5S7
Vistar Telecom	local	systems	wireless			http://www.vistartelecom.com/	427 Laurier, Ste 1410 Ottawa, K1R 7Y2
VP Systems	local	consulting	several	1997		http://www.vp-systems.com/	120 Thornbury Cres, Nepean, K2G 6C2
WaveCell International	local	systems	wireless			http://www.wavecell.com/	2780 Rowatt St, Ste 21 Ottawa, K2B 6P1
Wireless Workforce	local	software	wireless	1999	5	http://www.wirelessworkforce.com	44 Byward Mkt, Ste 220 Ottawa, K1N 7A2
Zarlink Semiconductor	local	semicon	several	2001	356	http://www.zarlink.com	400 March Road Ottawa K2K 3H4
Zim Technologies	local	software	wireless		40	http://www.zti.ca/	200 Colonnade, Ste 20 Nepean, On K2E 7M6
Zucotto Wireless	local	semicon	wireless	1999	75	http://www.zucotto.com/	130 Slater, Ste 1300 Ottawa, On K1P 6E2
					Total 2892		



Summary of local wireless sector

Market space	
Sector	Total
Consulting	9
Defense	3
Semiconductor	8
Software	12
Systems	29
Grand Total	61

Employees	
Market sector	Total
Consulting	190
Defense	250
Semiconductor	796
Software	408
Systems	1248
Grand Total	2892

Wireless sector	
Core	Companies
Application	6
Others	12
Wireless	43
Grand Total	61

Sum of Employees	
Core	Total
Application	331
Others	981
Wireless	1580
Grand Total	2892

Headquarter status	
Place	Companies
Global	10
Local	42
US-based	9
Grand Total	61



4.3 Appendix 3: Ottawa's latest VC deals

VC's investments in the first half of 2001

(Source: Ottawa Business Journal June 25, 2001)

Company	Core Business	Sector	Amount (million)
Analog Design Automation	application	software	8
Atmos Corp.	memories	semiconductor	13.1
Atreus Systems	application	software	26.29
BitFlash	wireless	software	23.74
BTI Photonics	photonics	systems	9.5
Cloakware Corp	security	software	4.6
CML-ATC Technologies	wireless	systems	3
Coast Software	internet	software	5
Databeacon	internet	software	10
Dragonwave	wireless	systems	12
Eftia OOS Solutions	application	software	30.9
Gotmarketing.com	internet	software	4.57
Hemera Technologies	graphic	software	25.5
IceFyre Semiconductor	wireless	semiconductor	1.9
JetNet Internetworking Services	internet	software	4.5
Killdara Corp.	internet	software	1.5
Lumic Electronis	wireless	semiconductor	20.37
Northland Systems	internet	training	1.5
ObjectWorld	internet	software	2.1
Quake Technologies	photonics	semiconductor	46.43
Sibercore Technologies	internet	semiconductor	30
Solidum Systems	processor	semiconductor	24.69
Solinet Systems	photonics	systems	144
Spotwave Wireless	wireless	systems	3
StartingStartups	investment	incubator	2
Symagery Microsystems	processor	semiconductor	20
Tarian Software	e-record	software	1.2
Tropic Networks	photonics	network	92
Watchfire	internet	software	37.4
Zucotto Wireless	wireless	semiconductor	52.4
Total invested			661.19



4.4 Appendix 4: Waterloo Wireless

Waterloo wireless is a well-known wireless centre in Canada. We gathered data from RIM and the University of Waterloo websites and talked to Paul Weber of Communitech (an OCRI like organization) who runs the Accelerator Partnership Program (like OCN) that aligns entrepreneurs with venture capitalists. (www.communitech.org)

Our findings on the Waterloo wireless sector were as follows:

Number of wireless companies is around 25 to 30

Flagship is RIM and it is the anchor company as well

Wireless employees are around 2000 (1,500 at RIM)

Main strength comes from the University of Waterloo (U of W) research activities

Have two local VCs (Waterloo Tech, and Waterloo Ventures), Get lots of attention from Canadian banks and from Toronto investment community. Boston based Kodiak Venture Partners has a keen interest in Waterloo. Although Paul Weber claimed that Ottawa gets more attention from U.S. VCs, our analysis shows there is not enough venture capital coming forth for wireless investment in Ottawa (most of the investments in the last six months are still related to photonics).



4.5 Appendix 5: Ottawa Photonics Cluster

The Ottawa Photonics Cluster (OPC) was officially launched early in the summer of 2000. Ottawa Photonics is regarded as a very successful cluster in North America. (www.pro.on.ca)

Ingredients for success

Research laboratories

CRC, NRC, NCIT and others are developing important technologies in laser, fibre optics and optic switches. This cutting edge technology has been transferred to local industries and many start-ups are applying this knowledge in creating new products.

Right timing – Internet Boom

In mid 90's the revolution of the Internet ignited major investments in the telecommunications infrastructure. There was a great demand for more bandwidth and fibre optic deployment was the best solution for it. Many major carriers rushed to revamp their systems and the companies, whose suppliers who had the right solution at the right time harvested big revenues. JDS Uniphase is the best example of this astonishing growth.

Acquisitions/mergers

The competition to provide equipment to the carriers and the success of Cisco's acquisition and merger strategy created the pace for other companies to follow. JDS merged with US-based Uniphase forming the biggest worldwide optical supplier.

Major companies like Cisco, Nortel and Lucent acquired many small start-ups. These companies used their common shares as part of the payment. In 2000 the technology shares were soaring, but now the situation has changed. Acquisitions and mergers will continue, but not at the same pace. The acquisitions and mergers caused the surging of many start-ups in the optical sector.

Financing

The "red-hot" photonics market got the attention from the VCs and investments in the sector made it relatively easy for start-ups to get the necessary funds for their operations.

In Ottawa there is a strong tendency for investments in photonics. Even today the start-ups in this area have a better chance of obtaining venture capital than other technologies like software applications or wireless. (http://www.ottawaphotonics.com/opc_home.html)