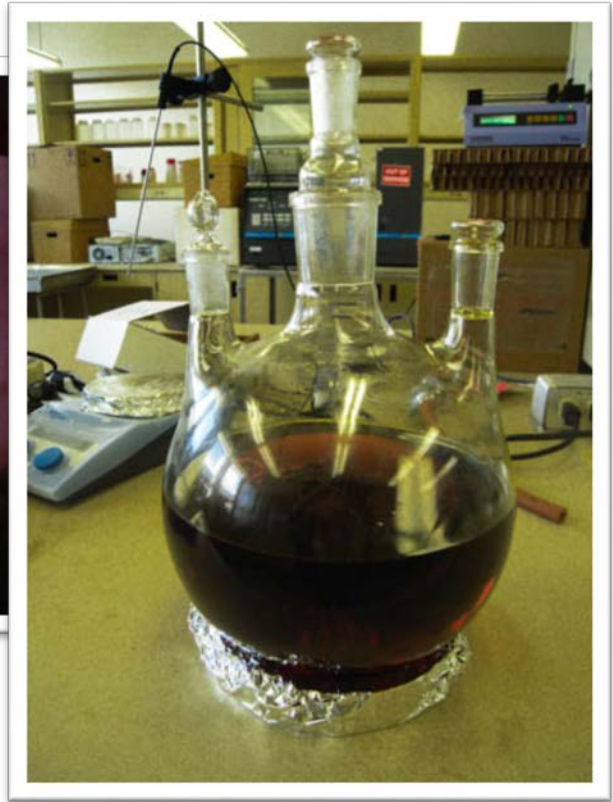
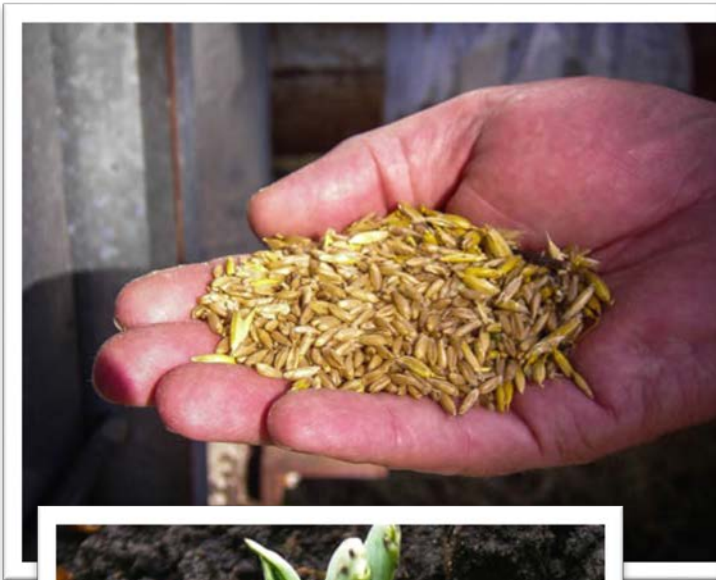


Grown in Alberta. Made in Alberta.

How value-added innovation can boost the value of our crops, create new jobs, stimulate local businesses, diversify the economy and benefit the environment.

A special report by the *Alberta Crop Industry Development Fund*



Introduction

Alberta grows an abundance of healthy, safe, high-yielding crops.

Today, 80% of those crops go to market in a truck, a train or the hull of a ship. Our raw, unprocessed crops are sold for the price the commodity market will pay, to buyers around the world.

Months later, we'll buy our own crops back at a much higher price. This occurs when we buy the finished products and ingredients made by others from Alberta-grown crops.

Why can't we process more of what we grow?

We can, and we are. Today, farmers, agribusinesses, market specialists and others are increasingly challenging the old way of thinking. They're planning and investing in facilities that will buy crops from farmers, make value-added products and ingredients, and sell these to buyers around the world. They're adding critical mass to a group of successful value-added companies already in place.

What happens when we add value to Alberta-grown crops?

Farmers have more secure markets and the potential of higher returns.

Processors buy equipment, employ people and produce high-value products.

Communities are energized by new economic activity.

The environment is safeguarded, by processing our crops here, not shipping bulk crops overseas and adding associated carbon.

Finally, Alberta's *economy* grows and diversifies.

What will it take to grow value-added processing of Alberta-grown crops? Above all, *Research and Development*.

By investing in R&D, Alberta can determine what the world wants to buy and will pay a premium for. By being focused, we can concentrate on the most likely and highest-value opportunities. By working together as a value chain, we can bring greater efficiency and maximize economic returns.

In this special report, the Alberta Crop Industry Development Fund speaks with 10 industry participants and asks for their best ideas on how to increase value-added processing of Alberta-grown crops. These discussions are presented in the next 10 pages of this report.

Despite operating in different areas of value-added, there was much consensus to their views. We've gathered their key ideas into five actionable recommendations for your consideration. You'll find those recommendations on page ___.

Welcome to the future of value-added in Alberta. Let's get busy.

The case for value-added for Alberta

As Darren Walkey explains, it all starts with the seed.

“Whether it's from a cereal crop, a pulse crop or oilseed, the seed has a value, and you can sell it in that form,” says Walkey, Business Director of the University of Alberta's Cereal Protein and Cellulose Program. “In fact most of the crops grown in Alberta are sold in exactly this way. However, you can also process the crop, and separate-out its protein, starch, oil and fiber and other fractions, each having its own economic value.”

Secondary or tertiary levels of processing could involve making these fractions into highly specialized nutraceuticals, cosmetics, building materials or other products.

While the raw crop is relatively easy to sell, it won't sell for more than the world price for that commodity at that time. Products made from crop fractions sell for far more and are less subject to the volatility of world commodity markets.

What happens when less raw crop is exported and more is processed here in Alberta? Capital investment occurs and employment is created. There's also a clear environmental benefit.

“If you start using and processing more crop at home, this reduces the carbon footprint associated with this activity,” Walkey says. “You don't have the transportation and logistics of a raw crop to go to Asia or the U.S., for example, to be processed there and then come back here as the finished product. So value-added is good for economic development and it's good for reducing carbon.”

What kind of value-added makes the most sense for Alberta? There are some extremely high-value applications in pharmaceuticals and nutraceuticals, but these use very little crop in terms of volume. Walkey favors first-level processing that's focused on extracting significant volumes of high-value proteins, starch, oil and fiber. It should be a crop where farmers have a number of market options, depending on the grade and quality they end up with.

Food companies in the world's top-performing value-added jurisdictions – such as Holland and Denmark – typically devote a high percentage of their revenue to research. If Alberta wants to compete in this space, a significant commitment to value-added R&D will be required. As Darren Walkey sees it, targeted research can help Alberta capitalize on the value-added opportunity.

“Research will play a key role providing innovation and new technology,” he says. “Research needs to be connected to companies; therefore academic research needs to be delivered in a way that companies can use it.”

Market push value-added doesn't work. Make it a market pull.

Over the past 40 years, value-added has been a regular topic in the agriculture industry of Western Canada. Art Froehlich should know. As a prominent agribusiness and communications executive throughout this period, he's been a strong advocate for more processing all along.

Still, if everyone agrees that more value-added is a good idea, why does Alberta still sell the vast majority of its crops in unprocessed, undifferentiated form?

Froehlich believes our traditional approach to value-added is to blame. Quite simply, we've been doing it wrong.

“I get very frustrated at the approach that we take in Western Canada, which is to try and find a market for something we grow,” he says. “Value-added only works when you find something the market wants and then determine a way to provide it.”

Ask *not* what else we can do with our cereals, oilseeds and pulses. Ask *rather* what buyers want, and figure out how to give it to them.

Froehlich advocates greater emphasis on market research, even if that means less money for more primary, discovery-focused crop research. In his analysis, pulses are seeing strong global demand for protein and other components. Hemp will continue to attract acres and investors. These crops will provide Alberta some of its best opportunities.

Froehlich notes that many farmers are unconvinced that value-added will increase their returns. The way to make the case is by pointing to the growth of the canola crushing industry and how this development opened markets and boosted incomes for growers. Alberta’s feedlot industry is another piece of evidence showing that value-added, done right, can benefit everyone.

After 40 years working in and talking about value-added, Art Froehlich is optimistic about the opportunity but certain that our old market-push approach won’t work.

“I am keenly interested in value-added in Western Canada and I’m convinced we can do it,” says Froehlich. “If we knew the market was looking for a certain protein isolate, for example, we could develop it. But we have got to be focused, we must know what we are doing and we have to start turning our thinking on its head.”

Innovation is key to value-added opportunity

Does agriculture in Alberta spent too much time thinking about its storied past, and not enough time planning an even better future?

Lori Ell sometimes think so. The long-time agribusiness and processing executive believes that Alberta clings to a narrative about being the breadbasket of the world.

“I think we need to spend more time on what we’ll be doing in the 2040s,” says Ell, “not what we did in the 1940s.”

Rather than embracing a mission of feeding the world, she thinks we might be better off figuring out how farmers, processors and retailers can make money.

“In Alberta, 70% of the retail price of food is based on transportation, storage and handling,” says Ell. “That’s a challenge for us, because all retailers are putting pressure on the supply chain. The supply chain has to come in and provide food that the retailer can make money on.”

What role can value-added play? She explains that if we produced more food closer to home, that 70% figure could come *way* down and everyone could share in the gain.

In Ell’s view, Alberta’s value-added aspiration must look far beyond simply crushing oilseeds and milling cereals. It will take innovation to find new ways to serve the value chain with products that might not even exist today. She points to companies creating innovation in areas such as plant-based meat alternatives and 3-D-printed leather substitutes.

“We have to know where the trends are heading,” she says. “This is not the value-added of 10 or 15 years ago. We need to move beyond that superficial level of value-added.”

If Alberta and Western Canada can do this, there's no reason that the crop production pie can't grow and benefit everyone.

“I think we have a huge opportunity here in Canada,” Ell says, “with the way we work, our sense of social responsibility, and our safe borders. It all adds up to be an opportunity to serve the world by innovating new technologies. The industry is ripe for technology and disruption.”

Today's food revolution is fueled by R&D

Walking through the aisles of your local grocery store, things might look much as they always have. Don't be fooled. As Dennis McKnight points out, there's a revolution going on. Food manufacturers are making fundamental changes to what goes in the food you eat.

“The big change you see is that companies are switching away from chemicals and additives to use more natural, plant-based ingredients,” says McKnight, Vancouver-based President of The Innovators and long-time consultant to Alberta's agriculture and food industry. “There's also a trend to replace meat and dairy-based products with more plant-based alternatives. Even Chef Boyardee has gone all-natural, just look at the ingredients on the label.”

To McKnight, if Alberta wants to be a value-added player in the future, this revolution in food ingredients is the place we want to be.

You might think that multinational food companies from large nations like the U.S. would be leading the pack. In fact, a small European country is punching far above its weight in this space.

“Denmark has about 15% of the world market in value-added food ingredients,” says McKnight. “The three leading companies are all former dairy cooperatives that have become food ingredient businesses.”

The Denmark model is based on an unrelenting focus on innovation and product development. It costs a lot and they spend a lot. While large multinational food companies normally spend 1% of sales on R&D, these ambitious Danish innovators spend up to 14% on R&D.

If Alberta wants to increase its value-added use of crops, innovation is a must and well-funded R&D makes it possible.

McKnight is one of the people behind the Alberta Food Cluster & Global Plant Protein Network. This group, with the help of ACIDF funding, aims to grow value-added by doing many of the things that Denmark does so well. This includes close collaboration between industry and academia and an increased focus on targeted research investment.

If we do this, there's every reason to believe that Alberta can increase its value-added and reap the rewards.

“This is a real opportunity for the Prairies, and not just for big companies,” says McKnight. “There will be great opportunities for local companies as well in processing facilities that will be built right here to have easy access to crops.”

Pulse grower sees gains from more processing

How will more value-added crop processing benefit farmers? It's a fair question. After all, if producers receive the same price for their cereals, oilseeds and pulses as *before*, are they really further ahead?

Sylvan Lake, Alta. farmer Allison Ammeter, President of the Alberta Pulse Growers Commission, is convinced that more processing will ultimately allow farmers to earn more. Prairie farmers' experience with canola over the past 30 years suggests why.

"We could just ship all our canola seed to China," says Ammeter. "But, by developing crushing capacity here, we get all those jobs associated with processing, packaging, sales and quality control. As you have more demand, there's more reason to grow it when it's less subject to global markets. And we'll ultimately see an increase in price."

She notes that Alberta currently exports up to 90% of its pulse crops to overseas markets. Imagine if we processed even 30% of our pulse crops here, and exported pea protein, starches and fiber fractions instead. There would be a huge impact on jobs, on the economy and on reducing agriculture's carbon footprint. Instead of shipping raw crops to Asia, and importing finished goods, we can keep that activity here and save the carbon load.

Ammeter maintains that R&D will be important to the effort of increasing value-added for pulses. She calls for more nutritional research to make clear the health benefits of protein starches and fibers from pulses, as opposed to the raw crop. She believes plant breeding will find, for example, new varieties of faba bean with a smoother shape that is more amenable to fractionation. Finally, she'd like to see more consumer studies relating to pulses.

"Once farmers grow higher-value pulses, they'll be able to earn a premium, as with Nexera canola or malt barley," says Ammeter. "I see lots of wins for producers in this, and it will also increase investment and create jobs."

R&D-driven processing improvements can give Alberta an edge

Alberta grows abundant, healthy crops. The world wants safe, high-quality ingredients.

Greg Fisher is one of the Albertans turning crops into ingredients. An engineer with Calgary-based Jadler Industries, he's an expert in the many and diverse processes involved in food manufacturing.

Fisher's been a key figure in the procurement and engineering of equipment for the seven-suite Agrivalue Incubator at the Food Processing Development Centre in Leduc. Jointly supported by ACIDF and Western Economic Diversification Canada funding, it's set to open its doors this spring.

As he considers Alberta's value-added future, Fisher believes that R&D isn't just needed for crops and market development. He'd like to see more focus on the challenging technical areas of processing.

"Most value-added processes are wet processes," he says. "We add water to field crop derivatives. There are advantages to wet processes, but the downside is that the products tend to have a short shelf life and can be inefficient to transport. We need to find better methods of drying."

Crop producers think a lot about yield. So does Fisher. In his work, yield refers to the ability of a process to deliver maximum output, consistent with technical requirements. Even small efficiency gains, determined through R&D, will add to Alberta's competitive advantage in value-added.

One reason why Fisher likes value-added is that its benefits are available to anyone with value to add, not just the big players. "It could be almost any size of company," he says. "A modest investment in equipment and even a half-dozen employees could be feasible."

Crop-based value-added will allow Alberta to reduce its dependency on petroleum extraction. Ironically, reduced oilpatch staffing will play a role. People with strong technical and scientific backgrounds are becoming available. Greg Fisher says, bring them on. With a heavy value-added workload in 2017, he could use the help.

"I think Alberta is well-situated to do more value-added," he says. "We have a lot of good people in engineering, science and technology and they can contribute to the area of field crop-based wet fractionation processing."

Alberta's next oil industry emerges

Over the past few years, many Albertans have been asking when the province will reduce its dependence on oil. To Jonathan Curtis, oil's not the issue. *Petroleum* is.

Curtis, Professor of Analytical Chemistry at the University of Alberta, is taking Alberta's oilseed crops in a bold new value-added direction. He's using oil from canola and other crops to make polyols used in foams and coatings for a variety of industrial applications. When bio-based products crack these markets, they'll largely displace petroleum-based products, performing the same function with far less environmental impact.

"I think it's complementary to producing oil for food," says Curtis. "There are plenty of opportunities for using non-food grades of canola and other crops. Camelina, for example, can be grown on more marginal lands and the oil has many possible applications."

On a recent day, Curtis was preparing to install the final pieces of a ACIDF-funded pilot plant equipment suite. Before this equipment arrived, he was restricted to making bio-based chemicals only 5 kg to 10 kg at a time. Now he can make up to 100 kg of product at one time.

Now that Curtis has a more capable suite of equipment, he plans to intensify his development work. He's now working on what he calls a third-generation polyol. This is a very flexible chemistry that can be used to make multiple products. This technology could be the basis for commercial-scale oleochemical plants that could ultimately be built in Alberta.

That's down the road a bit, however. Today, Curtis is working with several corporate partners who see potential in bio-based products. One company is focused on bio-based urethane spray foam insulation.

"Commercial development is just as complicated as the science and requires people with different skill sets," says Curtis. "I feel optimistic today that we are getting to a point where, technically, there isn't a barrier. The question now is, can we get the commercial and regulatory side in order? It's up to us to be innovative."

In building materials, Alberta-grown hemp fibers reinforce better

The food manufacturing industry isn't the only part of the economy that's starting to favor natural over synthetic. According to Mike Pildysh, the very same thing is happening in building materials.

“In general, the building materials industry has long been preoccupied with synthetic materials,” says Pildysh, owner of Calgary-based Canadian Greenfield Technologies. “These very often came from other industries and were used in spite of their overall poor performance. Concrete is normally reinforced with what's basically fishing line that originated in the carpet industry.”

Pildysh and his company spent the last five years developing concrete reinforced with hemp fibers. This built on knowledge from two previous R&D efforts backed by ACIDF funding. As Pildysh explains, concrete reinforced with natural fibers such as hemp is more durable, stronger and has better tensile strength than with synthetic fibers.

In January 2017, he took his product to Las Vegas to exhibit it at Concrete World, the largest tradeshow of its kind. Over the course of just a couple of days, Pildysh received 150 requests for samples of his hemp fiber-reinforced concrete. A Japanese company is particularly enthusiastic.

All this tells Pildysh that five hard years of R&D, engineering and product development is about to pay off. It's not just his own company he's speaking of, but rather the opportunity that is available to Alberta.

Pildysh calls for greater research focus and funding on the use of Alberta-grown natural fibers to reinforce substances such as concrete, asphalt, plastic and car components. The opportunity is real, the potential market is huge and Alberta's chance of success is significant.

“Reinforcing with natural fibers rather than synthetic materials is about going back to basics with the very best of 21st-century engineering,” says Pildysh. “Alberta is well-positioned to become a go-to place in the world for industrial hemp for these applications. We have the climate, the land, skilled farmers and quality-oriented people. And, we are close to the U.S., the largest building material market in the world.”

This value-added crop-based business is thriving

Alberta needs more businesses like W.A. Grain and Pulse Solutions. A *lot* more.

Founded in 2007 by Chris and Tracey Chivilo, the company buys crops (mainly pulses) from Alberta farmers, processes them into value-added products and sells them to customers around the world.

As Chris Chivilo explains, the idea for the company was based on asking why Alberta ships so much of its crop production overseas, unprocessed, only to buy it back at a premium in processed form.

“I just thought we needed to change the focus from exporting raw commodities to doing more further processing,” he says. “We de-hull and split peas, lentils and faba beans and grind them into flour and other products.”

After a rare down-year in 2016, Chivilo sees revenue increasing by about 20% in 2017. That projection is based on strong demand for plant-based protein in a variety of markets.

“I think the markets are there,” he says. “The problem for these companies is finding the products they need. They are looking for protein and there is not enough protein to keep them busy. I think it's going to be like that for the next 10 years.”

As W.A. Grain and Pulse Solutions expanded over the past decade, it outgrew its core facility in Innisfail, leading it to purchase facilities in Bowden and Bashaw, as well as in Saskatchewan. At the Innisfail site, Chivilo is planning to build a 50,000-tonne pet food facility, with a similar capacity added on for other value-added products.

Nor is value-added simply a pulse-related story in Alberta. Chivilo thinks there's a long way to go with other crops as well.

"I'd like to see further processing down the line, such as using canola meal in new ways," he says. "We can also grow canola to replace oil-based plastics. And the growth of craft brewing has malt barley going in new directions."

Surging global demand for plant-based protein is likely to keep Chris Chivilo busy for years to come. Still, he believes the upside would be even greater if Canada and Alberta were more focused on capturing these opportunities. He advocates increased spending on value-added-related research. This, combined with the province's abundance of human talent, will be critical to increasing value-added in the coming years.

"I've seen a shift in mindset around value-added in the last couple of years," says Chivilo. "We have a lot of entrepreneurs in Alberta and some very intelligent people coming into this space."

Five habits of a 21st-century value-added food company

We've discussed opportunities for Alberta's crop production sector by increasing its value-added component. We've explored a variety of barriers that could prevent this from happening. We've highlighted how research and development can give Alberta companies a greater spark of creativity and innovation.

As Darrell Toma considers the future of value-added in Alberta, he's cautiously optimistic. A veteran agribusiness management consultant, he's studied the issue of value-added from all angles over the past three decades.

He sees five characteristics that a sustainable, successful Alberta-based value-added company will want to have.

1. **An orientation toward Asia.** Toma believes that Asia is the best market opportunity Alberta has. The market is growing, consumers are increasingly affluent and Canada already has an advantage that many countries might envy. "They look at Canada," Toma says, "as a high-quality, safe food producer."
2. **Not too big, not too small.** A big multinational food company will have deep pockets but it can lack the operational nimbleness to go after emerging opportunities. As Toma sees it, many smaller and medium-sized companies, perhaps with as few as 50 employees, could be the right size to win at value-added. "You can have a small enterprise come along that becomes a real world-beater," says Toma.
3. **Processes, patents and logistics.** These may not be the sexiest topics in the value-added space, but these nuts and bolts operational issues are where the money is made. The ability to plug into global supply chains and master them will separate winners from also-rans.
4. **Foreign market knowledge.** Toma points out that it's difficult for an Alberta company to truly understand what a foreign market wants. He likes the model, now being seen occasionally, where a foreign company buys or joint-ventures with a Western Canadian

company. The foreign partner knows their home market intimately so the Canadian partner or management can focus on production.

5. **Close-to-market R&D.** To Toma, understanding the needs of overseas markets demands a reshuffling of our research priorities. “We need a different business model put together to make all these things work,” he says. “There's very little effort spent on market interface and market testing. But, the more near-market activities we do, the better off Alberta will be.”

Summary

Building a value-added innovation action plan for Alberta

Discussions with our 10 influencers yielded many powerful ideas for how Alberta can increase its value-added use of crops. Here are five key takeaways.

Adopt a market-pull strategy. For decades, we've tried to grow value-added by masterminding new uses for Alberta crops, then seeking out buyers who want these products. This hasn't worked well enough. Instead, let's approach it from the global market point of view and determine how Alberta can best serve it.

More R&D. Market leaders like Denmark and Holland spend 14% of revenue on research and development. In North America, companies spend 1%. We can't win this way. Alberta needs more R&D to support innovation and efficiency in value-added.

More *near-market* R&D. Invest to understand what global buyers want and are willing to pay for. Invest to make value-added crop processing more efficient and profitable. Invest to make our crops better-suited to what the market wants.

Think far down the road. The value-added products of today will be supplanted by better-performing products in the years to come. Alberta must build its value-added based not on where the market is today, but where it's going.

Start now. The stakeholders quoted in this report agreed: dynamic global markets aren't sitting around while Alberta decides on a strategy. The market is changing and growing. The opportunities are huge, the obstacles are addressable. Let's get after it.

Value-added, innovation and ACIDF

A key theme of this special report is the need for Alberta to create new knowledge in areas such as market understanding, product development, value-added processing and crop improvement.

Since 2001, the Alberta Crop Industry Development Fund (ACIDF) has selected and successfully managed research projects across this spectrum. This includes 40 successful projects in the area of processing automation alone.

As Alberta's crop industry looks to its value-added future, ACIDF is ready to lead.

We look forward to your comments.