

Identifying “The Saskatchewan Advantage”

Using Jurisdictional Advantage Assessment to Identify the Core Drivers of the Saskatchewan Economy

A Summary Report by Innovation Saskatchewan

Jurisdictional Advantage Assessment (JAA) – What is it?

A Jurisdictional Advantage based methodology provides a cautious approach to investment decisions. Jurisdictional Advantage identifies the core engines of the economy – those areas that drive growth and sustain the province over the long term. It is an evidence-based process that identifies the unique strengths, weaknesses and opportunities that define the province’s sustainable advantage. Jeremy Heigh, Chief Economist of Sift Every Thing Corporation (Sift) was contracted to use his proprietary JAA tool to conduct a preliminary JAA for Saskatchewan.

Sift is a Western Canadian based due diligence, competitive intelligence, and analytical foresight company. It developed its proprietary Jurisdictional Advantage Assessment tool in co-operation with Dr. Maryann Feldman of the University of North Carolina (formerly University of Toronto) and nine PhD economists drawing on a synthesis of over 300 economic articles. Sift’s clients include governments, institutions, associations, and private companies.

Sift’s preliminary Jurisdictional Advantage Assessment for Saskatchewan project conducted in 2010 addressed three areas of work:

- Assessment of Character of Place – evidence (a combination of quantitative – published statistics and qualitative – interviews with business leaders) to support the identification of Saskatchewan’s jurisdictional advantages was collected;
- Identification of Key Areas of Jurisdictional Advantage – translating the data collected into descriptions of the relatively few areas where Saskatchewan has world-class competitive advantage; and,
- Assessment of Competing Jurisdictions – assembling information from jurisdictions with similar advantages to learn from their experiences.

The 2010 evidence consisted of the information gleaned from one to two hour interviews with 47 Saskatchewan business leaders and data from 25 economic indicators. The preliminary work was followed by a more in-depth assessment of two Saskatchewan industrial ecosystems in 2011. An industrial ecosystem is broader than a sector. It includes a sector and those that provide inputs to and process outputs from that sector. This portion of the work involved 63 interviews and the analysis of 18 indicators.

Why did Innovation Saskatchewan Contract a JAA for Saskatchewan?

Innovation Saskatchewan (IS) is charged with providing recommendations and advice to the Saskatchewan Government regarding research, development, demonstration, and the commercialization of new technologies and with facilitating coordination of the Province's innovation activities and its science, research and development infrastructure. To form a framework for evaluating initiatives, to provide the Government with the basis for informed, defensible decisions, and to assist the IS Board in strategic planning, IS needs to be grounded in Saskatchewan's inherent and created advantages – its Jurisdictional Advantage. Initiatives that build on or are connected to areas where Saskatchewan has jurisdictional advantage are more likely to be sustainable and therefore should receive priority in an innovation strategy. Initiatives not connected to the province's advantages are more likely to fail or move to a jurisdiction where they are better aligned to that jurisdiction's advantages.

The Findings

There was clear consensus among leaders and the data that the Core Engines – those sectors that sustain and drive growth in the Saskatchewan economy – are:

- Agriculture (11.1% of 5 year average GDP);
- Oil and Gas (9.4%); and,
- Mining and Minerals (3.4%).

These three sectors that encompass our key natural resources and their industrial ecosystems (companies providing inputs to and processing outputs from) are **The Saskatchewan Advantage**.

Agriculture is the most complete core engine with good interaction with the economy both upstream and downstream of primary production and good interaction with the province's supporting institutions. Oil and gas and mining do not appear to enjoy the same support or interconnections with the rest of the economy suggesting that addressing this gap might be an important element of an innovation strategy. This finding prompted IS, in collaboration with Saskatchewan Energy and Resources and Enterprise Saskatchewan, to commission the 2011 analysis of the industrial ecosystems surrounding these two core engines. This summary report contains a combination of the findings of both studies.

Agriculture

Agriculture has the most comprehensive industrial ecosystem with a significant agricultural equipment and fertilizer manufacturing sub-sector on the input side, and a smaller but growing processing sub-sector adding value to the output side. It has a diverse and sophisticated set of supporting institutions and research infrastructure. There are nearly 50 trade associations and research organizations active in Saskatchewan and 16 public-private agriculture-based centers, pilot plants and incubators. The share of private to public investment dollars is constant: approximately \$3 of private investment for \$1 public. Agriculture files more patents than any other sector.

Senior executives in the sector recommended the following agricultural innovation strategies:

- attack the low return per acre and the low level of value-added processing problems;

- enhance crops for higher yield, quality, and bio-chemical content, particularly cereals;
- use crops and cropping systems as platforms to enhance performance and diversify into non-food applications;
- pursue the interface between plant, animal, and human health;
- leverage Saskatchewan's disadvantages (cold, isolated, water shortages, low population density) to create opportunities in testing, treating disease, and developing genetic material.

Moving forward with these, or any other opportunities, would be best done with a more complete understanding of agriculture and those providing its inputs and processing its outputs. Innovation Saskatchewan, in cooperation with the Ministry of Agriculture and Enterprise Saskatchewan, intends to conduct a follow on study to probe more deeply into the sector's industrial ecosystem in 2012.

Oil and Gas

The oil and gas (O&G) sector leads the province in value of production and is a close second to agriculture in contribution to GDP. Private to public capital investment ratio is approximately \$3 to \$1. The sector is being primarily developed by companies based outside of Saskatchewan, mainly in Alberta. This includes not only the O&G producing companies, but most of the industrial ecosystem. Many of the manufacturers and service companies that serve the sector in Saskatchewan are headquartered in Alberta.

Although there has been an oil and gas industry in Saskatchewan for a long time, the sector in Saskatchewan is less mature than Alberta. As a result the supporting infrastructure in Saskatchewan (readily available information, roads, pipelines, housing for oil field workers, etc.) is less well developed. That said, the companies operating in Saskatchewan have very positive view of their futures in the province. They appreciate the royalty structure, the stability it has, and the programs available for new Enhanced Oil Recovery projects.

The ecosystem as a whole is flexible and robust. It is action oriented with a "let's get it done" kind of attitude. The companies are confronted with a sizeable but very challenging resource. In the heavy oil area (Lloydminster-Kindersley) existing technologies are only able to extract 10% or less of the original oil in place. Therefore O&G companies are willing to try innovations proposed by service providers. It is unlikely that technology companies will be attracted to relocate head offices from Alberta, however there is the potential to grow new companies around new technologies developed to address Saskatchewan unique problems and for Alberta based companies to establish significant operations in the province.

The analysis found the following opportunities to promote innovative O&G sector growth:

- develop specialized services, manufactured products, and companies delivering them to address unique Saskatchewan problems;
- capitalize on niche expertise in provincial research institutions;
- help companies operating heavy oil fields address declining production;
- help O&G companies address declining sector productivity;
- identify and disseminate knowledge of technology opportunities within and outside of the O&G sector that have application to the sector.

Mining and Minerals

Saskatchewan is a world leader in potash and uranium mining. Most of the mining companies operating in Saskatchewan are headquartered in the province employing head office as well as mine site personnel. From a growth perspective, the M&M ecosystem appears vibrant and healthy. Data suggests that the sector could be even stronger. Some factors to consider for sector enhancement include:

- Vulnerability to commodity cycles (there is concern about what will happen to potash prices in 2015 when new and existing mine expansions bring their new production on stream);
- Increased engagement between the sector and innovation channels;
- Growing the mining focused manufacturing and technical service companies – the following data suggests there is room to grow:
 - British Columbia has 10-12 times as many companies serving M&M for smaller M&M industry;
 - Only 5% of the output from Saskatchewan’s manufacturers is for M&M and O&G;
 - Engineering Procurement Construction Managers (EPCMs) engaged by the M&M companies to manage mine expansions and new mine development, tend to favor more focused manufacturers from other jurisdictions that meet quality and safety standards at lower costs than local manufacturers;
 - Some local companies have employed a focused approach to opportunities in the mining sector have successfully competed against competition from other jurisdictions;
- There is room for more junior companies in the province – an essential part of the ecosystem that drives expansion;
- Labour supply is dangerously thin:
 - The SMA-MIHR (Saskatchewan Mining Association-Mining Industry Human Resources Council) survey says industry needs 49,000 new entrants by 2021;
 - Labour productivity has fallen 9% below the 5 year average;
 - Unit labour costs are 21% above the 5 year average.

Mining sector data for Canada and the United States reveals the potential to improve the sector by even greater use of productivity improvement technologies:

- Canada spent 2.37 times the US in structures (2000-2007), but only spent 57% of the US on machinery and equipment and 35% of the US on ICT. Investments in Machinery and Equipment and ICT are required to improve productivity. Canada’s M&M sector is expanding faster (building more) but investing less in technologies that drive productivity improvement than the US.
- From 2000 to 2008, Canada’s M&M labour productivity fell by \$1.40 of real value added per hour.
- Canada’s 10 year average rate of change in M&M labour productivity was -\$0.30/year while the US rate was +\$2.00/year. Provincial data, which combines M&M with O&G data demonstrates the influence of O&G – Canada’s combined rate was -\$4.91 (versus -\$0.30 for M&M alone) – and the difference between Saskatchewan (-\$14.66) and Alberta (-\$6.57).

The JAA revealed there are relatively few supporting institutions in the mining sector provincially and nationally with none focused on the types of minerals mined in Saskatchewan. It identified the need to establish an institute to ensure that this core economic engine, the only one without a dedicated centre in the province, continues to drive growth in the province’s economy.

JAA interviews revealed that Saskatchewan’s mining industry exhibits strong innovation opportunities especially in:

- production processes (diagnostics, drilling, measurement, hydrology and geophysics);
- greening production (biological systems, metagenomics, remediation tailings ponds, and management of other waste streams);
- exploration and sensing

Value Chain and Enabling Sectors

The Core Engines are supported by portions of the following value chain and enabling sectors with manufacturing being the largest of these and the most important innovation source:

- | <u>Value Chain Sectors</u> | <u>Enabling Sectors</u> |
|---|---|
| <ul style="list-style-type: none">• Manufacturing (7.6% of 5 year average GDP)• Transportation and Transportation Infrastructure (6.2%)• Engineering and Construction Companies (5.9%)• Utilities (2.4%) | <ul style="list-style-type: none">• Information and Communications Technology (ICT, 2.6% of 5 year ave GDP)• Supporting institutions (universities and colleges; associations; government policies, programs and agencies, 2.0%) |

Of these, the JAA focused primarily on manufacturing and because the sector contributed 7.6% of the province’s GDP, well above mining and approaching O&G. However, unlike the three core engines which are driving growth in the economy, manufacturing is driven by the opportunities found in the core engines. But the “drive” is not in proportion to the size of the core engines. Agricultural implements account for 65% of Saskatchewan’s machinery manufacturing while O&G and M&M together utilize only five percent of machinery manufacturing capacity in the province.

While Scientific Research and Experimental Development tax credits to manufacturing are significantly higher than any other area of the economy, sector executives revealed a number of areas for improvement for innovative, sustainable growth to occur:

- more public institution support and increased incentive programs;
- mining sector product requirements better communicated to the manufacturing industry;
- Saskatchewan-manufactured product promotion to export markets.

The ICT enabling sector has a great opportunity to assist all sectors with productivity challenges. Canada lags most developed countries in productivity measures. Those countries with high productivity credit the successful implementation of ICT solutions into all elements of their economy. Saskatchewan ICT companies have the potential to develop productivity solutions for the core engines – a local market that will help the core engines continue to compete on the world stage.

Latent Sectors

The JAA identified two latent sectors – forestry and health. Saskatchewan has a significant forest resource. However, the industry has been decimated due to world market issues to the point that its contribution to GDP is barely measurable and it employs less than 1% of the work force. New products and markets must be found that need the kind of forest resource that Saskatchewan has as a primary input. The interface between forestry and energy illustrate an opportunity to capitalize on

Saskatchewan's forest advantage. Adding value to this sector by converting biomass to energy in support of northern resource development and bringing conversion technologies (pelleting, pyrolysis, biochar, gasification, and fractionation) to Saskatchewan could enhance this sector.

Health, on the other hand, represents over 6% of the province's GDP and employs more than 12% of the workforce, with the highest percentage of highly educated people of any sector. It, however, is largely a cost to the public purse as opposed to being an industry that creates economic value. The Health sector needs to find opportunities to provide products and services that have a connection to Saskatchewan's jurisdictional advantages. The province's strength in agricultural biotechnology is an obvious place to start. Key existing infrastructure such as the Vaccine and Infectious Disease Organization (VIDO)-Intervac, Canadian Light Source and National Research Council – Plant Biotechnology Institute could contribute to this latent opportunity. This agriculture-health relationship illustrates a unique, jurisdictional advantage-oriented approach to economic development.

Learnings from Other Jurisdictions with Similar Advantages

The report concluded with discussions on how this information can inform innovation strategies:

- Leveraging strength and embracing (understanding and not ignoring) weakness;
- Advantage-of-Place-Based Innovation: helps manage risk and anticipate innovation; and
- Invest at the Core: diversify within strengths – the core engines and the sub-sectors focusing on the core – incubating from within, taking risks at the edges, not in unplowed ground.

Agriculture: Germany and Brazil

Germany is a leader in the technological and social issues involved in transitioning parts of agriculture to bio-industrial uses in general and alternative energy in particular. It has put policies in place that have driven this change because of its scarcity of oil, societal commitment to pro-environmental policies, and significant agricultural capacity. Similarly, Brazil, blessed with an excellent climate and the highest opportunity to increase agricultural land in the world has policies to enhance the growing sugar cane for ethanol and soy for biodiesel. But Saskatchewan does not have the societal or climatic drivers that Germany and Brazil have and therefore would probably find following their lead into agricultural-based alternative energy a risky proposition.

However, it can still learn from how well these countries have done with their focused agricultural policies. Saskatchewan is regarded as a world-leader in agriculture innovation as it pertains to food. With the global situation of rising populations and increased demand for food, it would be prudent to follow the lead provided by these countries to have a focused strategy that includes a deeper commitment to food in Saskatchewan's agriculture innovation agenda.

Mining: Chile and Australia

The experience of the Chilean mining sector illustrates how a core engine like mining can be used to accelerate the application of technologies in other sectors. Chile's investments in mining have encouraged the growth of new companies based on mining related biotechnology, nanotechnology, and information technology. Using Chile as an example, the right investments in Saskatchewan's mining

industrial ecosystem could lead to transformational niche opportunities in biotechnology, robotics, geomatics, remote sensing, nanotechnology, advanced materials, bioinformatics, and environmental genomics.

Australia's mining experience shows how dependent mining is on access to transportation. Production costs and opportunity to add real value are not determined entirely by the core sector. As the province develops its transportation system, it should investigate innovation opportunities in logistics, storage, waste handling, and ways to enhance transportation efficiency.

Oil and Gas: Alberta, Norway, Scotland

Alberta's long and deliberate history of investment in oil sands development is an example for Saskatchewan. Today's key economic driver would not have been developed without a focused strategy and significant government investment in the 1960s and '70s. Its recent experience with changing the royalty structure shows how the industrial ecosystem supporting oil and gas remains fragile.

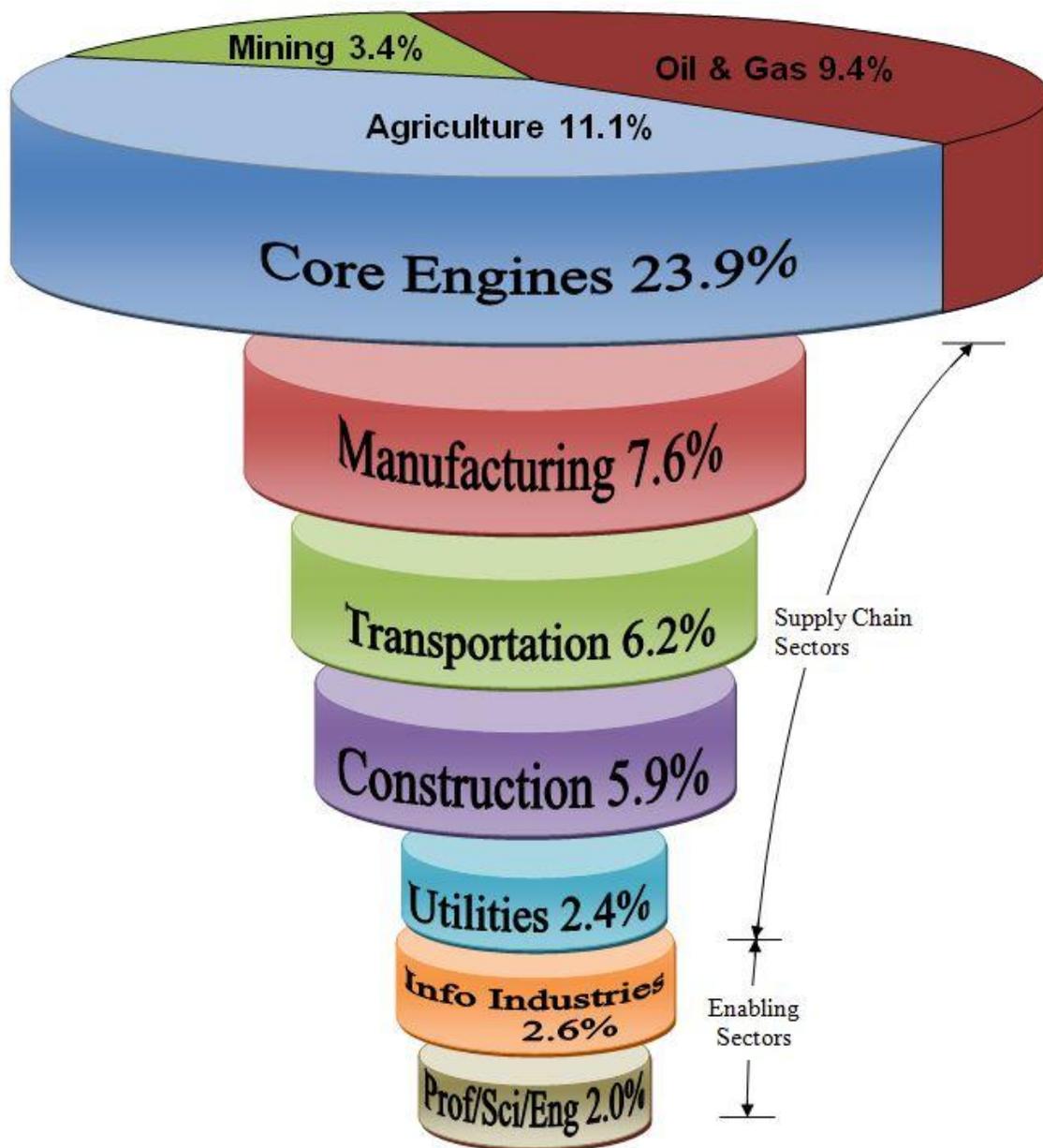
Norway is committed to stewardship and conservation in the oil and gas sector, in spite of significant resource availability and extraction technology. This has led the country to have the cleanest petroleum industry in the world. With its intentions to lead in clean energy alternatives and de-carbonization solutions, Norway is an example for Saskatchewan to note.

Saskatchewan is well positioned to follow Scotland's approach of making and exporting services and technology priorities and domestic production secondary. Without large O&G corporations dependant on steady resource production, Saskatchewan can focus on developing world-class solutions to complex production challenges. When leveraged as advantages, these characteristics enable the province to test and develop technologies and zero-in on developing small, integrated energy production processes.

Using the Learnings from the JAA

The Jurisdictional Advantage based methodology has provided Innovation Saskatchewan with an evidence-based pragmatic approach for making defensible investment decisions. It has identified the core engines of Saskatchewan's economy – those areas that drive growth and sustain the province over the long term – the province's sustainable advantage. With clear evidence on which sectors contain its core advantages, Saskatchewan is well positioned to pursue innovation investment and to mitigate risk. By investing in its core strengths while incubating opportunities that spill out into the rest of the economy, the province can create an environment that fosters sustainable diversity.

As well as providing Innovation Saskatchewan with the framework that it needs to guide its decisions, the knowledge produced by the JAA has the potential inform decision-making in all of government, and even beyond. Although further work is needed to better understand the details behind opportunities to enhance the economy through innovation, the work to date has provided Innovation Saskatchewan with the information it needs to define the "sweet spot" for investing in research and development, demonstration, and commercialization projects or in science and technology infrastructure.



Saskatchewan Innovation Sweet Spot – investing in innovation options in the economy’s core engines or complementary opportunities in its value chain and enabling sectors creates sustainable diversity while mitigating risk. (Disk volume represents the five year average of each sector’s contribution to GDP.)