

How a Canadian Not-for-Profit Commercializes IP

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How an Alberta firm has successfully used intellectual assets to work with customers and partners

The Alberta Research Council (ARC) is an incorporated Canadian, wholly-owned, not-for-profit subsidiary of the Alberta Science and Research Authority. In partnership with global leaders, ARC helps advance the economy and well-being of Alberta by providing technology innovation to meet current and emerging needs of industry and government. The ARC was formed in 1991 and has built significant capabilities in science and technology related to Alberta's key economic sectors.

One of the ARC's earliest technology contributions was the hot water extraction process that now forms the basis of Alberta's thriving multibillion-dollar oil sands industry. Since 1989 the ARC has sharpened its business focus on developing and commercializing innovative technologies that will generate the greatest competitive advantage for Alberta industries. We now work with private- and public-sector customers and partners in a variety of business arrangements including performing contract R&D, investing in development and commercialization of technology, licensing out its technology as well as forming in-venturally developed technologies.

Outline of This Article

Examples of technology development and commercialization initiatives illustrate how ARC works with its customers and partners. ARC's core business, strategies to stimulate innovation, and the creation of new intellectual assets as well as the economic benefits to ARC's customers and partners are described. Finally ARC's model for

managing and mining all its intellectual assets is presented.

EXAMPLES OF TECHNOLOGY DEVELOPMENT, LICENSING AND COMMERCIALIZATION

The following examples illustrate the range of technologies and the diverse development, transfer, licensing and commercialization arrangements:

Improved bacterial vaccines: ARC has developed patented technology for improving bacterial vaccines based on direct linking of oligonucleotides to protein carriers. Rights to commercialize this technology have been assigned to a company specializing in marketing intellectual property in this area.

Web Computer-based patient monitors: ARC is co-venturing with a company to develop and commercialize a web computer-based patient software system extending physicians' ability to diagnose and treat patients securely and effectively via the internet thereby improving patient care and reducing health care costs.

Computer-based physical therapy systems: ARC is co-venturing with a company to develop and commercialize a portable isotonic system with multiple applications in physical therapy, orthopedic treatment outcomes, repetitive strain and workplace physical assessments and to measure rapid deterioration of muscle and bone in astronauts.

Granulation based technology for forest inventory and ecological mapping: ARC has developed a proprietary software system using a scanning laser, digital photography and proprietary software. Integrated with global positioning and inertial navigation the system accurately maps and measures

forest inventories and can be used in forest management applications such as modeling tree growth and forest yields. The technology has been licensed to a forest service company.

Water analyzers for pulp mill effluents: ARC has developed a family of instruments for measuring mill water quality online, thereby minimizing downtime and allowing operators to control chemical processes directly and with great accuracy. The technology is being commercialized in partnership with an instrument company.

Lightweight ceramics for wear and ballistic protection: ARC is co-venturing with an Alberta manufacturing company to develop wear-resistant ceramic materials and coatings that increase the life span of equipment used in the petroleum and mining industries. Other products under development include lightweight, cost-effective armor for protection of military and police personnel and vehicles.

On-line control of oriented strand board manufacturing: ARC has developed several instruments for the online control of oriented strand board. One instrument monitors and controls the pressing parameters during manufacturing. This instrument is being marketed and installed worldwide by ARC. The other instrument measures online the stiffness and strength of panels as they come off the production line. This technology has been licensed to a machinery company.

Clay gels to reduce water shut-off costs in oil production: A new technology for reducing the amount of water pumped from oil reservoirs into the wellbore prop-

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retiree of days to penetrate and shut off high-water zones in the reservoir. ARC is seeking an appropriate industry partner to field test and commercialize this technology.

Disposed catalyst for upgrading heavy oil: ARC has developed patented technology for upgrading high-sulfuritic crude oils to high-quality transportation fuels. This unique technology offers substantial cost and product quality advantages over existing technologies. Experiments of interest have been solicited from leading engineering and operating companies to scale up and commercialize the technology.

STRATEGIES TO STIMULATE INNOVATION AND THE DEVELOPMENT OF INTELLECTUAL ASSETS

Market-Focused Core Businesses

Activities are focused in market sectors of importance to the Alberta economy. Three-year business plans and budgets have been developed based on identified market trends and technology niches where ARC is uniquely positioned to have the greatest impact. The core business sectors are: Agriculture, Minerals and Health, Energy Technologies, Forest Technologies, Industrial Processes and Services.

Build Technology Platforms

The business planning process has identified the need to build potential scientific capacity and innovative skills around strategic technology platforms. A technology platform is an integrated set of technologies with critical mass of expertise capable of delivering multiple proprietary and products to an identified market at an attractive benefit-to-cost ratio. The following technology platforms have been targeted:

- Sensors and process control.
- Engineered wood fibers.
- Animal vaccines.
- Transgenic plants.
- Fuel Desulfurization.
- Carbohydrate chemistry.
- Disposed catalyst upgrading systems.

• Control of petroleum production wells.

It is expected that the ongoing planning process will identify additional technology platforms with strong market potential.

Stimulate Innovation and Award Success

To stimulate innovation, ARC created an internal investment fund to:

- fund early stage ideas brought forward by employees to determine their technical and market feasibility.
- Advance an idea further along the value chain to the point where an external partner can be interested.

• Joint ventures with one or more external partners.

• Acquire technology from external sources to bundle or add value to technology that has been developed in-house.

In 1998-99 ARC invested about \$6.5 million in 120 projects. All projects are stage gated to manage the risks from innovations to commercialization with the level of investment required. Business units were challenged to meet stretch targets by bringing forward innovative investment projects. Targets were also set for external contracts and contributions to the net corporate revenue. In 1998-99 the majority of the business units met or exceeded their financial targets. All staff members in these business units were rewarded with a financial bonus in proportion to the net corporate revenue. (Graph A)



Develop Human Resources; Promote Employee Alignment and Satisfaction
ARC has more than 500 highly

skilled scientists, engineers, technical and support staff. Successful development and commercialization of technology depends on the creativity and skills of these employees. This includes the depth and breadth of technical and business education and experience and their ability to work with customers to identify and implement technologies in the commercial environment. Strategic hiring and training strengthen gaps in technical and business skills. Comprehensive annual employee surveys have helped to promote understanding and alignment with corporate mission and goals. It has stimulated dialog on ways to improve performance and employee satisfaction at all levels in the organization. Overall employee satisfaction has remained at 87.6% during a time of transition and change and steady progress toward a market-driven business culture. Results confirm the importance of corporate culture and intrinsic motivators such as a creative work environment and the opportunity to participate in developing and commercializing new technologies.

Maximize Intellectual Assets

Management of intellectual assets has evolved from a decentralized system managed by business units to a centralized system managed by a technology commercialization office.

In 1997, a common database was created and a multi-stakeholder team evaluated all existing patents and licensing agreements. The original patent holdings were reduced from 438 to 368. Forty percent of the abandoned patents were deemed to have no value to ARC while 50% lapsed due to improper filing or maintenance. A simplified disclosure form was implemented. In the first year it resulted in 55 new patent disclosures. Patent filing and maintenance costs were controlled and costs were reduced. These improvements have increased the rate of innovation disclosures and have improved the quality and value of ARC's intellectual property portfolio.

In 1998-99, employees submitted 32 new innovation disclosures. These

new patents were approved in Canada, 13 in the United States, and three in other countries. Of these patents, five are unique, or "first in family." ARC generated \$1.7 million in commercialization revenue (licensing and royalty revenue, plus sales of ARC-developed products). Licensing and royalty revenues came from 18 organizations, with five of those each generating \$50,000 or more. Product sales came primarily from one sensing-and-control system. The technology commercialization office licensed out nine technologies and licensed-in one external technology for further development and ultimate commercialization with an industrial partner. ARC's goal is to create commercialization revenue to 10% of its annual budget, or approximately \$33 million by 2005.

ECONOMIC IMPACT AUDITS AND CUSTOMER SURVEYS

ARC works with more than 750 customers and partners each year. Since 1995-96, high-level performance audits were introduced to assess the economic impact of ARC's work with industry. Economic impact, defined as incremental domestic and export sales and new jobs created, has increased from \$90 million and 798 jobs in 1995-1996 to \$140 million and 800 jobs in 1998-99. In 1998-99 the province invested about \$25 million in ARC and external contract R&D received \$25.5 million. Consequently, ARC currently achieves an economic impact to government investment ratio greater than 3:1 and a private-sector-to-government investment ratio of about 3:1. By 2005 ARC plans to increase these two ratios to about 5:1 and 3:1, respectively. This growth will be achieved by creating new technology platforms, strategic alliances and acquisitions and by in- and out-licensing of technologies.

Annual customer surveys are conducted to provide valuable feedback on customer needs and where improvements can be made. Overall customer satisfaction increased from 93% in 1998-1999 to 96% in 1999-2000. The survey results confirm the importance of high-quality

ARC company teams with complementary skills in successful development and commercialization of technology. It also points to the importance of having clear upfront agreements on the ownership of intellectual assets and the sharing of commercial revenues. (Graph B)



MANAGING AND MINING ARC'S INTELLECTUAL CAPITAL

ARC is a knowledge organization. Its intellectual capital is made up of the tangible and intangible assets that give a competitive advantage in developing and commercializing technology and achieving financial goals. Intellectual capital is comprised of the knowledge of ARC's employees, shared learning with customers and the organizational infrastructure, values and leadership. In short it is the

sum of everybody and everything involved with ARC as depicted in Graph C.

The primary value of the model is that it provides a comprehensive framework for understanding and managing all aspects involved in the creation of knowledge and extracting value from the total knowledge pool. Mining technology, know-how, skills and data located in different parts of the organization can lead to new commercial products such as ARC's geographic-based forest inventory and ecological mapping system. This product combines technologies, know-how and data from forest management, silviculture, land topography and ecology, information technologies, laser scanning, digital photography, global positioning and inertial navigation.

Conclusion

During the past several years ARC has progressed toward becoming a leading knowledge organization in assessing, sourcing, developing and commercializing technology. It works in various business arrangements, primarily with Alberta industry. Continuing success requires stronger international links and ARC is actively seeking mutually beneficial business arrangements with global leaders for licensing, developing and commercializing technology in its core business areas.

ARC's Intellectual Capital is composed of its human capital, customer capital, intellectual assets and organizational capital.



GRAPH C