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**Facilitating Innovation in Agricultural Biotechnology:  
An Examination of the Ag-West Bio Inc. Governance Model**

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**Abstract**

The evolving nature of the global biotechnology industry and international trade issues with respect to food safety has necessitated responsiveness on the part of all industry actors. Institutional changes in the wake of controversies and consumer perceptions require evolving organizational models to respond to these changes. Government is no different. Governments have developed arms' length organizations to advocate, support and service the agricultural biotechnology industry. In this paper we examine Ag-West Bio, a non-profit venture funded by the Saskatchewan government. Ag-West Bio has delivered a wide range of services to the Saskatchewan biotechnology industry, including acting as a mediator between business and government, a project facilitator and financier, and offering visible leadership and direction for the biotechnology sector.

**Key Words:** Innovation; Strategy; Governance Models

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# **Facilitating Innovation in Agricultural Biotechnology: An Examination of the Ag-West Bio Inc. Governance Model**

## **1. Introduction**

Arms' length government organizations have long held a vital role in the development and sustainability of the agricultural biotechnology industry in Saskatchewan. In particular, the Saskatoon based agricultural biotechnology cluster (Innovation Place) has evolved into a world renowned research centre for canola, its success due in large part to support of federal, provincial and municipal government in the areas of infrastructure, investment and funding. The rapidly changing world agricultural market and changing consumer perceptions have necessitated government intervention to encourage continued investment and sustainable innovation in the industry.

The evolving nature of the global biotechnology industry and international trade issues with respect to food safety has necessitated responsiveness on the part of all industry actors. Institutional changes in the wake of controversies and consumer perceptions require evolving organizational models to respond to these changes. Government is no different. It has developed arms' length bodies to advocate, support and service the agricultural biotechnology industry. In this paper we examine such an organization. Ag-West Bio Inc. (AWB) is a not-for-profit organization funded by Saskatchewan Agriculture, Food and Rural Revitalization and has delivered a wide variety of services to the Saskatchewan biotechnology industry, including mediation between business and government, project facilitation, project financing and visible leadership and direction for the biotechnology sector.

In this paper, we examine the AWB governance model, its history and its role in the evolving agricultural biotechnology industry. In Part 2, we present the history and development of Ag-West Bio. In Part 3, we examine innovation theory to provide a background for business model evolution and the justification for the AWB model. In Part 4, we introduce our methodology for analyzing the AWB governance model regarding facilitating innovation, consisting of a blend of activities: financing, networking and advocacy. It is in this section that we apply and assess the model. Finally, in Part 5, we offer some potential next steps for continuing the innovation process.

## **2. Background**

The Canadian biotechnology industry has achieved world class recognition for the development of a number of important products, particularly in the healthcare and agricultural sectors. In absolute numbers Canada now ranks second in the world after the United States. A recent Statistics Canada report (2003) indicates that as of 1999, the Canadian biotechnology industry consisted of 358 dedicated biotechnology or core firms, with 42% of companies involved in the healthcare sector and 33% involved in the

agricultural sector. The agriculture and food processing sector accounted for 9% of biotechnology-related R&D in 1999 and generated C\$709 million revenues in 1999 (up 120% from 1997), equal to 37% of all biotechnology sales in Canada. Revenue earning capacity and firm size appear to be positively correlated. The report provide some evidence that actors and organizations that operate in advanced technology sectors agglomerate into regions of concentrated economic activity in an effort to facilitate face-to-face R&D partnerships (which 70% report engaging in) and increase access to new knowledge. Clusters of actors and life science-based activities are situated throughout Canada, including Ottawa, Vancouver, Montreal, Halifax and Saskatchewan.

While Saskatchewan is home to only 5% of the total Canadian biotechnology firms in Canada, those firms account for 61% of the gross revenues from biotechnology in the agri-food sector, generating almost C\$433 million in 1999, up from C\$56 millions in 1997 (representing a 673% increase in revenues). Over the same period, Saskatchewan firms posted the largest gain in net exports of biotechnology products in Canada and annual R&D expenditures in biotechnology increased to C\$28 million in 1999 from C\$19 million in 1997.

Saskatchewan's success is directly attributable to the activity generated by the agricultural biotechnology-based cluster situated in Saskatoon. Innovation Place in Saskatoon, Canada, is small in terms of geographic size and actor density, yet is one of the most clearly self-defined agricultural biotechnology innovation clusters in the world. Its world-renowned reputation in canola research and research excellence has served to attract many multinational actors to the research park – Innovation Place – and is responsible for bringing GM canola and flax to the world market.

Ag-West Bio Inc. has played a pivotal role in the development and continued success of the agricultural biotechnology industry in Saskatchewan. As a non-profit organization, AWB continues to deliver a wide variety of services to the Saskatchewan biotechnology industry, including acting as a mediator between business and government, as project facilitator, in a financing capacity and by providing visible leadership and direction for the biotechnology sector as a whole. The economic and agricultural biotechnology impact this organization has had for the Saskatoon region and the province as a whole cannot be understated. In its 14 year history, AWB has turned an aggressive idea for an agricultural biotechnology research park, into an internationally recognized agricultural biotechnology research center of excellence.

Ag-West Bio Inc. was founded (as Ag-West Biotech Inc.) in 1989 and is a registered not-for-profit Saskatchewan corporation funded by the Saskatchewan Department of Agriculture, Food and Rural Revitalization. It operates under the direction of an independent Board of Directors. The organization's mandate is to "initiate, promote and support the growth of Saskatchewan's agricultural biotechnology industries and the commercialization of related food and non-food technologies, by working with industry and external stakeholders" (AWB 2005).

The AWB history is unique. In 1997, AWB merged with the International Centre for Agricultural, Science and Technology (ICAST). Prior to this (between 1992 and 1997), ICAST made investments to assist the commercialization of agri-food products and processes in Western Canada.

### **3. Innovation and Agricultural Biotechnology**

The knowledge revolution is transforming the basis for the global economy. Drucker (1994) has argued that the historic economic resources, that being land, labour and capital, are no longer the essential elements for production, but rather it will be knowledge. Lundvall (1995) argues that, especially in a knowledge-based world, what is key is that innovation be the driver of economic growth. He suggests that ongoing research and discovery will ultimately produce new products and new markets for those products. markets. It is these new markets that will continue to drive additional research investments.

Growth, which is ultimately facilitated by the accumulation of technical knowledge that flows from the innovative process, entails the commercialization of the resulting improvements. Investment in this process develops an industry's breadth and depth of organization and enhances its capability to build markets for new technologies.

Technological capacity is especially critical to regional growth. The accumulation of both company-specific and diffused technological competence becomes a stimulus for innovations by new and expanding operations, while additional companies often are attracted to locate new facilities in a region by the strength of that region's scientific and technical base.

Recent research shows that experts who predicted an end to regional advantages may in fact be wrong. While it has not been clearly defined, there is an attraction expressed by firms to belong to a geographical innovative community. The global demand for new technology products is growing yet due to the limited number of qualified workers, the innovative growth will be limited to only a small number of areas in the world. Audretsch (1998: 19-23) suggests that, "... economic activity based on new knowledge generates higher wages and greater employment opportunities reflecting the exploding demand for new and improved products and services." This would indicate that due to limited labour resources there would be a restriction in the number of innovative centers that have the potential to develop. Audretsch also identifies that "... apparently, large firms are more adept at exploiting knowledge created in their own laboratories, while their smaller counterparts have a comparative advantage at exploiting spillovers from university laboratories."

Ultimately, the payoff of technological change is macroeconomic growth and development. If innovative efforts create knowledge that spills-over into companies that are limited to a specific region, then that creates the possibility that "... comparative advantage is endogenously generated ..." because as "... countries engage in

technological competition, comparative advantage evolves over time (Grossman & Helpman 1991: 338).” Thus, if the final product is tradable but the innovation-based knowledge is a non-transferable intermediate factor of production, then the fact that innovation begins or is supported in one jurisdiction could indefinitely put that site on a higher trajectory of R&D and new product development (Grossman & Helpman 1991: 220-1). As a result, the high-technology share of gross domestic product and of exports will be higher than otherwise, raising productivity and incomes.

This evolving knowledge based global economy has significant impact for Saskatchewan’s economy in that, in large part, the province has been resource dependent since settlement.

This may be especially important for Saskatchewan, as many of the new technologies have the potential to differentiate the commodity and food markets. If Saskatchewan is not undertaking agri-food research and commercializing the results for those markets, then other regions may do so. The theory suggests a small lead can translate into a large overall impact. If Saskatchewan does not invest in innovation; other regions may capture our current high-value markets and push Saskatchewan producers into lower-valued commodity-markets. The result may be that Saskatchewan producers could no longer compete, given higher average costs of production than many competing commodity-producing regions.

Successful, sustainable innovation requires that the capacity to innovate be matched with an ability to take the results of any innovative process and position them in the marketplace in such a way as to capture a return that both compensates for the investment in the innovation and yields a positive return to the risk taker. Those two different abilities do not always go together.

There has been extensive research in other countries to determine the elements of sustainable national systems of innovation. Metcalfe (1995: 38) says such a system comprises “... that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technology and which provide the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artifacts which define new technologies.” Mowery and Oxley (1995) point out that the system involves more than the research actors and private companies, but also must include public programs intended to support technology adoption and diffusion and the array of laws and regulations that define intellectual property rights and manage the discovery, production and marketing systems. The combination of the actors and the connective structures makes up the innovation system and effectively determines the 'absorptive capacity' of an economy to exploit either domestically developed or imported technologies (Mowery and Oxley, 1995).

The concept of innovation is used in connection with the analysis of process of technological change (Cooke, 2003). In particular, innovative activities can both be cause and result, consequence and prerequisite to technological change. The question is: who

mediates such activity? No single firm can drive innovation. Rather, it is rather a collective-based initiative. Therefore, there must be a collective-based organization to facilitate the process at the regional level. AWB is such an organization. Its membership includes individuals and organizations from both the public and private sectors.

In 2002, the Canadian government launched a new innovation strategy. This strategy is intended to make Canada one of the top competitive countries in the world. Key pillars in this strategy are to support the development of globally competitive industrial clusters and to strengthen the innovation performance of communities (Government of Canada, 2002). The report identifies the target of having 10 internationally recognized technology clusters by the year 2010. The agricultural biotechnology cluster can be seen as a model for other Canadian clusters. The following section we assess the role that AWB has played in facilitating the Saskatoon research cluster.

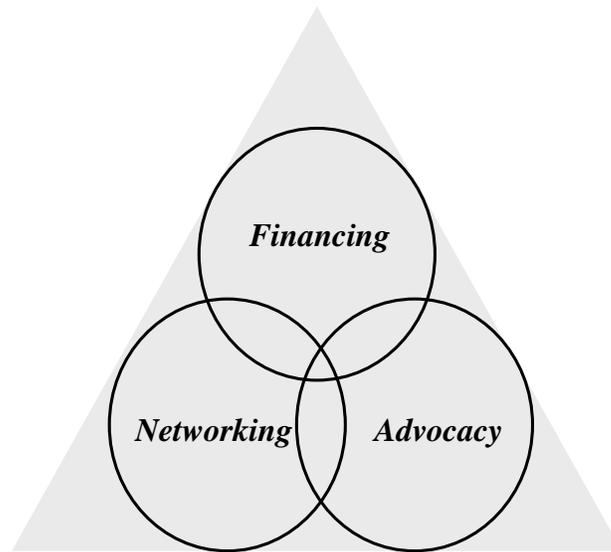
#### **4. The Ag-West Bio Governance Model**

Ag-West is a key-linking agency in the Saskatchewan and western Canadian agricultural biotechnology industry, targeting to develop the province's capacity to build on existing capabilities and resources in order to achieve a strong and profitable agricultural biotechnology industry. The innovative process is typified by gaps in resources and management capabilities (Dodgson and Bessant, 1996) experienced by a diverse collection of groups—from multinationals to small entrepreneurial enterprises. Ag-West responds to the needs of these groups with a variety of formal and informal services, which address barriers to innovation in the operating environment:

- Ag-West actively directs investment flows towards growing firms with greater responsiveness and efficiency than the traditional financial sector;
- Ag-West seeks to enhance the mobility of information by facilitating networking;
- Ag-West acts to raise awareness by public institutions of industry positions on important issues through the organization of direct contact opportunities with the private sector; and
- Ag-West provides a focal point for action and visible leadership within the industry.

These activities are inter-related and are shown in Figure 1. Ag-West has three key areas of business focus: financing; advocacy; and networking. These activities all overlap with and support each other allowing AWB to have developed a strong service commitment to the agricultural biotechnology cluster. Each of these three key areas of business focus is explained in greater detail below.

**Figure 1: The Ag-West Bio Governance Model**



Source: Authors.

#### **4.1 Financing Activities**

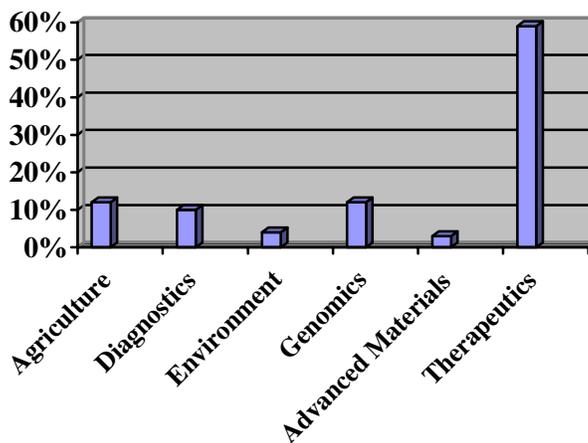
There is a direct connection between the specialization and flexibility of a financial system and the development of innovative capability (Lundvall, 1995). The innovation process requires financial investment in the R&D, commercialization and production stages. However, traditional financing sources such as banks seldom support the early stages of innovation because they are averse to risk. Innovative ventures often require extensive capital relative to the assets of the firm, which compounds the normal uncertainty of start-up or expanding ventures. Traditional sources of investment frequently have difficulty assessing the prospects of success for a technologically complex project with a high share of intangible investment (OECD, 1995). Such difficulty to capitalize investments compounds the effects of risk-averse investment and lending organizations, leading to under-investment in innovation.

Financing growth has always been difficult. Management studies have shown that most commercialization efforts and start-ups require in the order of seven infusions of capital before they become sustainable. Early stage funding tends to come from sweat equity, friends, family and 'angels.' End stage funding predominantly comes from the capital markets or commercial lenders. The middle stages represent a problem area. Venture capitalists and government venture programs have tended to supply capital at this stage. Getting access to capital for knowledge-based growth is even more difficult because development times tend to be long and variable, market returns are often highly speculative because of uncertain market acceptance (at least partly due to evolving regulatory requirements), clear ownership of the rights to exploit an innovation is sometimes difficult to prove in a world of increasingly private intellectual property and it

is next to impossible to use the innovative knowledge as collateral for the funding. For all these reasons, venture capital for agricultural biotechnology has been almost non-existent. In the United States in 1997, only US\$8.9 million or less than one percent of the US\$948 million of venture capital put into all biotechnology companies went into agriculturally-based ventures. Furthermore, only about 8% of the US\$12.2 billion of venture capital invested in 1997 was in biotechnology, most went into software and telecommunications companies, knowledge-based ventures that have a shorter development period and a more certain regulatory environment (NABC, 1998). Agricultural biotechnology in Saskatchewan has been faced with even greater problems due to an absence of angels and fewer venture capital firms. This lack of investment capital in the late 1990s highlights the importance of having locally-based organization capable of timely capital infusions.

The Global Biotechnology Report published by Ernst & Young (2004) notes that agricultural biotechnology companies in Canada for the most part, do not attract significant amounts of venture capital. Figure 2 shows the percentage of biotechnology firms in the various sectors of the biotechnology industry in Canada. Agricultural biotechnology represents 12% of the total biotechnology firms in Canada and this helps to explain why it is difficult for firms of this nature to attract financing. In addition, the report indicates that Saskatchewan had 3% of the total biotechnology firms in Canada in 2001 compared to 6% in 1997. This is an indication of the rapid growth of the biotechnology industry in Canada.

**Figure 2: 2004 distribution of biotech companies in Canada by sector**



Source: Ernst & Young, 2004.

Ag-West works to close the gap between demand and supply in two discrete ways. Ag-West uses its intimate knowledge of the science, regulatory systems and agricultural biotechnology markets to intensively screen and monitor individual start-up and expanding firms, assisting them to recognize and address their specific deficiencies, thereby reducing the risk and uncertainty associated with investing in these ventures. In

addition, Ag-West financially supports promising technologies at the early stages of development that offer too great a risk for private capital sources.

Direct investment by Ag-West in the commercialization process has been designed to fill funding gaps experienced by start-up and growing firms. Ag-West has seeded new initiatives and accommodated expansion, contributing approximately \$9.3 million towards 46 projects in 37 companies and agencies since 1989. Table 1 shows that all but four of the loans were to entities that were entrepreneurial (although many of them involved public sector partners). The largest single investment was \$872,000 and the smallest \$10,000. The average investment was \$200,000 with the median at \$156,000.

**Table 1: Summary of Ag-West investments**

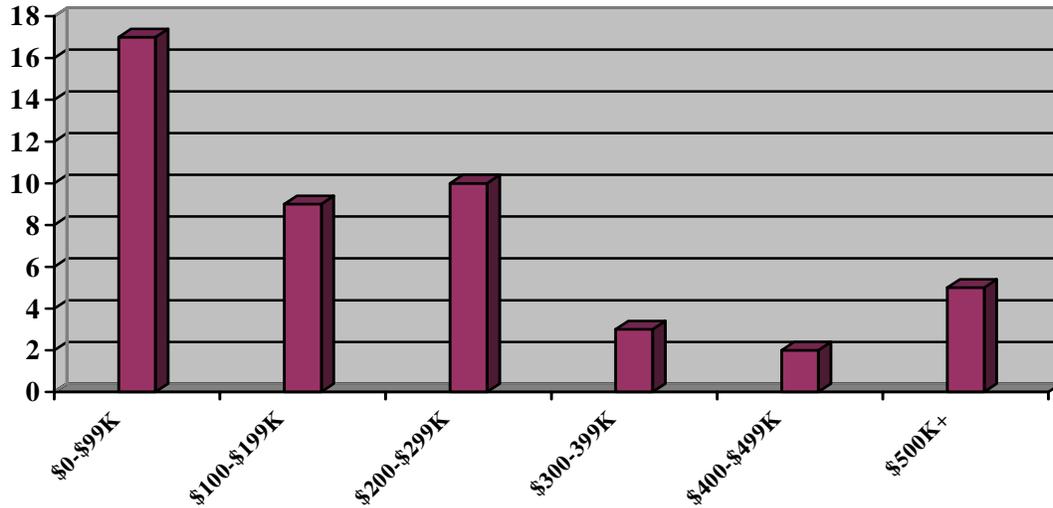
<b>Distribution of investments by size of loans and by type of institution</b>		
	Private	Public
Number of investments	42	4
% of funds disbursed	96.6%	3.4%
Average investment	\$212,000	\$78,000
Minimum investment	\$18,000	\$10,000
Median investment	\$156,000	\$52,000
Maximum investment	\$872,000	\$200,000

The investments cover the range of possibilities. Fourteen investments were to develop new technologies for commercialization. Eleven investments were for the development of new varieties of or uses for existing crops, including canola, flax, potato, oats and mustard. The remainder was for development of livestock vaccines, nutraceuticals, fertilizer applications, native plants and various food and medicinal products. Four investments were to develop capacity in public institutions.

Three of the investments were used by multinational agro-chemical companies to assist with the relocation of specialty technology businesses to Saskatchewan. These had perhaps the largest single economic impact on Saskatchewan as their relocation generated ongoing research, development and commercialization of product that otherwise would not have happened in the province.

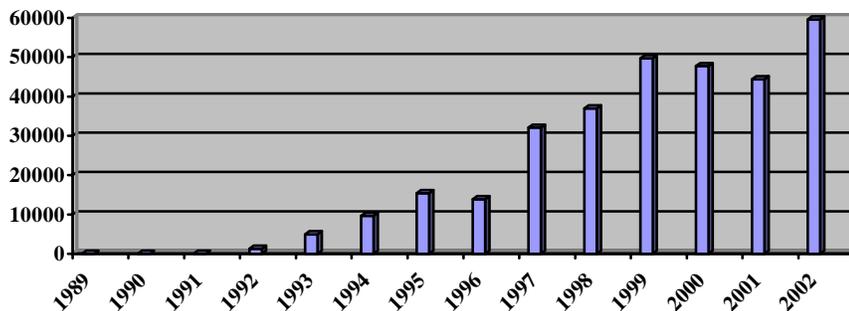
This size of investments has varied as is shown in Table 3. The majority of the investments have been under C\$100,000. Nine investments have been made in the C\$100,000-\$199,000 range and ten investments between C\$200,000-\$299,000. These three levels of investment account for 78% of all investments made by AWB. Very few investments have been made at the higher end of the scale, with three between C\$300,000-\$399,000 and two between C\$400,000-\$499,000. The final five investments have been substantial investments of greater than C\$500,000. This data indicates that firms require smaller capital infusions at timely periods, which lends to the flexibility of AWB investment strategy.

**Figure 3: Comparison of investment portfolio by amount invested**

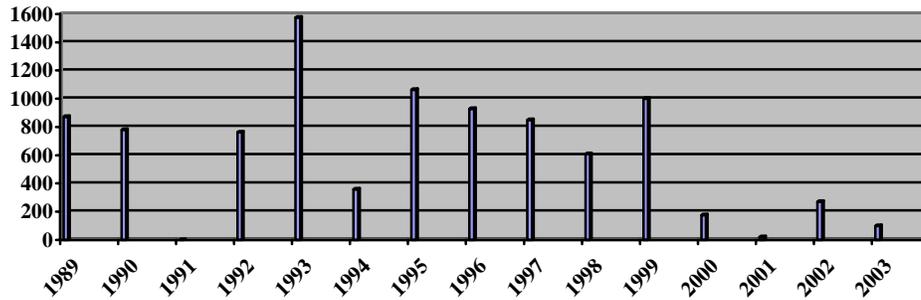


Approximately one third of the companies financed by Ag-West have introduced their products in the marketplace. More than ten companies are already selling product while others have begun production and are moving small amounts of product as part of market development efforts. Companies report that those products already in the marketplace yielded combined gross sales of \$60 million in 2002 up from \$50 million in 1999. Figure 4 shows the sales revenue from the firms in Ag-West's investment portfolio. An assessment of the Ag-West investments showed that the average lag between investment and market introduction was approximately three years, with the minimum being one year (for investment targeted to assist with market development) and the maximum at seven years (for investments in developing entirely new products). Figure 5 shows the investment values on a year to year comparison.

**Figure 4: Annual sales revenue from investment firms (\$000s)**



**Figure 5: Ag-West investment values by year since inception**



Ag-West has provided flexible terms for repayment of investments. Nineteen of the investments (mostly to the larger firms) were treated as modified loans, 16 of the investments stipulated repayment via royalties on product sales, providing for repayment based on some negotiated rate of interest, 11 of the investments involved Ag-West accepting common or preferred shares in the venture. Investments totaling \$2,328,000 or 25% of the portfolio have already been repaid and others have begun to make royalty payments as established in their agreements (Table 2). As one would expect with higher risk investments, some of the projects have not survived. Of the 46 investments in 37 companies, 21 investments in 18 companies worth approximately \$4.1 million or 45% of the portfolio have been written off (although some of the ventures may yet commercialize a product, providing for royalties or loan repayments to Ag-West).

**Table 2: Current status of the Ag-West portfolio**

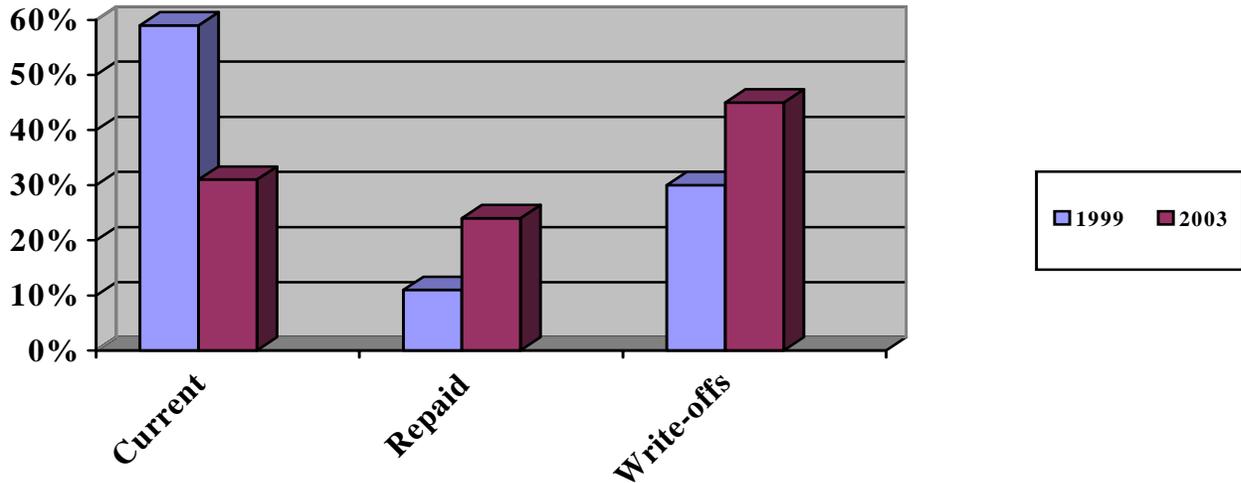
	Total	Current	Repaid	Write-offs
Number of investments	46	17	8	21
% of funds disbursed		31%	24%	45%

Figure 6 compares the status of the investment portfolio in terms of present investments, repaid investments and write-offs with those after the first decade of operation. The current value of investments has decreased, but this amount is reflected in the doubling of repaid investments and additional write-offs over the past four years.

The companies identified that the \$9.3 million initial investments by Ag-West generated a total of \$62 million (Table 3) of research activity in Saskatchewan, yielding a 6.7-to-1 leveraging ratio (which is likely more reasonable than the 9-to-1 ratio used as a rule of thumb by many in the technology business).

The respondents indicated that approximately \$4.2 million of the leveraged funds came from other public sources (e.g. AAFC, IRAP, AFIF, and NABI) but that the balance came from private sources. Those investments that were written off were not available to contact. For those investments it was assumed that every \$1 investment by Ag-West leveraged \$1 of additional direct effort.

**Figure 6: Status of investments in 1999 and 2003**



Almost all of these research funds were invested in Saskatchewan salaries and purchases of goods and services. A few companies indicated small imports of specialized equipment and out-of-province marketing expenses, but the outlays were within the normal bounds of expenditure. This aggregate fiscal outlay figure was reduced by 25% to account for direct imports of product and supplies from other provinces and then grossed up by the average provincial multiplier of 1.5. The result is Ag-West investments boosted the provincial GDP in 2002 by more than \$71 million over what it would have been without the investment. Over the 1989-2003 period, GDP was raised by a total of nearly \$425 million.

This activity generated approximately 560 direct person-years of employment (Table 4) in research and development over the period and over 780 person-years of employment, including direct employment generated in the projects and indirect employment generated by the economic activity in the projects.

The average gross provincial government cost per direct person-year of employment was approximately C\$12,500 (C\$9.3 million less C\$2.3 million repaid, divided by direct R&D employment). This is higher than the average cost of activity created through many provincial grant and subsidy programs but significantly lower than the average cost per job generated via government capital programs. The cost is reduced because some of the investments caused the relocation of research activities from other countries, leading to relatively large, ongoing research programs. Taking direct and indirect employment, the net total public sectors' cost per person-year of new employment is about C\$7,200.<sup>1</sup> It

<sup>1</sup> Other government agencies have also invested in these projects, so that the total gross public cost is estimated to be approximately C\$11.7 million, which would yield a total government gross subsidy cost of approximately C\$27,000 per direct PY of employment and C\$17,500 per total PY. Although fiscal equalization limits the net tax-back in Saskatchewan, the economic expansion in Saskatchewan generates new taxable income for the Canadian government, such that a significant portion of the costs are recovered through sales, personal, and corporate income tax and lowered equalization payments to the province. This analysis assumes that 30% of the new investment is taxed away by all levels of government.

would be fair to assume that many of the projects will commercialize a product and that those that have already done so will continue. This will lower the long-term cost of employment as some companies will repay their investments while all of the companies that extend their activity will end up creating more person-years of employment.

**Table 3: Activity Resulting From Ag-West Funding (\$000s)**

	Sources of investment funds		Direct impact		Output effect
	AWB	Other	Research Outlays	Product Sales	GDP
1989	872	872	1,744	-	1,962
1990	780	664	1,444	-	1,625
1991	0	62	62	-	140
1992	763	664	1,427	1,330	3,102
1993	1,575	2,215	3,790	4,942	9,825
1994	359	1,235	1,594	9,662	12,664
1995	1,064	1,550	2,614	15,402	20,268
1996	928	5,145	6,073	13,872	22,439
1997	850	7,495	8,345	32,067	45,464
1998	609	8,017	8,626	36,962	51,287
1999	1,000	9,092	10,092	49,689	67,253
2000	176	9,427	9,603	47,710	64,478
2001	20	2,590	2,610	44,358	52,839
2002	270	3,490	3,860	59,572	71,706
2003*	100				
<b>Totals</b>	<b>9,368</b>	<b>52,518</b>	<b>61,886</b>	<b>315,566</b>	<b>424,706</b>

\* - To the end of March 31.  
Source: Author.

**Table 4: Estimated employment generated by Ag-West investments (in person-years)**

	Direct R&D Jobs	Indirect Jobs	Total Jobs
1989	16	6	22
1990	13	5	18
1991	1	0	1
1992	13	5	18
1993	34	14	48
1994	14	6	22
1995	24	9	33
1996	55	22	77
1997	76	30	106
1998	78	31	109
1999	92	36	128
2000	87	34	121
2001	24	9	33
2002	35	14	49

<b>Total</b>	<b>563</b>	<b>221</b>	<b>784</b>
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The economic impact of Ag-West’s investments is not limited to Saskatchewan. Many of the products will be sold across Canada and globally, creating economic activity in those areas. As a rule of thumb, one could assume that the Canadian economy is boosted by about half as much again as the Saskatchewan economy.

#### **4.2 Networking Activities**

Innovation, as a process where existing knowledge and technology are applied to a wide scope of possibilities, requires interaction. Collaboration and information exchange among firms improves the ability to deal with today’s complex and dynamic markets. The collective sharing of information and resources reduces uncertainty and contributes to greater technological competence. The activities of Ag-West are fundamental in helping create new networking opportunities within Saskatchewan’s R&D and business community.

Broadly speaking, Ag-West events could be categorized as ‘Networking Activities’. However, the word ‘networking’ may not adequately reflect the role that the events play in helping support and achieve Ag-West corporate goals – especially in the areas of communications, marketing and corporate/public relations, as the role of Ag-West in these events goes well beyond standard networking activities. Ag-West events serve educational, communications, public relations and marketing objectives and span local, regional, national, and international audiences. The scope of these events may include launching a new business, providing information on biotechnology that will address public understanding, or enhancing Saskatchewan's image as a world-class R&D and business community by participating in business missions to other countries. The audiences vary in size from 3 to 300 and come from all regions of Canada and around the world. Table 5 highlights the event activities of Ag-West.

The process of planning Ag-West events involves the following objectives:

- define the business objectives of the tour or event activities;
- define the scope and categories of target visitor/groups/audiences;
- determine the appropriate vehicles, activities and treatment of events;
- determine the level of financial and human resources required;
- ensure effective post-event follow-through; and
- act on achievement indicators, to monitor and measure results.

**Table 5: Schedule of events hosted by Ag-West**

Event Category	1998	1999	2000	2001	2002
Visitors/Tours	16	53	35	37	25
Conferences	54	36	37	37	38
AWB Seminars	11	15	7	6	6

Events that met the above objectives contribute to the facilitator role that Ag-West has established within the local innovation community. The challenge of trying to determine whether an event met all of its expected objectives is that a profitable transaction from a networking event takes time. Cultivating a key contact may take two to four years of close contact before an opportunity arises that will allow both parties to benefit. This networking lag makes it very difficult to connect actual transactions to specific networking events.

Since its inception, Ag-West has aggressively pursued opportunities to allow those public and private firms and institutions located in Saskatoon to come together periodically and share knowledge. This process has worked well, as there is a close-knit working relationship between public institutions and private enterprises. Over the past five years, Ag-West has hosted 175 visitors/tours. The delegates comprising these groups have come from around the globe. In this time frame, Ag-West has been involved in over 200 conferences. These conferences have ranged from small local events hosted directly by Ag-West to large international events where Ag-West staff has participated. One crucial component of knowledge sharing occurs through Ag-West seminars, where experts discuss topics of importance to the local innovation cluster.

Ag-West has enhanced the level of technological and information transfer needed for collective action by hosting Agricultural Biotechnology International Conferences (ABIC) in 1996, 1998 and 2002. Since its inception, ABIC has become one of the world's premier conferences on agricultural biotechnology. ABIC 1996 and ABIC 1998 each attracted more than 400 participants from over 30 countries. ABIC 2000 was held in Toronto and attracted 464 attendees. ABIC 2002 was held in Saskatoon and attracted nearly 1,000 delegates and participants (Table 6). The growth and importance of this event is evidenced by the decision to hold ABIC annually starting in 2006. This conference has gained an international reputation in the six years since inception as ABIC 2004 was held in Cologne, Germany, and ABIC 2006 in Melbourne, Australia.

**Table 6: The participants at ABIC conferences**

	ABIC '96	ABIC '98	ABIC '00	ABIC '02
Total number of participants	547	400	464	977
- from United States	11%	13%	12%	5%
- from Europe	7%	8%	NA	3%
- from other foreign countries	7%	12%	NA	3%
- local residents	37%	27%	NA	61%
- other Canadian residents	38%	41%	67%*	27%
* This figure represents all Canadians in attendance.				

It is difficult to assess the direct economic impact of the connections facilitated. One useful indicator, however, is that 95% of respondents to the evaluation survey conducted for ABIC '96 indicated that the conference satisfied expectations. Almost 92% evaluated the sessions as excellent or good. Respondents identified their participation as beneficial to gaining direct contact with relevant potential collaborators, for enhanced networking

opportunities and for access to strategic information on industry and competitor actions. Delegates to ABIC 2002 commented favourably on the quality and depth of the presentations, both in terms of the appropriateness of the subject matter and the quality of the presentations. There was a strong interest in socio-economic sessions such as benefit sharing, the needs of the developing world and environmental issues. By 2004, the ABIC in Cologne drew over 700 delegates from 37 countries.

One direct and immediate way these conferences contributed to the local economy was by attracting non-resident tourists to the province. Based on the conference costs, the number of residents and non-residents attending the conference and Statistics Canada tourism expenditure multipliers, it is estimated that the total direct impact was approximately \$716,000 in 1996, \$657,000 in 1998, \$936,000 in 2000 and \$863,000 in 2002 (Table 7). The gross domestic product effect was approximately \$800,000 in 1996, \$740,000 in 1998, \$1,053,000 in 2000 and \$971,000 in 2002, which would generate between 15 and 20 person-years of employment in the service industry in each year.

**Table 7: Direct contribution to local economy of ABIC events**

	ABIC '96	ABIC '98	ABIC '00	ABIC '02
Location of ABIC	Saskatoon	Saskatoon	Toronto	Saskatoon
Direct Economic Impact:				
Conference expenses	\$475,000	\$450,000	\$711,000	\$613,000
Personal expenditures	\$242,000	\$207,000	\$225,000	\$250,000
Impact on GDP	\$807,000	\$739,000	\$1,053,000	\$971,000
Source: Ag West Biotech Inc.; Research Resolutions for Tourism Saskatchewan from Statistics Canada 1996 Canadian Travel Survey and International Travel Survey; GDP estimates based on 25% imports leakage and GDP multiplier of 1.5.				

While it is impossible to put a dollar figure on the networking activities of Ag-West, the sheer volume of events is indicative of the importance of networking within innovation clusters. The facilitation of knowledge sharing within the agricultural biotechnology community plays an important role by establishing the environment for potential research collaborations. Within any innovative community, it is vital to foster the potential for collaboration or knowledge sharing as this is a very innovative process with the potential for a large dividend from a small initial investment. In addition to the sharing of knowledge is the sharing of experiences, which can serve to lower the costs for other firms within an innovation cluster.

### **4.3 Advocacy & Leadership**

Complementing its financing and networking activities is AWB's role as an industry advocate. Advocacy manifests itself through a variety of activities both in regulatory affairs and through media tracking and response mechanisms.

The Ernst & Young Fourth Report on the Canadian Biotechnology Industry, published in 1997, presents results of a survey of biotechnology companies that shows that Canada's complex regulatory system is the greatest challenge and impediment to commercialization (Goudey and Nath, 1997). This is a vital issue to the growth of the biotechnology industry, as a regulatory delay of one year decreases the rate of return for a biotechnology company by 2.8%, while a two-year delay decreases the rate of return by 5.2% (Heller, 1995). Clearly, improving the operation of the regulatory system, as well as educating firms about the best approach to the system, will be critical to earning the rates of return required to sustain growth in the sector.

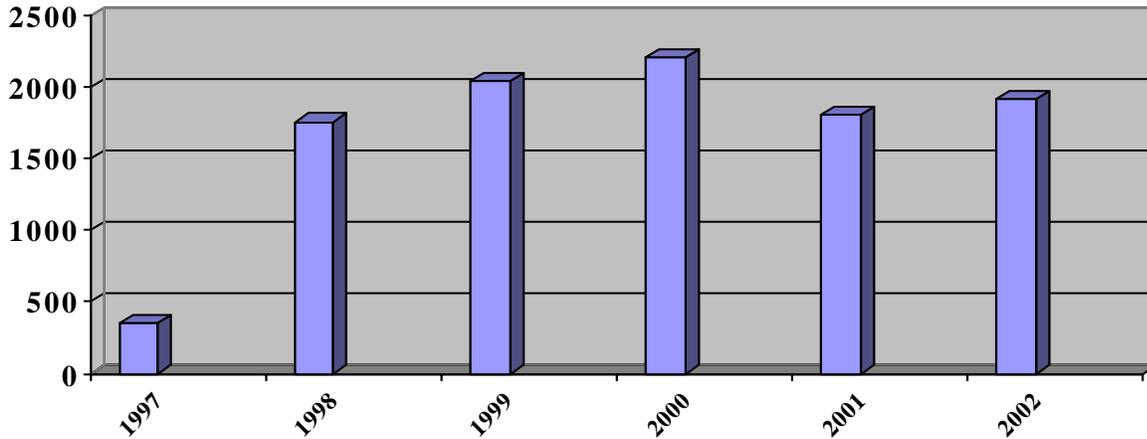
The public sector is primarily responsible for shaping the commercial environment through policies affecting taxation levels, financial support, regulation standards, public procurement, and subsidization. Regulation of the sector ultimately controls the pace of innovation. Developing an effective regulatory system requires interactive learning between the public and private sectors (Lundvall, 1995). Ag-West provides an accessible, timely, cost-efficient forum for governments to consult with industry and for industry to learn from government. Ag-West hosts seminars offering technical and market information to the leaders of several levels of government and a range of public institutions, targeting to enhance the level of awareness and understanding of the value and role of the ag-biotech industry. Participants in seminars and courses offered by Ag-West throughout its existence have regularly included representatives from: industry, Agriculture & Agri-Food Canada, Industry Canada, Saskatchewan Agriculture, Food and Rural Revitalization, Saskatchewan Economic and Co-operative Development, the National Research Council, the University of Saskatchewan and provincial and federal government and opposition parties. Meanwhile, Ag-West provides seminars and other learning experiences for private companies to learn from the regulators and from each other on how to effectively maneuver through the complex regulatory system.

Ag-West produces regular reports and commentaries on the state of the industry and issues important to firms and the industry. The *Agbiotech Bulletin* is sent to nearly 2,200 locations around the world. This is up from 1,700 in 1999. A new service called *Infosource* provides short news articles relating to biotechnology and is electronically mailed to over 450 locations, with an additional 250 hard copies distributed. A further publication called *Newtrition* distributes 450 copies on a quarterly basis.

In 1997 Ag-West launched the Saskatchewan Agricultural Biotechnology Information Centre (SABIC) to provide a visible, proactive mechanism to undertake efforts to enhance public awareness and understanding of the industry. In the first full year of operation, SABIC has hosted approximately 2,000 visitors wishing to learn about agricultural biotechnology and its place in the food system. By the end of 2002, over 10,000 visitors had passed through the SABIC laboratory doors. Figure 7 shows the breakdown of SABIC visitors since inception. Recent studies (Creative Research International, 1996) indicate that Saskatoon residents view biotechnology relatively positively. Residents in other Canadian biotechnology centers (e.g. Toronto, Montreal, Vancouver) revealed opposition to some aspects of biotechnology. The actions of Ag-West since 1989 certainly have contributed to the increased public acceptance in Saskatchewan. Recently

SABIC conducted various tours for over 800 people, involving 10 groups of school students and teachers, groups from the National Research Council of Canada and the Canadian Food Inspection Agency Plant Biosafety Office and several groups from the University of Saskatchewan.

**Figure 7: SABIC visitors since inception**



Ag-West launched the Saskatchewan AgBiotech Regulatory Affairs Service (SARAS) in 1997 to provide companies with expert advice, mentoring and other assistance in achieving product registration. As a focal point for regulatory matters, SARAS will formalize and enhance the support for rapid commercialization of Saskatchewan biotechnology products.

A recent survey of companies undertaking biotechnology initiatives in Saskatchewan (Phillips and Khachatourians, 2002) revealed strong recognition of Ag-West in nurturing the Saskatchewan agricultural biotechnology community and significant kudos for the past and current presidents of the company. Beyond the financial support, respondents recognized the importance of a visible leader and spokesperson for the sector, both when dealing with governments and when responding to public concerns. Dr. Murray McLaughlin and Mr. Peter McCann both put something in here on 'civic entrepreneurs' and/or have become recognized leaders and advocates for the business, and gain significant respect from the private companies and public researchers in the industry. The Ag-West staff participates in trade shows around the world, helping to increase the awareness of Innovation Place and Saskatoon as a leader in agricultural biotechnology. Ag-West has been present at BIO annual meetings where over 15,000 delegates from the world over attend. Although it is impossible to quantify the benefits of this function, it is a critical factor in a successful national system of innovation.

Another important service the AWB provides in terms of advocacy is in its media analysis and response program. Utilizing a clippings service, AWB tracks papers in Saskatchewan, Alberta, British Columbia as well as national newspapers to articles that

are related to AWB (but not specifically biotechnology). Responses would be made if, in fact, incorrect or misleading information is represented in the media<sup>2</sup>. Responses are generally directed to the Editor and the goal is to respond within 48 hours of the original article publication. The overall idea of the program is to facilitate or improve the public's understanding of biotechnology and the work of AWB<sup>3</sup>.

Finally, Ag-West has developed a continuing relationship with the University of Saskatchewan to build academic capacity in Saskatchewan to support commercialization of new products. In 1999, Ag-West made a five-year, \$100,000 commitment to a new \$1.1 million NSERC/SSERC Chair in Managing Knowledge-Based Agri-Food Development, that focused on issues related to freedom to operate within existing intellectual property rights and national and international market access. This contribution was used to hire graduate students and to provide these students with the ability to present their research at international events.

Ag-West has begun to implement a Life Sciences Strategy. Part of this Strategy has led to the formation of Bio-Products Saskatchewan Inc. This new organization has been developed through a great deal of work by Ag-West and co-operation from industry and government. The objective of Bio-Products Saskatchewan is to promote and support the growth of Saskatchewan's based-bio industry sector, through the development and commercialization of products and related processes, and the development of associated technologies, by working with industry, government and academic stakeholders.

#### **4.4 Governance**

Genome Prairie is one of five Genome Centers established by Genome Canada, the primary funding and information resource relating to genomics and proteomics in Canada. Genome Prairie is focused primarily on the support of research taking place in universities and federal laboratories in the Provinces of Saskatchewan, Alberta and Manitoba, but projects also include researchers in every region of the country and collaborations with other scientists abroad. Genome Prairie currently funds six projects, of which five occur in Saskatchewan. Ag-West and the support of former President Peter McCann have been of great value in assisting the location of these projects in Saskatoon. The projects with a Saskatoon focus are:

- The Functional Genomics of Abiotic Stress (FGAS) in wheat and canola crops is led by Dr. Graham Scoles at the University of Saskatchewan with colleagues in British Columbia, Alberta, Manitoba and Quebec.
- The Functional Pathogenomics of Mucosal Immunity (FPMI) project represents a group effort between researchers at the Veterinary Infectious Disease Organization

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<sup>2</sup> For example: comparing GM canola to GM wheat, I would point out that canola is 20% outcrossing whereas wheat is only 0.5% outcrossing so you cannot compare pollen flow in the canola situation to what may occur with GM wheat.

<sup>3</sup> Between August 2002 and January 2003, a total of 212 articles were identified and responded to by AWB. Thirty eight percent of those were identified as having a positive spin, while another 38% were identified as having a negative spin. Another 50+ were identified as neutral.

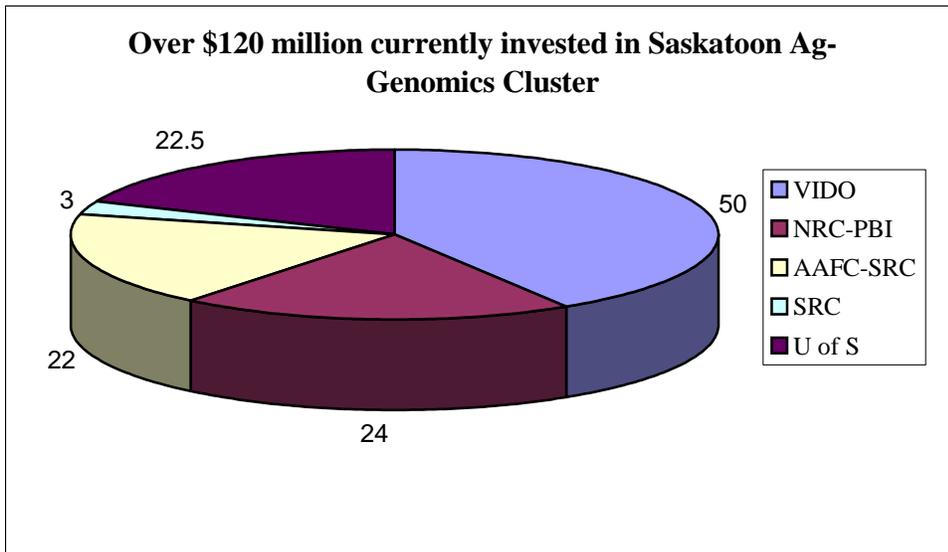
(VIDO) at the University of Saskatchewan and the University of British Columbia. Dr. Lorne Babiuk is the lead of this project.

- The Enhancing Canola Through Genomics (ECTG) is led by Dr. Wilf Keller at the National Research Council's Plant Biotechnology Institute (PBI) and the University of Saskatchewan, in cooperation with Agriculture and Agri-Food Canada.

The total value for these five projects is nearly \$70 million. Of this funding, \$31 million will be invested in Saskatoon. The funding will go towards hiring additional graduate students to conduct new research, attract highly skilled people to move to Saskatoon and contribute greatly to increasing the research infrastructure in Saskatoon.

When these investments are combined with other agricultural genomics investments and associated equipment and building expansions, the Saskatoon ag-biotech cluster has received over \$120 million (Figure 8). Some of this funding has already been allocated and the remainder will be dispersed over the next three years. The allocation the genomics investments has impacted all of the large public research institutions in Saskatoon. VIDO has attracted the largest portion of investment funding with \$50 million. The next largest recipient of funds is NRC-PBI with \$24 million. The University of Saskatchewan had received \$22.5 million, with collaborative efforts between Agriculture and Agri-Food Canada and the Saskatchewan Research Council attracting \$22 million. The final portion of genomics funding at \$3 million has been granted directly to the Saskatchewan Research Council.

**Figure 8: Genomics investments in Saskatoon**



**5. Conclusions**

Ag-West Bio Inc., has played a critical role in creating the networks, linkages and the financing that support the development of a Saskatchewan-based agricultural biotechnology industry. Although many would view the investment efforts as Ag-West's most important contribution, the intangible benefits provided by the company may in the long run contribute more to growth than the flow of funds.

In the course of interviewing the companies for this study, many respondents offered unsolicited complementary comments about Ag-West. A number of respondents adamantly asserted that without Ag-West funding, they never would have got started. This even involved the larger companies, which asserted that locating or relocating their research efforts in Saskatoon was only possible with the cash flow provided by Ag-West. The kudos for Ag-West even came from companies that had been unsuccessful in commercializing their product or had disagreements that terminated their funding before the product was commercialized. A number of those respondents observed that Ag-West staff were the first and only people they had met in the financial business that understood the particular challenges and opportunities of start-up entrepreneurial ventures.

There are three key observations that have resulted from this study. The first is that it is possible that what is key to the long-term sustainability of a research cluster is an organization that has a business component and a governance framework to bind the research community together in a cohesive fashion. Clusters can be established with leading edge technologies and the brightest researchers, but if there is no single agency responsible for facilitating the sharing of knowledge through the meeting of new people, there is no force in place that is working to ensure sustainability. The ability to make capital investments in firms provides support to firms located in Saskatoon, while the governance framework has been a crucial factor in the success of this research cluster.

A second observation is that for an organization attempting to foster the development of a research cluster, that the indirect activities are as important to the community as the direct activities. As shown in the paper, the ability to invest in firms has generated positive economic benefits for Saskatoon and Saskatchewan, but the networking and advocacy components have been crucial factors in the success of Innovation Place. The ability to host events and bring researchers together into one room has spin-off benefits that are more difficult to measure and substantiate, but must not be underestimated in the overall success of cluster development.

The third observation is that key people make the difference. As AWB evolved, the position of President in the organization was key to the evolution of AWB and the research community. It is important to have the right leader at the appropriate time in the evolution of an organization such as AWB. For example, having a leader that only has a skill set for running a mature organization would not be appropriate at the start up of an organization. One of the key successes for AWB was to have leaders with skill sets that matched the needs of the organization as it evolved.

As a final point, it is important to note that this study did not endeavor to review either the management performance or the priorities of the organization. That would clearly require a different approach and methodology. This study, however, suggests one

possible area for further examination. This review of the investment portfolio shows that a disproportionate share of those investments targeted to mainline agricultural biotechnology initiatives (e.g. canola, flax, oats) have succeeded while almost all of those investments targeted on consumer-level products, mechanical technologies or medical research have failed. This suggests that the company may want to review its investment priorities to determine why the relative success ratios vary. It is possible that the level of expertise and knowledge to span such a wide variety of markets and technologies may exceed the capacity of such a small organization.

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