

ROCKET BUILDERS
bringing technology to market

Final Summary:

High Growth Firms in the Natural Resources Sectors in British Columbia: Forestry, Mining, Oil & Gas

Summary of key findings and recommendations of a market research study on high growth firms in the natural resources sectors in British Columbia.

Prepared for Industry Canada.
Policy, Analysis and Intelligence.

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Background & Summary

Rocket Builders was asked to apply the process used to select companies for the Ready-to-Rocket list (a list of the companies in ICT, Cleantech and Life Sciences judged most likely to enjoy rapid revenue growth) to seek out early-stage innovators in the natural resource sector and supporting industries with the potential to become high growth firms. Specifically, we looked for early-stage innovation in the Forestry, Mining and Oil & Gas sectors.

Rocket builders defines high growth firms as those having the potential to grow by 100% per year for smaller companies, 50% per year for companies with revenues over \$10 million, and more than 30% for companies with revenues of more than \$20 million.

There are structural barriers to achieving this type of growth for most companies delivering innovations into the natural resources sector. (i) There are huge penalties for any innovation that does not work. (ii) A rise in commodity prices distracts the players from structural problems and the need to innovate as they focus on scaling production. (iii) A fall in commodities prices then puts them in batten the hatches mode without the funds needed for innovation.

A search of British Columbia companies (the scope was limited to British Columbia) found very few potential high growth companies. Typically, high-growth companies have a product in the market and have initial evidence of product-market fit. High growth companies will have strong reference clients and will be addressing well-defined market segments. Growth will be supported by macrotrends that are powering the kinds of structural market change that early-stage companies are able to exploit better than large, well established incumbents. They will either be able to generate enough positive cashflow to finance rapid growth (unusual) or will have raised or have the potential to raise the investment they need to finance growth. This investment does not have to come from conventional venture capital. Strategic investors are likely to be important in the resource sectors, and companies with predictable revenue streams can use mechanisms such as subordinated debt. The business environment and company culture must also be able to support high growth.

No candidates were found in the forestry or oil & gas sectors, though for very different reasons. One company was identified in the mining sector and a recent exit ([acquisition of Gemcom by Dassault Systems](#)) suggests potential in this sector. The company we identified is [MineSense](#) which received SDTC funding and in March 2013 had an investment from Chrysalix, a venture capital firm focused on Cleantech (MineSense was on the Ready to Rocket Cleantech list for 2013).

Forestry: As discussed below, value and profit capture in the forestry sector is now controlled by large downstream companies (none of which are located in Canada). This makes for a very difficult

environment for the diffusion of innovation. There is a need for continuous incremental improvement in operational efficiency, which create some demand for innovation, but as the profits are captured downstream there is not enough money in the sector to finance conventional innovation models. There may be opportunities to find disruptive uses for fiber and other biomass and this is an avenue which should be explored. The forestry sector is fortunate to have a large and capable public sector research organization in [FP Innovations](#), something that would also benefit the mining sector, and possibly the oil & gas sector.

Mining: There is good potential for innovation through services in the global mining sector. That more companies were not found is probably a reflection of the relatively low level of basic R&D being carried out in Canada when compared to competing jurisdictions such as Australia. Mining is not constrained by the structural issues seen in the forestry sector, but it is highly cyclical and has long investment timelines making it slower to introduce many types of innovation (those dependent on large capital investments). As a result it has been difficult to grow services companies that are capable of financing, developing and monetizing innovations, especially when compared to the Oil & Gas sector, which has similar paths for the diffusion of innovation. [GE's creation of a business unit to support the global mining sector](#) is further evidence of the potential in this sector.

Oil & Gas: There is little evidence of a vigorous innovation economy in the BC Oil & Gas sector. This is not surprising as the sector is small in BC and dominated by companies from other jurisdictions. The innovation economy in Oil & Gas appears to work reasonably well, using a services-based model for innovation diffusion. As the sector grows in BC there will be opportunities for innovative services companies and some companies may be able to take innovations from other sectors (such as mine reclamation) and apply them to opportunities in Alberta and other regions.

There are a number of concrete steps that can be taken to stimulate innovation and wealth creation in the natural resources sector, which are proposed in the next section.

Recommendations

Innovation means the commercialization of new Canadian-sourced processes, products and services. It does not mean capital investment in existing technologies to achieve production efficiencies.

General Principles

- Maintain and expand basic R&D
- Provide mechanisms to mitigate financial risks of innovation investment
- Provide incentives for cross-industry collaboration
- Provide incentives for investment in and supply of raw materials to disruptive start-ups; provide these start-ups with access to pilot facilities

How to create incentives for more R&D

- Maintain (forestry and oil & gas) or significantly expand (mining) basic R&D funding on critical innovation vectors
- Create incentives for academic and industry research organizations to commercialize IP with services companies and start-ups
- Include local R&D commitments in return for approval of foreign investment

How to support the funding of pilot projects to prove the value of enabling technologies

- Expand the financing and coverage of STDC to cover innovative pilot projects in these sectors
- Provide tax incentives for pilot projects similar to flow-through model used in mining and oil & gas exploration
- Invest in infrastructure that can support multiple pilot and demonstration projects and provide data from these to the linked open data platform

How to encourage more collaborative research across companies to build more Canadian competitiveness

- Create a framework for and fund commercialization research that can get matching funds from industry.
- Create a framework for and support industry-driven consortia that address shared innovation challenges
- Create shared repositories of information and allow companies to create for-profit services on top of these repositories

Executive Summary

In Common

- Large capital investment requirements
- Long innovation cycles
- Many innovations captured initially in services sector
- Growing role for data as an innovation driver

Forestry

- Value chain dominated by & profits captured downstream
- Many opportunities for lateral innovation (innovation outside current value chain)

Mining

- Long value chain with high risk in exploration, highly cyclical
- Low Canadian R&D investment impeding innovation

Oil & Gas

- Profitable value chain with profits distributed across chain
- Robust services-based innovation but no large BC players

The conditions for innovation are different in the Forestry, Mining and Oil & Gas sectors in BC. In all sectors a primary vector for the diffusion of innovation is services companies that play a much more important role than they do in IT, clean energy or life sciences. This is in part as these are mature process industries with large capital investment requirements and because of a lack of major equipment providers based in BC. There are ways to leverage the importance of services companies in innovation to BC's advantage.

Additionally, the value structure of these three sectors is very different. In Forestry most profit is captured downstream and although constant innovation is required for the sector to remain competitive with its growing global competition these innovations will not lead to higher profits, which will drain off to the downstream giants (Wal-Mart, Ikea, Staples, etc.) that control the value chain. Value capture will require a new approach to the commercialization of innovation that takes advantage of lateral innovations into new sectors where more profit can be captured. This will require (i) the cultivation of a new innovation community in the sector and this sector will somehow need to be assured of access to fiber.

BC is much better placed in mining and there are important opportunities to create and capture value. Mining is primarily a service-based innovation economy and the prejudice that certain funding agencies and investors have against services businesses needs to be addressed. There is also a need to sharply increase R&D for the sector. Canada is being out innovated by its major competitor Australia.

Innovation diffusion in Oil & Gas is also services driven. As there is a lot of profit generated in this value chain it is generally healthy. The issue for BC is that the entire sector is small in BC compared to Alberta. This could change with the growth of the LNG and pipeline industries, or if there is a renewal of refinery operations and the introduction of new technologies. All of these depend on political considerations that are beyond the scope of this report.

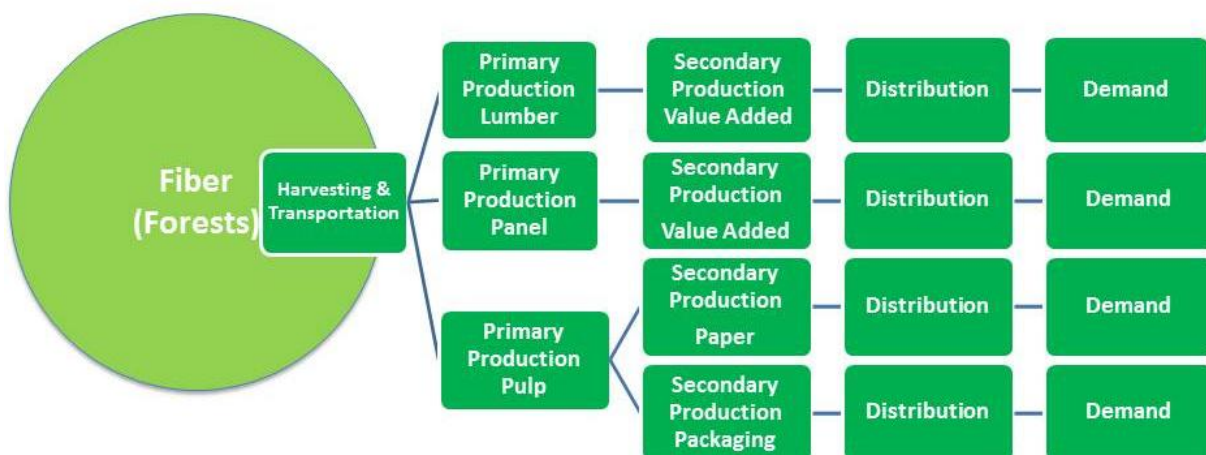
The Recommendations offered by this report take into account the different conditions and needs of each sector. The report is focused on the situation in British Columbia and should not be generalized to other provinces without additional research and validation.

Innovation in the BC Forestry Sector

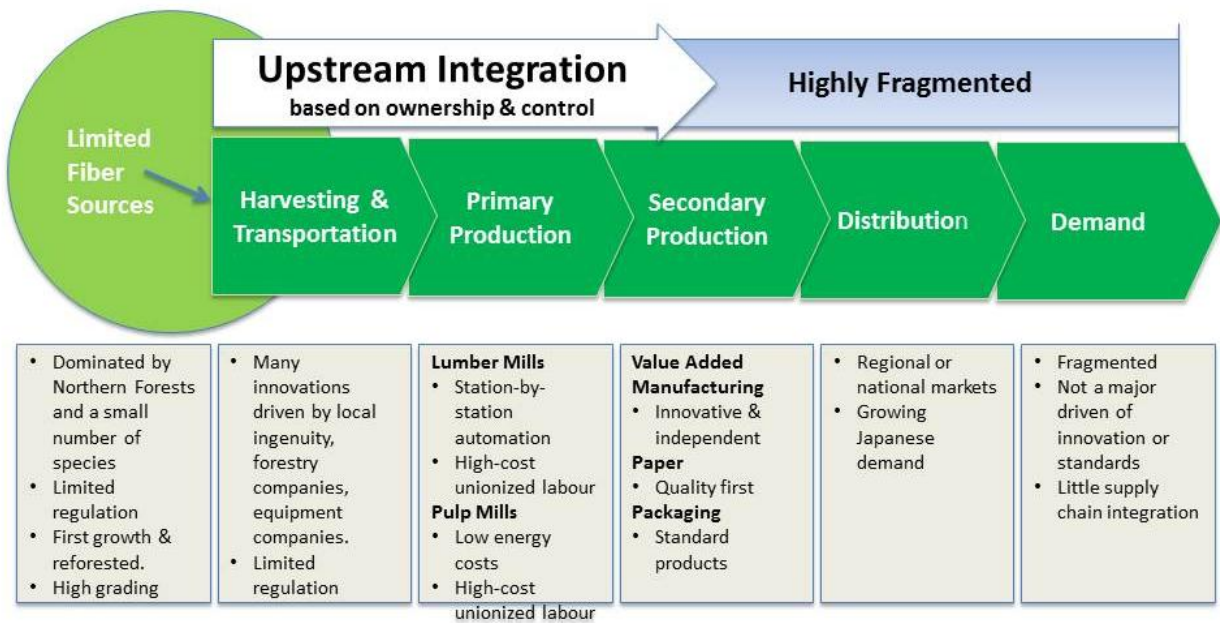
Changes in Forestry 1980s to Present

1980s	Today
Limited variety of fiber sources	Diverse fiber sources – many new species, cultivation models, geographic areas, recycled fiber
Regional demand	Global demand
Process near fiber source	Processing near demand
Long-term investment focus	Short-term investment focus
Upstream control	Downstream control
Control through equity ownership	Control through standards and supply chain integration
Large, profitable Canadian companies	Profits captured downstream (outside of Canada)

The Forestry Value Chain

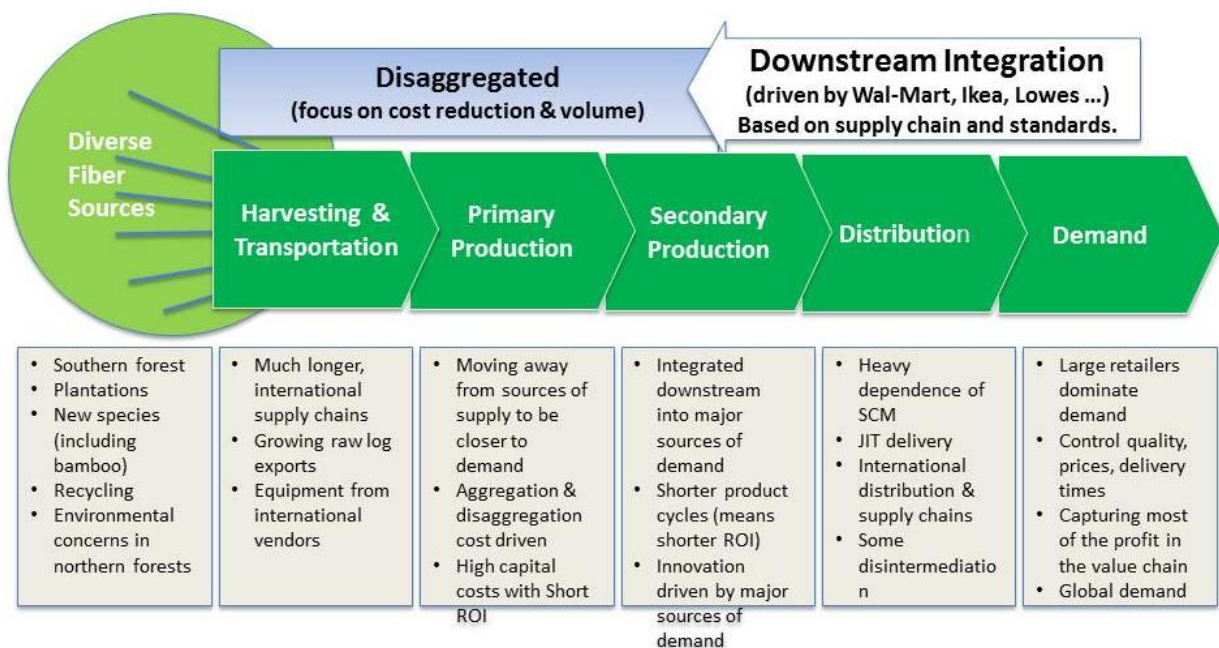


The Value Chain in the 1980s



In the 1980s the BC forest industry was robust, with large local companies such as MacMillan Bloedel, technology innovations like Paralam and active trade promotion through the Council of Forest Industries. BC forestry companies operated on a global scale and dominated the local economy.

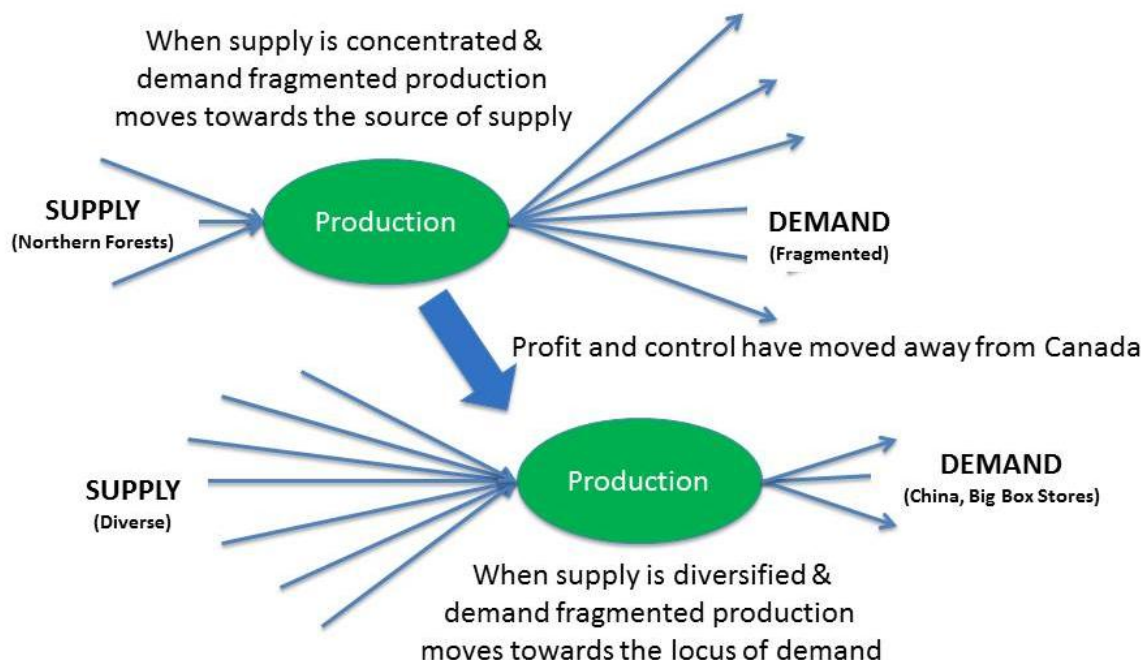
The Value Chain Today



But by the first decade of the 21st C the situation has changed completely. The most important changes were as follows:

1. A shift in the locus of control from the large forest companies to the large downstream retailers and distributors (especially the big box retailers and the large office suppliers such as Staples and Office Depot. These companies tend to control the value chain not through ownership and investment but through requirements on the supply chain – specifications, delivery, price. These companies now absorb almost all of the profit in the industry and have forced economies of scale throughout the system.
2. An enormous diversification in the in fibre sources by species, geography, methods of cultivation (fiber plantations) and a large increase in recycling.
3. Concentration of secondary processing and manufacture close to the source of demand, which in many cases is China. This makes raw log and pulp exports all but inevitable.

These changes mean that the only innovations that can enter the industry are those that improve the efficiency of upstream processing. These innovations do not lead to higher profits, profit flows downstream, but keep companies in the game, even if it is a game with declining margins and a very weak strategic positioning. R&D efforts to increase demand are largely superfluous as demand is driven by global economic forces and is channel through China and other major manufacturing centers.

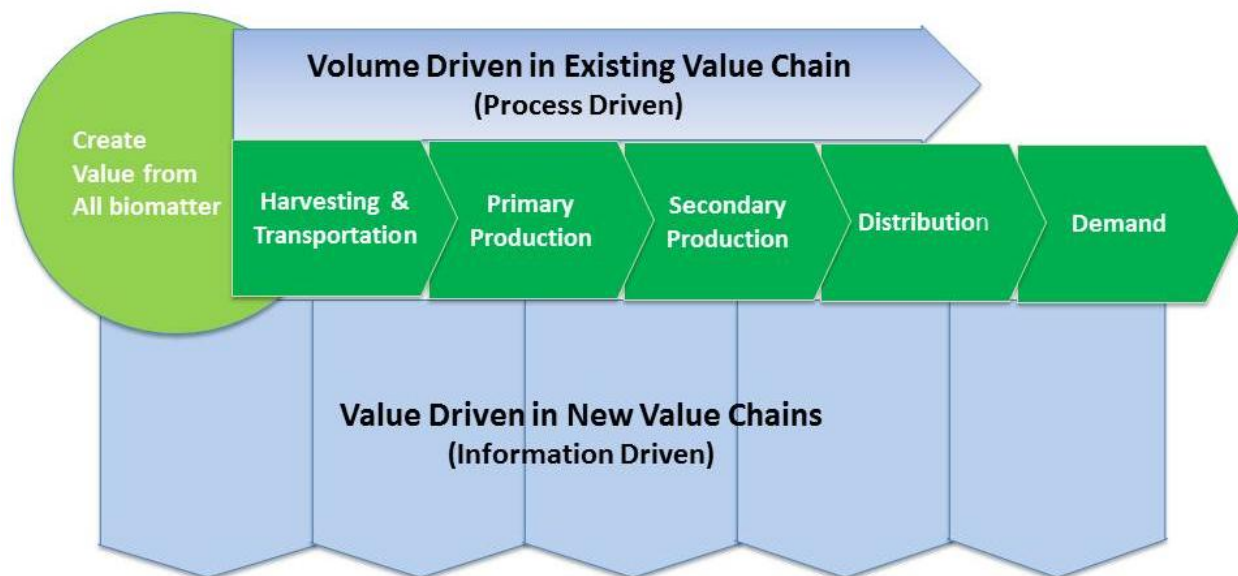


Barriers to Disruptive Innovation

The BC forestry industry has steep barriers to disruptive variation while incremental innovation functions only to keep production going (and not even to maintain overall market share). The key issues are as follows:

- Loss of Control
 - Downstream companies control the value chain
 - Primary producers are owned off-shore
- Single-minded focus on efficiency and volume
- Small number of buyers – limited number of buyers for innovative services
- Down stream profit capture makes it difficult for upstream companies to capture profits and get an ROI
- High Capital Investment Requirements
 - Shortage of capital, need for short-term ROI
- Lack of risk-taking entrepreneurs in industry
 - Operators, not owners or investors
- Innovations are trapped in services companies that are unable to commercialize and scale

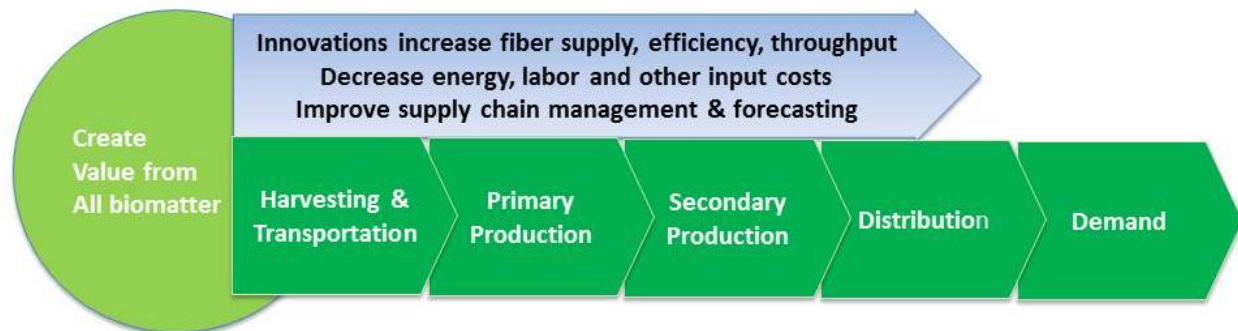
Two Models for Forestry Industry Innovation: Volume Driven and Value Driven



There are two innovation vectors in the forestry industry: volume driven and value driven. Volume driven innovation is continuous in nature and is the only kind of innovation taken seriously by most companies that are actually part of the main value chain. Value driven innovation involves a lateral

move into new industries and new value chains, many of which are not conventionally thought of as part of the forestry industry.

Volume Innovation in the Forestry Industry



Incremental innovation reinforces the existing industry structure

Service providers struggle to productize and scale their own IP

Incremental innovation is critical for an industry that is struggling with increasing global competition, higher environmental and energy costs and severe demands from the downstream companies that dominate the value chain. This is an industry caught in a 'Red-Queen Game' ("You have to run as fast as you can" the Red Queen said "just to stay in the same place, if you want to get anywhere you must run twice as fast as that." Lewis Carol in Alice Through the Looking Glass).

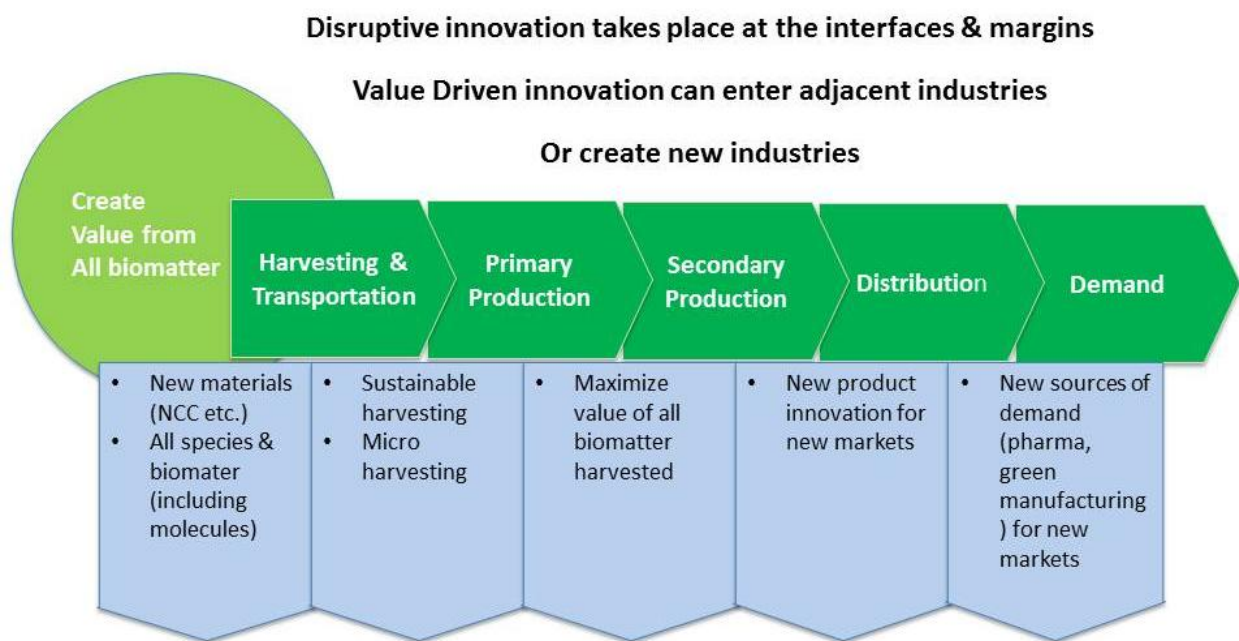
"A Red-Queen Game is a competitive scenario in which every player's success requires her to match or exceed the current efforts or expenditures of rivals, so that each is forced by the others to bid ever higher, and all participants find themselves required, in Lewis Carroll's felicitous phrase, to run as quickly as they can in order to stand still." W.J. Baumol, 'Red-Queen games: arms races, rule of law and market economies' Journal of Evolutionary Economics June 2004, Volume 14, Issue 2, p 238.

Innovations are generally introduced by services companies and once proven in actual operations they may be picked up by the large capital equipment companies and rolled out across the industry (unfortunately none of these companies are based in BC, or even Canada). Mills of all types are engaged in high volume continuous manufacturing and can ill afford shut downs. The risk of failed innovations is much higher in forestry than in most other industries, while margins are thinner and most mill companies are operators rather than investors or major players in the supply chain. This makes innovation difficult even in areas where the need is acknowledged.

❑ Innovation within the value chain (volume-based)

- ▣ New structural materials (laminates, structural cardboards, ...)
- ▣ New architectural systems (high-rise wood frame buildings)
- ▣ Supply chain integration systems for profit optimization (maximize the value of wood being cut over time)
- ▣ Systems for tracking provenance (as part of 'green' standards) and other data integration systems that span the value chain
- ▣ New energy and material conservation and recycling systems

Value Innovation in the Forestry Industry



If the goal is to maximize the value of the biomatter in BC forests a new approach to innovation is needed. This innovation is likely to be disruptive and to occur at the margins between steps in the value chain and in adjacent industries. The innovations may even be in completely new industries. The only way for this to happen is for the new uses of biomatter to create more value (and more opportunities for profit capture) than the traditional lumber, panel and pulp uses. Even then, these new industries will have to compete with the traditional uses for fiber supply and they are likely to begin with much lower volumes.

❑ Innovation across the value chain (value-based)

- ▣ New materials from pulp such as nanocrystalline cellulose (NCC), cellulose filaments (CF), sugars, enzymes, and so on

- ▣ New molecules for pharmaceuticals
- ▣ Fiber as a material for new manufacturing technologies (including additive manufacturing)
- ▣ Extension of forest industry processing technology to new industries and applications
- ▣ New building technologies

Enabling Innovation

- **Innovation within the value chain (volume-based)**
 - ▣ SR&ED subsidies are insufficient as profits are captured downstream
(dedicated commercialization financing may be needed)
 - ▣ Long-term commitments are needed
 - ▣ Mechanisms to support pilot projects are needed
- **Innovation to diversify the value chain (value-based)**
 - ▣ Innovators need access to fiber supply
(small initial volumes – hard to get access)
 - ▣ Value-based innovation will be driven by convergence
(adjacent industries such as cleantech, pharma, energy, next-generation manufacturing are part of the ecology)
 - ▣ An innovation ecology must be built
(research, entrepreneurs, investors, advisors – incubators, mentoring)
 - ▣ A long-term commitment will be needed

Innovation in the BC Mining Sector

Changes in Mining 1980s to Present

1980s	Today
Confidence that resources could be replaced	Resource replacement rate dropping
Limited Number of well understood minerals (Fe, Ni, Au, Ag, Al, Cu, etc.)	Growing demand for rare earths and other exotics
Exploration focused on limited number of geographies	Global exploration in more-and-more remote geographies
Mines remote but connected by rail and other infrastructure	Mines even more remote and difficult to access
Limited ecological and stakeholder requirements	Intense ecological and stakeholder scrutiny
Limited recycling, energy conservation, restoration	Intense pressure for efficient use of water and energy and high standards for reclamation
Long timelines and capital investments	Even longer timelines and larger capital investments
Demand dominated by leading industrial economies	Demand driven by emerging economies which are also becoming an important source of investment
Emerging use of data but little integration	Growing amount of data available, many opportunities to add value

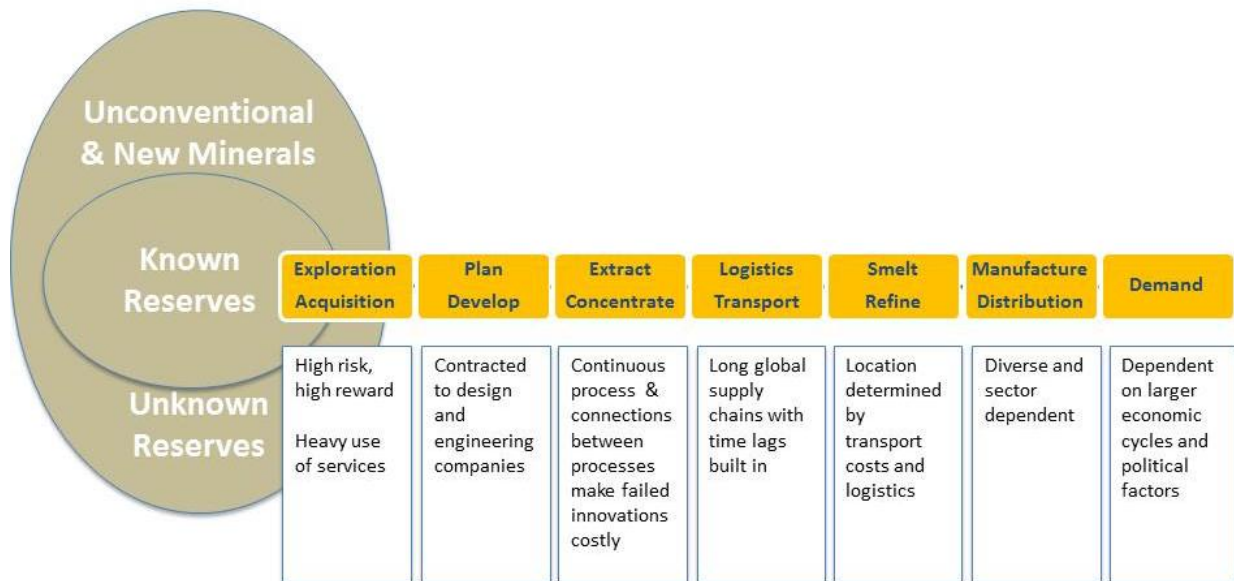
The changes in the mining sector have been less traumatic than those in the forestry industry. Generally speaking, the industry is the same as it was in the 1980s only more diverse, more complex and with more external uncertainty due to the overall changes in the global economy. At some point this continuous incremental change may push the industry to some form of phase shift, but this has not happened so far. The industry is not insulated from general social and economic pressures and it can also leverage some of the same forces that are driving innovation in other areas, especially Big Data.

Two of the most interesting companies uncovered in this project were in the Mining sector. Gemcom Software, which was acquired by Dassault Systems in 2012, shows that technology companies focused in mining can scale and generate attractive exits. MineSense Technologies, a spinout from the University of British Columbia, has an industry-changing sensor technology that dramatically increases that ability to separate mineral and non-mineral bearing ores of different types. The goal is to sort ore at the mine face. Minsense has been in development for more than eight years. It has had SDTC support and recently received an investment from the cleantech VC Chrysalis.

The cloud on the horizon is the overall level of research and development (as opposed to exploration or mine development) is low compared to Canada's major competitor Australia. If this R&D can be

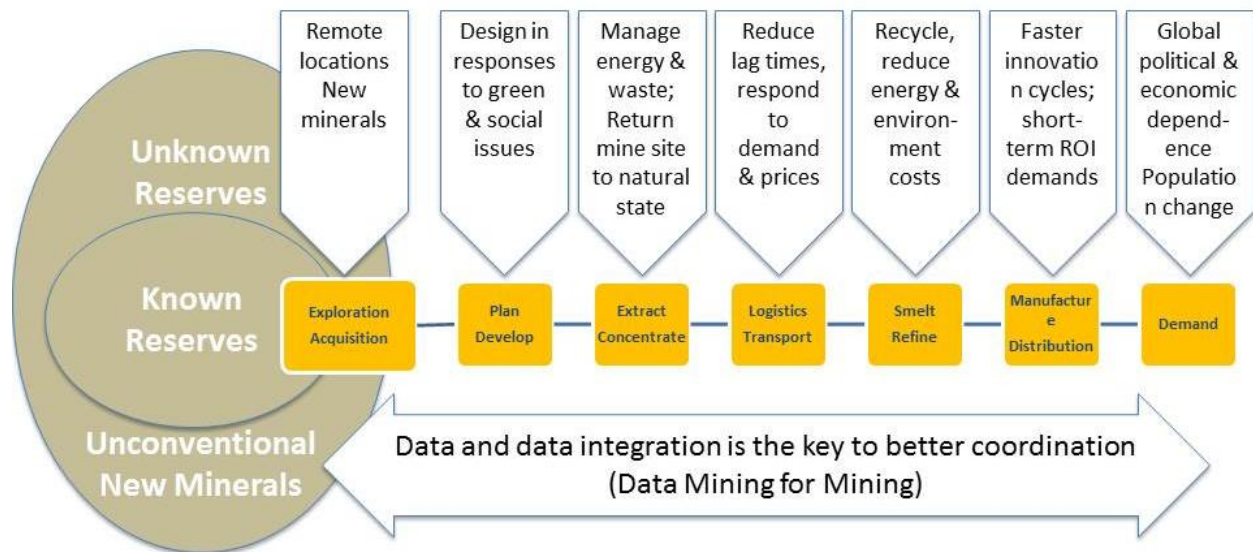
converted into value and used to capture profits then we can expect Australian companies to be more attractive to capital and for them to use this to acquire the most attractive Canadian companies.

The Mining Industry Value Chain



The mining industry is unusual in its value chain in that there is a sharp separation between the companies that carry out exploration, and the speculative risk capital that supports them, and the much larger companies that operate viable mines. The industry does not have the kind of downstream economic integration that characterizes the forestry industry, in part because the uses of its outputs are so diverse and because value creation in manufacturing has shifted to marketing, design and supply chain management – information centric business activities. At the same time, mining does not, in general, deliver the same level of sustained profit as the energy sector and it is more sensitive to economic cycles, making it more difficult to establish predictable (and investable) models for the diffusion of innovation.

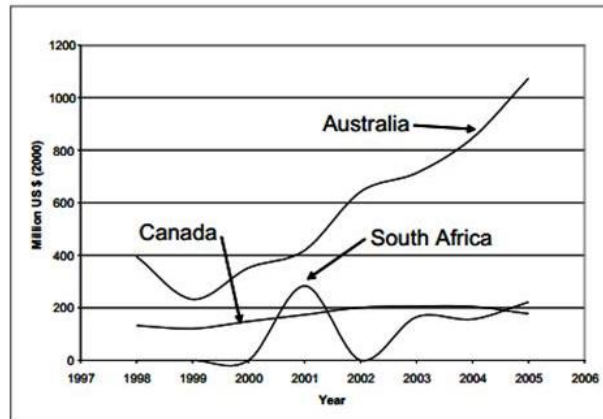
Change Drivers for the Mining Sector



The mining industry is changing rapidly as it responds to external pressures and new opportunities. These pressures range from environmental (green) and social pressures, to higher energy costs, and volatile commodity prices. At the same time there is growing demand for more and more different minerals, especially the rare earths used in many advanced technologies. The fast innovation cycles common in high-technology are increasing demands on the mining sector, which needs to become more responsive and able to profit from shorter opportunity cycles.

Part of the solution will be in better collection, distribution and analysis of data. There are many emerging opportunities for big data in the mining value chain and this is one area where BC companies have an opportunity to innovate.

Canada Falling Behind Australia in R&D Investment



Source: OECD, Main Science and Technology Indicators Database (Paris, 2008).
Note: The OECD data set used to construct this graph includes: R&D expenditures related to exploration and extraction in the mining and oil and gas sectors, and specifically includes the mining of coal and lignite; extraction of peat; extraction of crude petroleum and natural gas (including oil sands); service activities incidental to oil and gas extraction, excluding surveying; mining of uranium and thorium ores; and mining of metal ores and other mining and quarrying. The data refer to domestic R&D expenditures by resident companies. R&D expenditures of resident companies abroad are not included. For methodological and definitional reasons, the OECD data set is not directly comparable with R&D expenditures reported by national statistical agencies, including Statistics Canada. Based on Statistics Canada data, Canadian business expenditures on R&D in the minerals and metals sector (all four stages, but excluding oil and gas extraction) grew in nominal terms from \$396 million in 2001 to \$504 million in 2005. See *Facts and Figures, a Report on the State of the Mining Industry in Canada* (The Mining Association of Canada, 2007) available at www.mining.ca.

Canada is not making the investments needed to remain competitive as a world leader in mining. We have not investigated the reasons for this, but the outcome can be predicted. If this trend continues Canadian mining companies will lose their competitive edge and will be bought by companies that have made sustained investments in R&D.

Diffusion of Innovation via Services

The forestry, mining and energy sectors tend to introduce new innovations through services and services companies. This is very different from the approach taken in the IT sector and the life sciences sector, though it may become more common in the future even in these industries.

Innovation presently resides in services for several reasons:

- ☐ Fits the sector's cost accounting model (allocations between capital investment, operating capital and operating costs)
- ☐ Long innovation cycles with huge capital investment requirements make it difficult to productize innovation
- ☐ High maintenance spending leaves money for services
- ☐ Risk investors in this sector are focused on finding and building mines, not investing in innovation
- ☐ Investors do not like service industries- cycle is too slow and long (conventional VCs need to see liquidity in ten years), opportunities to scale are limited

Barriers to Innovation in the Mining Sector

Financing & Investment

- ☐ Large capital investment requirement
- ☐ Cost accounting models that push innovation into services
- ☐ Siloed cost management models do not favour innovations that make the entire value-chain more efficient (this is a big difference from forestry)
- ☐ Risk investors are focused on exploration and not innovation

Value-Chain Structure

- ☐ Equipment used for years
- ☐ High maintenance costs
- ☐ Pace of innovation is slow in the middle of the value chain, fast at the ends
- ☐ Weak network effects, most companies compete, do not share or integrate
- ☐ To survive innovators are service companies (and are not attractive to conventional innovation capital)

Enabling Innovation in the Mining Industry

Financing & Investment

- ☐ Long-term commitment to R&D required (must come from government and universities)
- ☐ Services model makes it difficult to finance pilot projects, a mechanism for financing pilot projects is needed

Value-Chain Structure

- ☐ Government and universities should provide large sets of open-source data and encourage innovative services based on this data (a culture of data sharing should be encouraged)
- ☐ Service companies should be incented to invest in
 - ☒ Building new services based on innovation
 - ☒ Controlling their intellectual property
 - ☒ Using technology to scale services offerings

Emerging Opportunities for Innovation in the Mining Sector

- ☐ **Exploration**
 - ☐ Improvements in data gathering and modeling including new approaches to mining big data
- ☐ **Planning**
 - ☐ Environmental and social services as part of mine planning and operation
 - ☐ Integration of long-term data gathering and analysis into planning
- ☐ **Operations**
 - ☐ Ongoing improvements to efficiency of operations
 - ☐ Multi-mineral mining
 - ☐ Cradle-to-cradle processing (water, energy, waste)
 - ☐ Mine site restoration
- ☐ **Manufacture and Distribution**
 - ☐ Data integration across the supply chain
 - ☐ Support for Just-in-Time design and manufacture
- ☐ **Demand**
 - ☐ New metals and minerals (including rare earths)
- ☐ **Industry Structure**
 - ☐ Learn from oil & gas industry services giants
 - ☐ Data integration across value chain
 - ☐ Application of mining technologies to other sectors

Recommendations for the Mining Sector

- ☐ Targeted SRED/IRAP program for mining innovation (like flow through tax incentives for exploration) or SDTC style pilot project support
- ☐ Create Commercialization Centre of Excellence for innovation in Mining - exploration & development, mine/mill processes
- ☐ Adopt CRCM/AMIRA model of public/private projects to improve mining (CANMET used to do this)
- ☐ Create an open data project to support the sharing and commercialization of mining data

Innovation in the BC Oil & Gas Sector

Changes in Oil & Gas 1980s to Present

1980s	Present
Many new fields to explore	Most conventional resources have been discovered
Easy to replace supply	More difficult and expensive to replace supply
Low barriers to infrastructure construction	High environmental and social barriers to infrastructure construction in developed world
Few powerful stakeholders (states & oil companies)	Many stakeholders and interventionists (NGOs, indigenous peoples, political parties)
Stable (planned) pricing	More volatile prices, long-term gains
Crude was the standard	Many types of crude + LNG, shale gas, and other forms of energy
Simple markets	Advanced markets with hedge funds, commodity traders, options, futures
Little data integration	Increasing data integration and exponentially more data
High capital investment	Even higher capital investment
Moderate pace of innovation	Accelerating pace of innovation

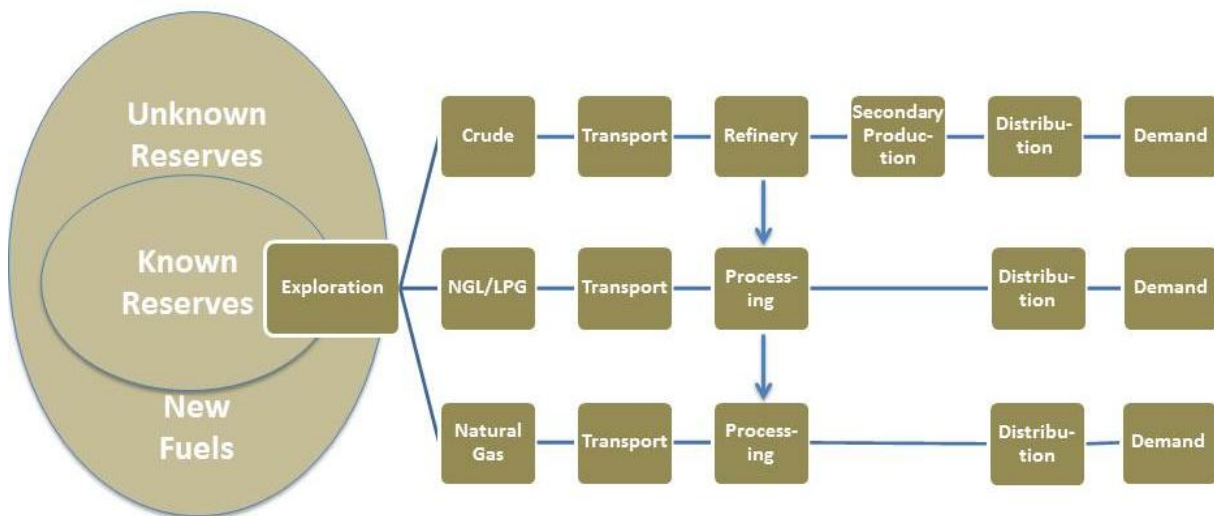
The oil & gas sector has entered a period of rapid change, driven by the depletion of conventional resources and their replacement by new forms of energy. In the oil & gas sector, this includes gas from hydraulic fracturing (often known as fracing) which is supporting rapidly growing supplies of and demand for liquefied natural gas (LNG), coal conversion and heavy oils from alternative sources such as the oil sands. At the same time, the sector is under intense scrutiny because of social change and greater awareness of environmental costs. Costs that could be externalized are now being forced back into the industry value chain creating many opportunities for innovation. As with the other sectors, demand is becoming more diversified and moving to the growth economies of Asia and Latin America (primarily Brazil). The growing information intensity of the advanced economies (including large sections of the Chinese and Indian economies) is reducing unit consumption of energy per GDP, but the information industry with its large data centers is becoming a large consumer of energy in its own right.

Diffusion of innovation through services works much better in oil & gas than in other sectors. This is in part because margins are higher and the industry is well organized, allowing very large and profitable services companies to emerge. These companies (such as Schlumberger and Halliburton) are large enough to carry out R&D and to make innovation-driven acquisitions.

British Columbia is not well positioned to take advantage of these trends as the local oil & gas sector is small, it has not invested in advanced technology for the coal industry, and it has allowed its refinery capacity to age. As a result there is little BC-based innovation in this sector.

This could change with investments in the export of liquefied natural gas and the expansion of pipeline capacity. There are also opportunities to use BC as a base for training the sectors workforce.

The Oil & Gas Value Chain



The oil & gas industry is developing a processing structure similar to forestry, and for similar reasons. Refinery and advanced applications are migrating closer to the sources of demand with most new refinery capacity (and generation capacity) located in Asia. There is a great deal of innovation in all steps of the value chain, including disruptive innovations at the interfaces and the borders. These innovations are not limited to oil & gas but include coal and other alternative hydrocarbons, as well as new energy sources. The distribution system is also the site of a great deal of innovation.

Sector Characteristics

Sophisticated Market

- ☐ Highly fungible market, both in terms of products and partners
- ☐ Long-term contracts the normal basis for business

Long-Supply Chain

- ☐ Large quantities of products managed on a global basis
- ☐ Typically long lead times for transportation
- ☐ Subject to disruption by external events (political and natural) leading to volatile spot market

Large and Very Profitable Companies

- ☐ Major companies are among the world's largest and most valuable
- ☐ High rate of M&A and asset exchange
- ☐ Very large and successful services companies

Workforce

- ☐ Highly skilled, in high demand, global labour shortages, high turnover

Innovation via Services

Oil & Gas is an example of a successful sector where services are a viable path for the diffusion of innovation. Other sectors would do well to learn from this, but the key is really the overall level of profitability in the sector and the power of the players, which will make it difficult for other sectors to replicate the full scale of success.

- ☐ Profitable operating companies can afford valuable services
- ☐ Services based (innovations are captured into services)
 - ☒ core to the business model
 - ☒ part of the risk management structure in the industry
- ☐ Highly profitable, able to support large firms and attract investment
- ☐ Supports the accelerating pace of innovation
- ☐ Growing use of information technology, sophisticated models, remote sensing – data driven
- ☐ Need to respond to rapid changes in markets and demands
- ☐ Highly competitive market forces services companies to innovate in order to win contracts

Barriers to Innovation in the BC Oil & Gas Sector

- ☐ Lack of a local industry makes it difficult to build services firms (services are located near industry centers such as Alberta)
- ☐ Shale gas extraction (fracing) is relatively new to BC
 - ☐ based on technologies developed elsewhere
 - ☐ Services are provided by Alberta companies which are experienced and have good market access (services travel east –west in Northern BC)
- ☐ Pipeline Industry is Immature in BC and Technology is Owned Elsewhere

Enabling Innovation in British Columbia

- ☐ Focus on areas where BC has a competitive advantage
 - ☐ Data acquisition and analysis, including GIS and BI
 - ☐ Human resource development and training
- ☐ Focus on areas where there is an emerging local industry
 - ☐ LNG
 - ☐ Pipeline construction and operation

Emerging Opportunities for Innovation in British Columbia

Leverage Existing Strengths

- ☐ Data acquisition and analysis within and across the value chain
- ☐ Human resources development and training

Address Emerging Needs and Demands

- ☐ Technology for oil spill prevention, cleanup and land reclamation
- ☐ Pipeline monitoring and maintenance

Look for Synergies

- ☐ New materials from petrochemicals, especially in hybrids with other new materials from forestry



About Rocket Builders:

Rocket Builders is a consulting group focused on helping technology companies identify and capitalize on market opportunities. Based on past success in driving the growth of technology companies, Rocket Builders are experts in market research and strategic planning and helps companies in building revenue through proven sales methodologies, building market capabilities through partnering programs, and building processes that lead to winning products. For more information, visit <http://www.rocketbuilders.com>.

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