Canadian Beef Improvement Network (CBIN) – Strategy Document.

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1 Summary

The concept of a Canadian Beef Improvement Network (CBIN) *to provide the analysis and information tools required to deliver optimal contributions from genetic improvement to the Canadian beef industry in a consolidated and efficient manner* has been explored. It has been established that CBIN is both needed and feasible. A series of steps to establish CBIN have been indentified and these include:

- Establishing an interim structure comprising a five person Board and a full time Chief Executive. The mission of CBIN being ***to ensure optimal genetic improvement for the long term sustainability of the Canadian beef herd.***
- Establishing an interim funding arrangement comprising, initially a mix of Government (Federal & Provincial) and industry funding, and growing services fees as CBIN develops valuable information services.
- Building a continuous improvement culture to facilitate the orderly development of a greatly enhanced genetic and information infrastructure for Canadian beef cattle genetic improvement.
- Developing a genetic improvement infrastructure comprising three main elements – breeding objectives, genetic evaluation and breeding scheme design.
- Building an integrated information infrastucture to support genetic improvement over a period of time by building on the information systems currently employed in the beef industry.
- Giving priority to effective communication with the stakeholders in beef cattle genetic improvement.
- Establishing an innovation network in partnership with Canadian research, extension and eduction institutions to enable CBIN to exploit developments in knowledge and technology to the benefit of Canadian beef producers.

A set of nineteen recommendations have been provided as the basis for the key strategic decisions which need to be made for CBIN to become established and to deliver on its mission.

2 Recommendations

The recommendations in this document are repeated here under six headings. This way of grouping the recommendations highlights the crucial elements required for a succesful CBIN and emphasize that CBIN is a new beginning for Canadian beef cattle breeding.

2.1 Create an Interim CBIN

1. Establish an interim CBIN structure.
2. Interim CBIN structure to comprise a Board of some five cattle industry leaders and a full time Chief Executive.
3. The mission of CBIN is to ensure optimal genetic improvement of the Canadian beef herd.
4. That the immediate priority for CBIN is to determine short-term priorities, access short term funding and allocate resources to deliver on the short-term priorities.

5. A mix of Federal and Provincial Government funding is secured to facilitate the establishment and development of CBIN.

6. Evaluate and choose the best option for beef industry funding to support the establishment, development and provision of CBIN services that benefit the Canadian beef industry.

7. CBIN working in conjunction with existing providers of services develops a range of fee paid services that provide extra value through a combination of cost savings and better quality information.

2.2 Continuously Improve

8. CBIN immediately implement an annual cycle of continuous improvement consultation meetings with the beef cattle breeding industry.

2.3 Genetic Gain

9. CBIN initiate as a matter of priority the development of the breeding objective for the national Canadian beef herd.

10. CBIN takes responsibility for ensuring accurate and relevant genetic evaluations are freely available for all beef breeding selection candidates (male and female) to be used in breeding commercial Canadian beef cattle of all breeds and crosses.

11. Ensuring an optimal breeding scheme design for the Canadian beef herd is a priority for CBIN in the intermediate future.

2.4 Information Infrastructure

12. That CBIN keeps an open mind on the scope of the information infrastructure to be established to meet its needs for genetic improvement.

13. That CBIN explores the full range of options for exploiting synergies with the Canadian cattle traceability system (CCIA's CLTS) in order to, (a) minimise costs associated with capturing data relevant to beef cattle genetic improvement, and (b) to maximise potential participation by cow-calf operators in genetic improvement activities.

14. That CBIN establishes agreements with animal owners and providers of services, especially Breed Associations, to establish a shared database that meets the information needs of beef cattle genetic improvement.

15. That CBIN in conjunction with its data providing partners establishes data recording standards and systems for populating and maintaining the database infrastructure for beef cattle genetic improvement.

16. That CBIN explores options for ensuring Canadian beef cattle breeding stakeholders have access to the best possible information to support their decisions which impact on genetic gain in the Canadian beef herd.

17. That CBIN evaluates the options for securing required information infrastructures to enable optimal genetic improvement in the Canadian beef herd.

2.5 Communications

18. That CBIN gives immediate priority to establishing an open, informative, and responsive, communication culture.

2.6 Innovation

19. To facilitate innovation in Canadian beef cattle breeding:

    a. CBIN builds and maintains a close and effective working relationship with Canadian Universities, Colleges and extension agencies involved in animal breeding and genetics,

    b. CBIN establishes an open information sharing relationship with the Canadian Dairy Network (CDN),

    c. CBIN actively participates in the activities of the International Committee for Animal Recording (ICAR), and

    d. CBIN encourages and supports participation by its research and extension partners in worldwide innovation forums.

3 Terms of Reference

This report has been prepared in accordance with terms of reference (full copy attached as appendix 1) relating to the possible establishment of a body referred to as the Canadian Beef Information Network (CBIN). *The envisaged task of the CBIN is to provide the analysis and information tools required to deliver optimal contributions from genetic improvement to the Canadian beef industry in a consolidated and efficient manner.* The focus is the genetic improvement of the commercial cattle population with the seed-stock sector, and to some extent the artificial insemination service providers, being the means by which genetic improvement in the commercial sector is achieved.

The *study is being carried out to address what this CBIN should look like, if it is needed, if it is feasible, and what are the steps needed to put it in place?*

*The study will start with consulting the major players in the beef industry …*and *… a strategy document will be prepared and presented to the industry.*

4 Background to Canadian Beef Cattle Breeding

To provide a good picture of where we are today, it is important that we look at past initiatives for data collection, development of genetic selection tools for the beef industry, and the development of traceability systems.

Purebreeds dominated the Canadian beef industry for most of the 20th century up until the mid 60's when a small group of producers started importing continental breeds to exploit hybrid vigour and target the traits most important to them. At the time, this was generally considered heresy and a mongrelization of the Canadian cattle herd. As research started to show the benefits of crossbreeding and heterosis, more Canadian producers started to crossbreed to get the "best of both worlds". Today, most of the Canadian commercial cattle are crossbred animals, yet most breeding bulls are purebred animals, with the exception of a few hybrid bull programs like Beefbooster[1] or Soderglen[2].

[1] http://www.beefbooster.com.

[2] http://soderglen.com

Some beef breed associations (Angus, Hereford, Galloway, Shorthorn), with the help of Agriculture Canada, helped establish the Canadian National Live Stock Records program in 1905 to track animal identification, pedigree, registrations, and some phenotypic traits[3]. It wasn't until the 80s that the industry started to use Estimated Breeding Values (EBVs) and Expected Progeny Differences (EPDs which are ½ EBV). The collection of data and generation of EPD's allowed producers the ability to select young animals, based on their predicted genetic merit. At this time, it became clear to cattle producers and government that a more coordinated data collection system should be established to enhance the genetic selection process by making EPDs more accurate, and by tracking new trait data

Agriculture Canada and Agri-food Canada[4] (AAFC) thus created the Canadian Record of Performance and bull test stations to better select breeding bulls. This went on for several years with mixed producer opinions about the total value vs the cost and time needed for trait recording and bull testing. In addition, Federal government cost cutting measures in the mid 90's resulted in the AAFC Canadian Record of Performance data being transferred to a new company called CBI (Canada Beef Improvement), which was created using AAFC funds matched by the beef industry through the CCA (Canadian Cattlemen's Association). CBI only ran for a few years until it went bankrupt and had to close its doors.

At the time when CBI went under, there was a new initiative located in Guelph called Beef Improvement Ontario and more recently known simply at BIO with a federal brief. BIO was spun out of the Provincial Ministry as a beef genetic improvement unit with responsibility for herd test and bull test. This was a part of the government-wide (provincial and Federal) desire to reduce head count of staff. A producer team investigated options for this service and recommended that BIO be created. Like other similar organizations (dairy and swine), BIO received direct government funding on a declining basis until 2004. Since then BIO has competed for R&D funding and derived service income[5].

In addition, individual breed associations had sought out, or were seeking out, new companies to gather their data, create genetic evaluations (EPDs), and record animal performance. Some of these were private international companies (e.g. Angus Genetics Inc, and ABRI's Breedplan), and some were US universities offering this service.

As CBI dissolved, they looked for a good place to take over the data. As BIO seemed to be the best Canadian alternative, all data was transferred to BIO to continue with performance recording and genetic evaluations. This, however, was not well received by the breed associations who had been sharing data with CBI, and sparked great debate on data ownership. Breed associations had not necessarily agreed to share this data, and BIO at the time was not willing to give it up. It was also perceived at the time that BIO would threaten the breeds' business model, as the associations were offering genetic evaluation services to their breeders for a fee and BIO was now a direct competitor, that held a bunch of "their" data and were computing across breed evaluations which was heresy for the purebreds[6]. Of interest, all major

[3] Black, R. K. (2005). *A Record of the Records: The History of the Canadian Livestock Records Corporation.* Retrieved 09 09, 2015, from Canadian Livestock Records Corporation: http://www.clrc.ca.

[4] Agriculture and Agri-food Canada - http://www.agr.gc.ca accessed 18th September 2015.

[5] Mike McMorris, pers. comm. 21st September 2015.

[6] Reynold Bergin, pers. comm. 14th September 2015.

breed associations now use or plan to use crossbred data in their calculation of genetic evaluations.

Currently, many of the breeds partner with their US counterparts to create North American EPDs. This is especially important for genetics and live breeding animal trade, to compare bulls north and south of the border. BIO has evolved a great deal in the past ten years and now offers a comprehensive data management software package and genetic evaluations for several species, mainly for commercial producers with crossbred herds. BIO is also very involved with research and development of genomic evaluations for beef cattle. AAFC no longer tests bulls, and is not involved in commercial performance recording, but does contributes to beef cattle research, and administers the Animal Pedigree Act.

In parallel with these developments in beef cattle breeding there have been major developments in animal identification and traceabilty. By 2008 the CCIA (Canadian Cattle Identification Agency)[7] had over 450M individual records in its national database and its system was internationally recognized and worked. It provided significant traceback assistance to CFIA (Canadian Food Inspection Agency)[8] during BSE investigations. The system provided traceback for Dairy, Beef, Sheep, Bison, and specific components of pork and poultry. In addition to the basic trace back as required within the Health of Animals Act it also offered value add services to animal health companies, and branded beef programs, for example.

The CCIA also worked with provinces to develop and house a state of the art Premises Identification system and later cross referenced with the provinces as they developed their own systems, for example in Alberta. The system included all of the requirements and capabilities for a full animal movement and traceability system. CCIA also housed the Wisconsin Identification Consortium and worked very closely with its United States counterparts. CCIA also developed the Beef Cattle Implementation plan and the proposal for Canadian Beef Advantage (CBA) and the Beef Information Exchange System (BIXS[9]). The plan was to build on the CCIA infrastructure and add value to the system through industry (CCA, BIXS, CBA, CBBC[10], etc). The vision was for seamless data transfer and efficient exchange of information, without duplication and with accuracy, from genetics through to the steak on the plate.

The CCIA database has since been re-developed, a number of infrastructure changes have been implemented, and a number of previous capabilities eliminated.[11]

In summary, Canada has a lot of history associated with initiatives to create a more efficient information infrastructure for the beef industry and in particular for the beef breeding sector. The organisations currently involved in the industry are to a large extent the result of this history. The current initiative is a further attempt to create an infrastructure that will faciliitate a more efficient and more profitable beef supply chain from seed-stock producers through cow-calf producers, to feed-lots, packers and finally to consumers.

[7] http://www.canadaid.com accessed 16th June 2015.

[8] http://www.inspection.gc.ca/about-the-cfia/eng/1299008020759/1299008778654

[9] http://bixs.cattle.ca.

[10] http://www.canadianbeefbreeds.com.

[11] Julie Stitt, pers. comm. 10th July 2015.

5 Process

The process followed in preparing this strategy document included the following steps:

- Preparation by the author of a presentation (appendix 2) to describe the ICBF[12] example.
- Preparation of an online survey of those invited to participate in consultation meetings scheduled for the week of Monday 25th to 29th of May, 2015. Results of this survey are contained in the appendix 2.
- A series of consultation meetings held in Edmonton, Calgary and by telephonoe conference calls during the last week of May 2015. Each of these meetings included a presentation of the ICBF example and the results of the online survey (i.e. appendix 2). The presentation was followed by a discussion covering the terms of reference for this study and participants observations on the envisaged concept of CBIN and its establishment. A summary of the discussion points from these meetings is contained in appendix 3.
- A debriefing meeting was held on Friday 29th May, involving myself and the University of Alberta personnel who initiated this study. At this meeting it was agreed that an invitation should be extended to meat packers to participate in a consultation webinar.
- The outcome of all consultations were reviewed in light of the current structures and organisations involved in Canadian beef cattle breeding and my experience in establishing and operating ICBF. Consideration was also given to my wider international experience and knowledge gained from a wide range of sources. This review gave rise to this strategy report.
- Drafts of this report were provided to University of Alberta personnel for review. All feedback received has been considered and where appropriate, in my view, the report has been amended.

6 Is CBIN Needed?

CBIN is needed for the following reasons:

- Beef cattle genetic improvement is a slow, complex, yet very powerful tool for improving the profitability and competitiveness of the Canadian beef industry.
- The national beef strategy[13] calls for improvements in productivity (increase production efficiency by 15% by 2020), competitiveness (reduce cost disadvantages compared to competitors by 7% by 2020), and beef demand (increase carcass cutout value by 15% by 2020). Genetic improvement is a tool which can potentially contribute significantly to each of these three pillars in the beef strategy.

[12] Irish Cattle Breeding Federation Society Limited – www.icbf.com.

[13] Summary of Goals, Focus Areas and Key Outcomes 2015 – 2020. 2-page summary. http://beefstrategy.com/pdf/National-Beef-Strategy-2-page%20summary.pdf accessed 7th September 2015. This website (http://beefstrategy.com) also holds a copy of the full strategy document and a concise 6-page overview.

- There are many organisations, including some 60,000 farmers, whose decisions impact on the long term genetic improvement of the Canadian beef herd.
- Genetic improvement results from well informed decisions on the selection of sires and dams of the next generation of males and females in the Canadian beef herd.
- The benefits of genetic improvement are realised over long time periods, 3 to 50 years, along all parts of the beef meat supply chain (refer to Figure 1 on page19). That is, breeders, cow-calf producers, feed-lots, packers, distributors, retailers and consumers.
- The current structure of beef cattle breeding in Canada contains most, if not all, of the elements required for effective and efficient genetic improvement, but they do not work in concert with each other[14]. The consequence is sub-optimal rates of genetic gain and a lost opportunity worth many million dollars to Canadian beef producers (refer to section 7 - Is CBIN Feasible?).
- There are a number of new technologies which are opening up opportunities for dramatically improving the flow of information available to all sectors of the beef supply chain. These include technologies associated with: genomics, animal identification, meat quality assessment, data collection, data processing, data analysis, and communications. CBIN is needed to help ensure these technologies are used effectively to the benefit of the full industry.
- World population growth is putting serious pressure on available land and water resources. This has resulted in an imperative to improve the efficiency of beef production in Canada and worldwide.
- Global warming as a result of increased green-house gases (CO_2 and CH_4) is resulting in major pressure to reduce the contribution that beef production makes through methane (CH_4) emissions. CBIN is needed to ensure the Canadian beef breeding industry responds responsibly to these challenges.
- The consumer is putting pressure on the beef sector to: a. use scarce energy, land and water resources more efficiently, b. to reduce or eliminate the use of antibiotics and hormonal growth promotants, c. to improve the economic sustainability of production and of beef producers, d. to reduce risks of human infections and diseases from beef consumption, and e. to improve the quality of human nutrition.

CBIN is needed to ensure the full range of potential benefits from genetic improvement are captured, in both the short and long term, by the Canadian beef industry, the wider community of beef consumers and future Canadian citizens.

[14] This was very clear from the survey results and during the consultation meetings held in May 2015 – refer to appendix 2 for a copy of the survey results and appendix 3 for a full report of consultation meetings.

7 Is CBIN Feasible?

CBIN is feasible:

- In Canada, the Canadian Dairy Network (CDN[15]) is an example of a national genetic evaluation system that allows dairy producers access to genetic evaluations within and across breeds. The CDN evaluates bulls and replacement heifers on an economic selection index - the Lifetime Productivity Index (LPI), to sort the potential best and worst bulls, cows, and heifers. This system has allowed the dairy industry in Canada to make accelerated improvements in many economically important traits, and has significantly increased the genetic gains in the Canadian dairy herds. It has also allowed for the Canadian dairy industry to have the flexibility and resources to quickly apply new technologies, like genomics, into their selection system. In fact, the cumulative benefits for each year of selection is now approximately $472M/yr for the Canadian dairy cattle industry with the value of genomic selection valued at $236M/yr of this total[16]. CDN costs some $CAN2.5 million per year[17] to operate.
- Ireland has established something similar, albeit totally integrated with the dairy sector, in the form of ICBF (the Irish Cattle Breeding Federation Society Ltd)[18]. This example is a useful demonstration of the practical feasibility of a CBIN like structure for an export oriented beef sector based on some 1.1 million dairy cows, and 1 million suckler cows in relatively small herds (avg. 15 cows – i.e.1 million suckler cows in 65,000 beef herds[19]). A recent Irish study[20] places a value of €750 million on the contribution to Irish farm profitability over 15 years from genetic gain in the Irish dairy herd arising from the efforts of ICBF. The total cost of ICBF over its first fifteen years of operation was some €50 million giving a very favourable cost to benefit ratio, from this one benefit alone, and nicely illustrating the potential returns from an example of a CBIN like structure.
- In the United Kingdom the opportunity for an improved beef breeding structure has been recognised and is being advocated.[21]

[15] Canadian Dairy Network - http://www.cdn.ca.

[16] Miglior et al. 2014. Advancing Dairy Cattle Genetics. Feb 17-19, Phoenix, AZ

[17] 20 Years of CDN! https://www.cdn.ca/document.php?id=402 accessed 11th September 2015.

[18] For more information refer to www.icbf.com and earlier publications such as Cattle Breeding in Ireland, 2007. An occasional publication to mark Ireland's hosting of the joint Interbull/EAAP Meeting, Dublin 24-30 August 2007. http://www.icbf.com/publications/files/eaap_cattle_breeding_booklet.pdf accessed 7th September 2015.

[19] Ireland's Meat Sector, 2009.https://www.agriculture.gov.ie/media/migration/agrifoodindustry/foodharvest2020/foodharvest2020/2020strategy/meat1.doc accessed 7th September 2015.

[20] A.R. Cromie, F Kearney, R Evans and D.P. Berry (2014). Genomics for Pedigree and Cross-bred Beef Cattle Populations; Some experiences from Ireland. Proceedings World Congress of Genetics Applied to Livestock Production, Vancouver, Canada 2014. https://asas.org/docs/default-source/wcgalp-proceedingsoral/260_paper_10495_manuscript_1361_0.pdf?sfv-rsn=2 accessed 11th September 2915.

[21] DEFRA August 2015. Report on how beef genetics can help increase the profitability of UK beef farmers. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/459192/fangr-beef-genetics-report.pdf accessed 18th September 2015.

- In summary, CDN and ICBF provide examples of the operational and economic feasibility of a CBIN like structure for Canadian beef cattle.
- A recent study[22] has quantified the economic impact of increased rates of genetic gain in the Canadian beef herd. The current Canadian situation (assuming 25% of bulls are selected for breeding **only** on the basic production traits of BW, WW, and Post Wean Gain) and compared and with efficient use of existing and new technologies with the results as summarised in Table 1. These results demonstrate the financial feasibility of a CBIN, costing some $CAN5 million per year (refer to section 10), in which rates of genetic gain are increased from a current $CAN3.90 to $CAN9.43 per commercial cow mated per year giving an annual return of some $CAN179 million (306 minus 127).

Scenario	Rate of gain in profit ($CAN) per cow mated per year	Annualised equivalent benefit in $CAN million to Canadian industry
Current (BW, WW, PWG)	3.90	127
Current + intensive recording (maternal and terminal traits)	4.81	156
Current + intensive recording + genomics (acc: 0.25)	6.58	214
Current + intensive recording + genomics (acc: 0.50)	9.43	306

Table 1. Potential estimated rates of genetic gain in Canadian beef herd with proper information.

- From the consultation meetings in May 2015 is was clear to me that the Canadian beef cattle breeding industry already has many of the building blocks required for CBIN. These include: an effective seed-stock sector, well motivated and highy skilled research teams, an advanced genetic evaluation capability, efficient data collection tools and information systems using the latest technology.
- The beef cattle breeding industry contains many highly motivated and suitably skilled people who are capable of delivering more rapid genetic improvement in the Canadian beef herd.
- Now is a good time to establish CBIN due to favourable market conditions and general awareness and support for an industry wide initiative.

CBIN is feasible, as demonstrated by the CDN and ICBF examples, with many of the elements already in existance in Canada and the current timing is good for this initiative. An annual investment of some $CAN5 million (this estimate is subject to a detailed business plan and is based on the resources committed in establishing ICBF) will give annual returns of some $CAN179 million. The prize is very large, but a serious initial investment on behalf of the beef industry is required.

[22] Peter Fennessy, Peter Amer, Jude Sise, Tim Byrne of AbacusBio Limited, and Mike Coffey of Scottish Rural University College. May 2013. Cost-Benefit Analysis of Genomic Tools for the Alberta Beef Industry. 46 page report prepared for Livestock Gentec, University of Alberta, Edmonton, Canada.

8 Steps Needed to Establish CBIN

The steps needed to establish CBIN include:

- Establish an **interim structure** and at a later time a permanent structure.
- Establish an **interim funding** mechanism and at a later time a more permanent funding mechanism.
- Establish a **continous improvement process** for the genetic improvement of the Canadian beef cattle herd.
- Establish plans and priorities for **genetic improvement** of the Canadian beef cattle herd.
- Establish plans and priorities for creating an integrated beef breeding **information infrastructure** to support genetic improvement of the Canadian beef cattle herd.
- Establish plans and priorities for **communicating with all stakeholders** in the genetic improvement of the Canadian beef cattle herd.
- Establish an innovation culture and structure.

These steps are elaborated in the following sections and are accompanied by a series of strategy recommendations which summarise the actions that need to be taken to establish CBIN.

9 Structure

A suitable organisational structure for CBIN does not currently exist in Canada. It will take some time to create an agreed and widely supported permanent structure. The process of creating the permanent structure will involve considerable negotiation with the range of stakeholders in the beef industry to ensure they provide the support required for a successful CBIN, and vice versa that CBIN will help them achieve their objectives. This process is very important and it should not be rushed. To give the required time and to provide guidance it is recommended that an interim CBIN structure should be established forthwith.

Recommendation 1: **Establish an interim CBIN structure.**

9.1 Ownership & Governance

CBIN should be owned and governed by those stakeholders in the Canadian beef industry with a strong interest in genetic improvement of the Canadian beef cattle population.

Based on my experience in Ireland and my observations from the consultation meetings, it will take some time (two to five years) to establish a suitable permanent structure to own and govern CBIN. During this period there will be important policy decisions affecting the longer term operation of CBIN to be made. Policies relating to the information infrastructure will require the development of detailed agreements with existing stakeholders These decisions and agreements will only be achieved with the full support of all three main stakeholders – that is, the government (Federal & Provincial), the cattle industry (producers, feed-lots and ideally processors) and the service providers (breed societies, seed-stock providers, information service providers). To provide a framework for these decisions an interim leadership structure should be established comprising an iterim Board. My suggestion is for an interim Board of five high level people, drawn from the key stakeholders: Canadian Cattlemens Association, Breed Associations, Feed-lots, Meat Packers and Agriculture Canada. The size of the interim Board is not a critical issue. However it is imperative that the people selected to form the interim Board

are able to provide leadership at the highest level for each of the stakeholder groups over a period of two to five years.

During the establishment of ICBF the interim Board played a crucial political role in helping to create an environment in which funding bodies and existing service providers could engage with the new structure and negotiate long term ownership, shareholding, capital and operational funding, and operational arrangements. I envisage the need for something similar for CBIN. It is important that service providers have a significant stake in CBIN and this should include a substantial shareholding with an associated commitment of capital funding. Creating the shared vision for CBIN and confidence in its ability to deliver will take time and energy. This is the main task of the interim Board.

The interim CBIN Board should initially be supported by an interim Chief Executive (one person with appropriate support) seconded for an initial period of two years. The role of the CBIN Chief Executive being to put in place the detailed agreements needed for longer term viability of CBIN and a more permanent structure

Recommendation 2: **Interim CBIN structure to comprise a Board of some five cattle industry leaders and a full time Chief Executive.**

9.2 Mission of CBIN

Mission of CBIN be "***to ensure optimal genetic improvement of the Canadian beef herd***".

In the context of this mission:

- *optimal* is defined as achieving the balance between costs and benefits which maximises the overall profitability of the Canadian beef industry.
- *genetic improvement* is defined in economic terms and refers specifically to the contribution that genetics makes to the profitability of commercial beef producers (calf/calf operators) taking account of the true value of beef to end consumers and the full range of sustainability considerations impacting on beef production.
- *the Canadian beef herd* being the entire population of beef cows located in Canada now and in the forseeable future.

Recommendation 3: **The mission of CBIN is *to ensure optimal genetic improvement of the Canadian beef herd.***

9.3 Immediate Priorities

The timing of this initiative is good. There is awareness of the potential benefits. There is frustration at previous failures. Cattle prices are good. Future consumer preferences and environmental challenges are recognised[23] and there is a desire amongst industry leaders to take initiatives which can deliver an improved competitive position for the Canadian beef supply chain and the wider industry.

The vision for the CBIN is ambitious and will take many (10+) years to fully realise. It is very important that this vision be realised in manageable steps based on agreed priorities for the short term (next year) and longer term (next five years).

[23] For example, Canada's sustainability initiatives - the Canadian Roundtable for Sustainable Beef and the McDonald's Pilot Project, both of which support the need for a CBIN (i.e., to track sustainability indicators and progress over time).

The immediate priority is to determine short term priorities, access short term funding and allocate resources to deliver on the short term priorities.

Recommendation 4: **That the immediate priority for CBIN is to determine short-term priorities, access short term funding and allocate resources to deliver on the short-term priorities.**

10 Costs and Funding

Establishing and operating CBIN will involve a number of costs as identified and summarised in table 2 based on the ICBF example. A detailed business case must be developed in order to refine these cost estimates according to the model finally adopted for CBIN.

	Years one to three				Year four +			
Cost Item	FTE	Employment Cost	Other Costs	Total Cost	FTE	Employment Cost	Other Costs	Total Cost
Administration (Chief Executive, Accounting, Legal, International)	2	200	100	300	4	300	100	400
Genetics (Breeding objectives, genetic evaluations, breeding scheme operation, genomics, Interbeef)	4	400	1,000	1,400	6	600	1,000	1,600
Information infrastructure (IT system, software development, website, network)	15	1,500	1,000	2,500	10	1,000	500	1,500
Research & Development	1	100	500	600	1	100	500	600
Service Support (call centre, service development)	2	150	100	250	10	750	500	1,250
	24	**2,350**	**2,700**	**5,050**	**31**	**2,750**	**2,600**	**5,350**

Notes:

1 All cost estimates in $CAN1,000.
2 Assumes it will take CBIN three years to establish services.
3 IT staff or equivalent contractors to build information system.
4 Genotyping some 20,000 animals per year with 50k SNP chip @ $50/animal.
5 Bulk of beef cattle breeding research & development is funded outside of CBIN and thus not covered by these estimates.

Table 2. Estimated annual cost for operating CBIN in first and fourth years of operation based on ICBF example.

CBIN funding should be a balance of government funding, industry funding and service fees as outlined in more detail below. The balance between these three sources is important as CBIN's mission will deliver a range of benefits to both current and future stakeholders in the Canadian beef industry. Initially, there will be a requirement for investment to establish CBIN and associated infrastructure and in the longer term the balance will shift to operations some of which will have associated and growing service income.

10.1 Government funding

Government in Canada is a mix of federal and provincial responsibilities. Beef cattle breeding involves long time periods and benefits which will acrue to consumers, meat industry organisations, feed-lots, farmers and breeders for many years into the future and throughout Canada. Government funding is an established mechanism for ensuring the benefits of beef cattle breeding are delivered to future stakeholders. In the ICBF case, Government funding played a key role in ensuring an information infrastructure which has a long term focus was established while at the same time providing valuable services, in the short term, to the current service users. It also provided leadership at the highest level thus giving industry stakeholders confidence to join in a spirit of partnership. For example, there were a number of occasions on which the Secretary General of the Department of Agriculture facilitated meetings to resolve outstanding issues related to the structure and operation of ICBF.

The Provincial spread of beef cattle in Canada means the beef sector is of varying interest to provincial governments. However, beef cattle are present in all provinces and it is important that CBIN takes, and is seen to take, a Canada wide approach to ensuring optimal genetic improvement of the national herd. Anything less will lead to disaffected groups and risk the continuation of the current piecemeal approach.

To facilitate a country wide approach at least part of the seed capital to establish the required genetic and information infrastructure should be secured from the Federal level. Additional funds from Provincial Governments should be used to support facilities and initiatives which are located in the relevant provinces and are part of the nation-wide strategy.

Recommendation 5: **A mix and Federal and Provincial Government funding be secured to facilitate the establishment and development of CBIN.**

10.2 Industry funding

With its focus on genetic improvement of the national beef cattle herd CBIN is required to take initiatives and provide information which is valuable and relevant to all beef cattle producers – seed-stock, cow-calf, and feed-lot. It is also required to ensure the impact of genetic improvement on the costs and benefits for meat packers is understood and optimised. For these reasons, a part of CBIN's establishment, development and operating costs should be funded at the beef industry level. These funds will enable CBIN to make investments and provide generic industry services that are in the best overall interests of the beef industry.

The best mechanism for industry funding needs to be explored. The current check-off system is one option. Other options need also to be explored. Consideration should also be given to a discussion with Federal and Provincial Governments which would establish a partnership approach with Government and Industry funding being linked in the long term interests of the beef industry and the wider community.

Recommendation 6: **Evaluate and choose the best option for beef industry funding to support the establishment, development and provision of CBIN services that benefit the Canadian beef industry.**

10.3 Service fees

CBIN should establish, at an early stage, a service culture and an infrastructure which delivers demonstrable benefits to specific stakeholders in the Canadian beef industry. These services should be provided on a fee paying basis to ensure their growth is financially viable and that resources are not wasted on services that customers do not value.

The details of CBIN's services have yet to be determined, apart from the fact that they are based on genetic improvement, and need to be designed in conjunction with current providers of services to the Canadian beef industry. The key features of CBIN's services should include:

- saving costs by spreading overheads
- saving costs by removing duplication
- providing extra value by achieving greater accuracy
- providing extra value by providing information that is more relevant to the goals of the service user
- providing extra value by providing information not currently available.

Recommendation 7: **CBIN working in conjunction with existing providers of services develops a range of fee paid services that provide extra value through a combination of cost savings and better quality information.**

11 Continuous Improvement Cycle

CBIN needs to deliver many improvements to the information infrastructure that services beef cattle breeding in Canada over the next two to ten years. Over the same period I expect quite rapid developments in relevant technologies including:

- Genomic technologies based on lower cost genotyping and an ever greater understanding of the relationship between animal genotypes and their reproduction, growth, nutritional requirements, disease susceptibility, behaviour, and the market value of resulting meat and other products. This is a trend that started dramatically impacting on cattle breeding in 2008 and is expect to run for many years into the future.
- Information technologies for gathing data on farms and through the meat supply chain, storing data, and communicating information. This is a trend that has been apparent for the last 30 years and shows no sign of slowing.
- Tools for measuring attributes of live and dead animals that are good predictors of economically important traits. These tools include physiological and biochemical measures and carcass images.
- Reproduction technologies including sperm sexing and more efficient and lower cost embryo harvesting and implantation tools.

For each of these developments the Canadian beef industry needs to be able to quickly evaluate their potential to contribute to profitability, to reject those of little value, and to adopt those of great value. There are well established continuous improvement processes employed by many industries and organisations for managing this process of evaluation and implementation. These processes typically employ a quality management philosophy as originally espoused by W Edwards Deming[24] that have more recently evolved into tools including Six Sigma™[25], ISO 9000[26] and Lean Manufacturing[27]. The key elements of these processes are based on a cycle of

[24] http://en.wikipedia.org/wiki/W._Edwards_Deming, accessed 4th May 2015.

[25] http://en.wikipedia.org/wiki/Six_Sigma, accessed 4th May 2015.

[26] http://en.wikipedia.org/wiki/ISO_9000, accessed 4th May 2015.

continuous improvement. CBIN should establish these disciplines at an early stage and use them to manage the change process which it will be leading. Specifically, CBIN needs to ensure the cattle breeding industry is well informed, is regularly consulted, and is supportive of the changes which are implemented. An annual cycle is proprosed comprising two or three open consultation meetings at which the following topics are presented and discussed:

- Research and development plans for the next four to six months.
- Results of research and development efforts over the last four to six months.
- Implementation plans for the next four to six months.

As a general principle, implementation should only proceed when widespread industry support has been gained. Where there are significant questions not fully addressed, further research and development using good science should be initiated and duly reported back.

For ICBF these consultation meetings proved to be an effective forum for seed-stock and cow-calf producers to be informed of, and to contribute to, the process of continuous improvement. Contentious technical issues related mainly to genetic improvement were thrashed out in this forum. The ICBF team provided very clear and strong leadership for these meetings. The output of the meetings was a clear mandate to ICBF Board to implement agreed innovations. I see the need for CBIN to operate something similar.

Recommendation 8: **CBIN immediately implement an annual cycle of continuous improvement consultation meetings with the beef cattle breeding industry.**

12 Genetic Improvement

The mission of CBIN is genetic improvement of the Canadian beef herd. As already outlined (in section 9.2) improvement is defined as the contribution genetic improvement makes to the profitability of beef producers. To ensure genetic improvement CBIN must address: breeding objectives, genetic evaluations and breeding scheme design as elaborated here.

12.1 Breeding Objectives

Establishing an agreed and supported breeding objective for the Canadian beef herd is essential for a number of reasons including:

- A clear breeding objective will greatly simplify communication with cow-calf operators.
- Cow-calf operators will demand better breeding stock if they are convinced that they can access information which identifies bulls that align well with their objectives. That is, cow-calf operators will insist on seed-stock which best meet their needs.
- The process of establishing, and updating, the breeding objective will require an engagement with cow-calf operators, feed-lots, packers and consumers. The process also requires that animal genetics scientists engage with economists to establish the economic value of all traits included in the breeding objective. This process will demonstrate that CBIN is providing leadership to the Canadian beef breeding industry.

[27] http://en.wikipedia.org/wiki/Lean_manufacturing, accessed 4th May 2015.

- A knowledge of the economic value of each trait will enable CBIN to prioritise research and development to underpin genetic improvement.
- The breeding objective will evolve over time in response to changing economics and new knowledge. It is important that development of the breeding objective for Canadian beef cattle be part of the CBIN continuous improvement process (see section 11 above).

Recommendation 9: **CBIN initiate as a matter of priority the development of the breeding objective for the national Canadian beef herd.**

12.2 Genetic Evaluations

Genetic evaluation is the process by which performance, pedigree, genomic and other data is analysed to produce best predictions of the true genetic merit of individual animals. Typically the process includes the production of biological evaluations for a wide range of relevant traits and the combination of these into economic indexes linked to the breeding objective.

Genetic evaluations are used by seed-stock producers to make selection decisions and to market bulls to cow-calf operators. Genetic evaluations are used by cow-calf operators to make bull (and semen) purchase decisions.

CBIN needs to ensure the genetic evaluations that are provided for use by seed-stock and cow-calf operators are as accurate as possible and highly relevant.

The accuracy of genetic evaluations is determined by a number of factors including:

- The accuracy of the pedigree and performance data used in the evaluations. Of particular concern are missing data, selective recording and selective treatment of animals.
- The amount of data that is available for each selection candidate. Of particular concern are traits not recorded, missing or erroneous parentage information, and limited numbers of progeny for bulls likely to be used widely.
- The quality of the training populations used to establish genomic predictions. Of particular concern are small training populations and populations not closely related to the selection candidates.
- The models and methods used to compute the evaluations. Of particular concern are models and methods which do not adequately identify and remove environmental influences and interactions from the evaluations.

The relevance of the evaluations is determined by a number of factors including:

- Their availability for all potential selection candidates. Of particular concern are evaluations on selection candidates available from other countries and Canadian animals of interest for use in other countries
- Cow-calf operators considering bulls of different breeds need access to evaluations which enable comparisons to be made across the breeds. In this respect, within breed evaluations are of limited relevance.
- There are two options for ensuring comparable genetic evaluations for Canadian and USA seed-stock under CBIN:
    a. A continuation of the current bi-lateral approach. That is, a system where the Breed Associations use the CBIN system. All relevant beef cattle breeding

data will be directly and automatically enterred there. The Breed Associations will extract the relevant data to do their within breed North American evaluations jointly with the USA (primarily focussed on benefiting the seed-stock producers and the export of genetics) and they or their service providers will publish these. An across breed Canadian evaluation will be published by CBIN (which would primarily benefit the Canadian Commercial cow-calf producer).

b. Adoption of a more fully international model. An alternative, or future direction, is to go for a more fully international model which considers multiple countries, and the potential for genotype-by-environment interactions. Such a model has recently been developed by Interbeef[28] and is being serviced by the Interbull Centre based at the Swedish University of Agricultural Science. This model provides a powerful tool for ensuring accurate identification of imported (and exported) animals, and uses raw phenotypes in international genetic evaluations. It is operational for Limousin and Charolais for weight traits and is being used by seven European countries. Each country publishes its own evaluations for seed-stock from all countries thus enabling breeders in each country to select the best animals from all countries according to their local breeding objectives. Current development is focused on extending the range of traits to include calving, carcass and female fertility traits as well as covering the Simmental breed.

- The extent to which genotype by environment interactions are present between the environment(s) in which the performance data is collected and the environment(s) in which the selected animals are expected to perform. Canada covers a very large area and includes a considerable number of distinct environments. Also, there are many other environments in other countries from which seed-stock might be considered for importation to Canada.
- The extent to which the economic indexes reflect the breeding objectives of the farm where the progeny of candidate bulls must perform. Of particular concern are indexes that do not adequately account for market returns and production costs on the farm where progeny will be located.

Recommendation 10: **CBIN takes responsibility for ensuring accurate and relevant genetic evaluations are freely available for all beef breeding selection candidates (male and female) to be used in breeding commercial Canadian beef cattle of all breeds and crosses.**

12.3 Breeding Scheme design

Genetic improvement is also dependent on a well designed breeding scheme. This aspect of beef cattle breeding is often overlooked especially in the absence of an organisation empowered to take the overview of beef cattle breeding. The availability of new tools, for example genomics, can impact on the optimal breeding scheme design. Design needs to consider a range of parameters including:

[28] http://www.icar.org/pages/working_groups/wg_interbeef.htm accessed 8th September 2015.

- The four pathways of genetic gain – sire to son, sire to daughter, dam to son and dam to daughter – and associated selection accuracy, selection intensity and generation intervals.
- The structure of the seed-stock sector relative to the cow-calf cattle population and in particular the breeding objectives pursued in the seed-stock sector relative to those of the comercial sector.
- The relationship between research populations and the active breeding population. Of particular relevance are: calibration and validation of genomic predictions, evaluation of new traits for inclusion in the breeding objective, relevance of the animals used in non-genetic research, and the implementation of research outputs.

CBIN currently has more pressing priorities than breeding scheme design although it is clear[29] that substantial improvements in rate of genetic improvement will result from optimal use of relevant technologies.

Recommendation 11: **Ensuring an optimal breeding scheme design for the Canadian beef herd is a priority for CBIN in the intermediate future.**

13 Information Infrastructure

There is an immediate and recognised need for a much improved information infrastructure to facilitate genetic improvement of the Canadian beef herd. Establishing such an infrastructure is a major organisational challenge. There are no particular technology barriers but there a number of very important organisational issues that need to be resolved as a matter of high priority. These are discussed in the following sections.

13.1 Scope

The information infrastructure required to facilitate genetic improvement is a subset of that required by the Canadian beef industry to support decisions at all levels along the supply chain from seed-stock breeder to consumers (refer to Figure 1). Potentially the information instructure facilitating genetic improvement could also be facilitating:

- Farm management – seed-stock, cow-calf operations and feed-lots.
- Quality assurance and food safety – from seed-stock to consumers.
- Disease and welfare of beef cattle – from seed-stock to processing.

The ICBF[30] database is an example of how the information infrastructure required for cattle breeding was able to be readily, and inexpensively, adapted to support this wider range of requirements of the Irish dairy and beef cattle industries. As a consequence, ICBF's genetic improvement mission has been easier to achieve especially for research on some of the more difficult to measure traits such as disease susceptibility and meat eating quality.

Recommendation 12: **That CBIN keeps an open mind on the scope of the information infrastructure to be established to meet its needs for genetic improvement.**

[29] Peter Fennessy, Peter Amer, Jude Sise, Tim Byrne of AbacusBio Limited, and Mike Coffey of Scottish Rural University College. May 2013. Cost-Benefit Analysis of Genomic Tools for the Alberta Beef Industry. 46 page report prepared for Livestock Gentec, University of Alberta, Edmonton, Canada.

[30] Irish Cattle Breeding Federation Society Ltd – www.icbf.com.

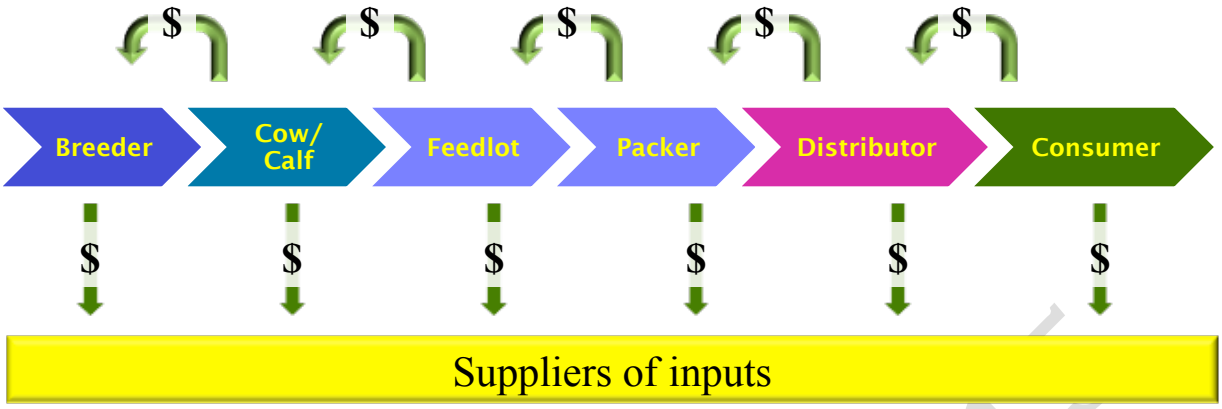

Figure 1. Beef supply chain.

Food safety and disease control are the main justifications for the Canadian Cattle Identification Agency[31] (CCIA). The CCIA operates the Canadian Livestock Tracking System[32] (CLTS) which requires a unique electronic tag to be attached to all animals at the point of sale. The availability of this identification and tracking system represents a major opportunity for the beef cattle breeding sector. The costs of establishing and maintaining systems for animal identification, and animal movements are being incurred for other purposes and the costs of these activities to the breeding sector can thus be dramatically reduced. This system also opens up opportunities for the breeding sector to access useful information from the full range of commercial cattle.

Recommendation 13: **That CBIN explores the full range of options for exploiting synergies with the Canadian cattle traceability system (CCIA's CLTS) in order to, (a) minimise costs associated with capturing data relevant to beef cattle genetic improvement, and (b) to maximise potential participation by cow-calf operators in genetic improvement activities.**

13.2 Access/Ownership

To ensure optimal rates of genetic improvement in the Canadian beef herd CBIN will need access to a great deal of data from a wide range of sources. CBIN will need to be able to analyse this data, to draw conclusions and to take action on the basis of its conclusions. Similarly, in order to make well informed decisions, all stakeholders in beef cattle breeding sector will need access to information relevant to their interests.

Issues of access to data and ownership of data can become unduly complicated and lead to protracted negotiations and even demands for substantial payments. In my view these difficulties can be circumvented by the adoption of several key principles as follows:

- The animal owner at the time of data collection has control of who can access the data and the purpose for which they can use it. In practial terms this means each herd owner

[31] http://www.canadaid.com accessed 19th June 2015.

[32] https://www.clia.livestockid.ca/CLTS/secure/user/home.do

(seed-stock, cow-calf, feed-lot, packer) will have an agreement with CBIN which enables CBIN to access all data collected on their animals for use in its genetic improvement activities and related research. This agreement should ideally include an instruction from the animal owner to CCIA, and other organisations such as BIXS, to provide all related traceability data to CBIN.

- CBIN has an agreement with providers of services to animal owners (e.g. Breed Associations, Veterinarians, Advisors, …) which covers data access, defines the services CBIN provides and associated service fees.
- The relationship between CBIN and Breed Associations be given a great deal of attention to ensure the beef cattle genetic improvement information infrastructure evolves in an atmosphere of trust and respect to deliver genetic improvement in the Canadian beef herd.
- It is envisaged that the CBIN information infrastructure will be able to provide seed-stock producers and Breed Associations with information services and genetic evaluations which substantially exceed the scope, quality and accuracy of those possible through the current information systems model. This improvement will come about primarily from access to large amounts of data on commercial cattle and to data from research populations.

Recommendation 14: **That CBIN establishes agreements with animal owners and providers of services, especially Breed Associations, to establish a shared database that meets the information needs of beef cattle genetic improvement.**

13.3 Data Recording and Validation

There is a need to standardise and simplify data recording and associated validation in order to enable commercial producers to have confidence in resulting genetic evaluations. Key principles include:

- Capture data in electronic form as close to source as possible and ensure they are validated and stored in the central database with minimal delay. For example, use a handheld computer when calf births are being recorded and ensure the birth is registered in the central database as soon as an internet connection is available.
- Record each event once only and then ensure the resulting data is readily available to all who have authorised access. For example, record details of slaughter at meat packers and provide results for use by: packer, feed-lot, cow-calf where born, genetic evaluation and research.
- Establish standardised data recording protocols which meet the needs of all users of the resulting data. For example, a birth record in conjunction with tagging using the CLTS tag and reporting calving difficulty to meet needs of: herd owner, Breed Association, CCIA and genetic evaluations.
- There should be no financial obstacles to animal owners providing timely, complete and accurate records on all events of relevance to genetic improvement.
- Ensuring data recording is complete. That is, all animals in a contemporary group are recorded and the data is provided to CBIN for potential use in genetic evaluations.
- Systems must be in place to monitor and investigate variation in animal performance within contemporary groups to ensure genetic evaluations are free from biases due to preferential treatment of animals.

Recommendation 15: **That CBIN in conjunction with its data providing partners establishes data recording standards and systems for populating and maintaining the database infrastructure for beef cattle genetic improvement.**

13.4 Information

There is a wide range of information required to ensure optimal genetic improvement of the Canadian beef herd including:

- Information for use by seed-stock producers in making selection and breeding decisions including: breeding objectives, animals to cull, herd sire selection, female replacement selection, breeding bull sales and animal marketing.
- Information for use by Breed Associations in operating their business and determining strategy for their breed including: membership, registrations, breed promotion, services to members, genetic trends, genetic evaluations, breeding objectives, implications of new technology, and research findings.
- Information for use by cow-calf operators in making selection and breeding decisions including: breeding objectives, animals to cull, sources of seed-stock, bulls available, timing of calving, marketing of weanlings, marketing of cattle ready for feed-lot finishing.
- Information for use by feed-lot operators in determining selecting of feeder cattle, price to pay, animal disease treatment, animal penning, pen feeding, finishing and marketing.
- Information for use by veterinarians and advisors to seed-stock, cow-calf, and feed-lot operators. This information typically would be both comparative information for multiple herds and herd level information which can be used in providing guidance on herd management and individual animal treatment.

There is thus a need for a very wide range of information to assist stakeholders in the Canadian beef herd to make good decisions. For the Canadian beef industry to operate at optimal efficiency each piece of information needs to be assembled using the best of science and from all relevant data. The challenge for CBIN is facilitate this in an efficient and effective manner.

Recommendation 16: **That CBIN explores options for ensuring Canadian beef cattle breeding stakeholders have access to the best possible information to support their decisions which impact on genetic gain in the Canadian beef herd.**

13.5 Resources

The Canadian beef industry already has considerable capability in information systems. In order to make progress as rapidly as possible with establishing and enhancing the information infrastructure supporting genetic improvement of the beef herd a number of factors need to be considered including:

- The current resources (eg BIXS, BIO, CCIA, Breed Assns, CreoEpisteme[33]) are to varying extents devoted to developing and supporting components that need to be integrated to form the new CBIN information infrastructure.
- None of the current information systems has the full range of features needed to support optimal genetic improvement of the Canadian beef herd. The BIXS strategy is

[33] Software system used by some Breed Assns - http://creoepisteme.com accessed 7th October 2015.

to facilitate the sharing of data but not to be involved in analytics. The BIO strategy is to provide herd owners with information, herd level analytics, to help them run more profitable operations. The Breed Associations are focused on seed-stock with emphasis on one or a limited number of breeds. Each has a part of the picture, nobody has it all. This needs to change.

- In my experience it is essential, in the development of an effective genetic improvement programme, that very effective analytical capacity is established and this can only be achieved if all the required data is readily accessable on an ongoing basis in near real-time.
- A substantial amount of development will be required over a number of years to establish the information infrastructure required for CBIN to deliver on its mission.

CBIN needs to explore the options for obtaining and deploying the resources required to establish, develop, maintain and operate the required information infrastructure.

Recommendation 17: **That CBIN evaluates the options for securing required information infrastructures to enable optimal genetic improvement in the Canadian beef herd.**

14 Communication

Communication should be an immediate priority for CBIN. The reasons for giving high priority to communication include:

- **Large numbers**. There many thousands of farmer stakeholders in the Canadian beef industry, a significant number of organsations providing genetic improvement related services to beef breeding and there are many organisations who have data of potential value to the mission of CBIN. These parties all need to be consulted with, kept informed and listened to, in order to ensure their support in creating the infrastructure which will enable optimal rates of genetic improvement of the Canadian beef herd.
- **Lots of changes**. The process of moving from the current structures to the more optimal structure will involve many initiatives with associated changes to operating procedures and information for improved decision making. This large amount of change can only be achieved if those affected are convinced of the need, understand what needs to change and have the skills required to make the changes. This will require CBIN to have very effective communication capability.
- **New Knowledge**. Over the period ahead there will be a lot of new knowledge becoming available as a result of CBIN's inititiatives. This knowledge will relate to; tools for use in genetic improvement, new technologies relevant to cattle breeding decisions, and new ways of operating as a consequence of the new information infrastructure.

The tools available for communication are evolving quite rapidly and include the following:

- **Website and Social Media**. A dedicated CBIN website should be created as soon as possible to be the place to go to for information on genetic improvement of the Canadian beef herd and the activities of CBIN. A weekly newsletter from the Chief Executive is an effective way of ensuring the wider industry has access to new information as it becomes available.
- **Consultation Meetings**. Consultation meetings, either in person or via appropriate media are a very important communication tool especially for obtaining feedback on

proposals in relation to planned developments. CBIN should establish a consultation culture from an early stage. It is important that the meeting schedule is communicated well in advance, that material for these meetings is distributed in advance, that adequate time is given to listening during the meetings and that an accurate record of each meeting is available within a few days of the meeting.

Surveys. Surveys are a very valuable tool for gauging the opinion, knowledge, and understanding of populations of people. Web based surveys are being increasingly used due to their low cost and rapid responses. Care need to be taken to ensure each and every survey is well thought out to avoid activities which respondents view as a *waste of time*. Writing useful survey questions is a special skill that needs to be developed to reduce bias and meaningless results.

Recommendation 18: **That CBIN gives immediate priority to establishing an open, informative, and responsive, communication culture.**

15 Innovation, Research, Development & Extension

The vision for CBIN is that of a lean, innovative organisation focused on the practical and operational aspects of genetic improvement in the commercial beef herd for the benefit of everyone in the industry and Canadian citizens. One of CBIN's envisaged strengths will be its ability to rapidly evaluate and to effectively implement (refer to section 11: Continuous Improvement Cycle) developments arising from new technology and the results of research. To ensure this happens CBIN needs to have a special relationship with the research, education and extension community. Some of the key considerations being:

- CBIN must have an effective relationship with the Canadian Universities, Colleges and extension agencies that have research, teaching and extension programmes in animal breeding generally and beef cattle breeding specifically. This relationship should be based on the pursuit of genetic gain with CBIN's role being: a. operational, b. provider of data for research[34], and c. the vehicle for implementing valuable innovations within the Canadian beef industry. The role of the Universities, Colleges and extension agencies being to: a. conduct research, b. provide education, c. to provide the industry with independent science based information, and d. to help farmers extract increased profits from their cattle breeding decisions and information sources.
- The CDN (Canadian Dairy Network) is the core of a CBIN like structure for dairy cattle breeding in Canada. It is a world respected organisation and has considerable expertise in a number of areas relevant to CBIN. CBIN should establish and maintain an open sharing relationship with CDN.
- Innovations in cattle breeding (beef and dairy) are taking place around the world and there are a number of international forums in which information is shared. These include ICAR[35], BIF[36], WCGALP[37], ISAG[38], ASAS[39], and EAAP[40]. The first of these,

[34] Consideration should be given to using the CBIN database as a long term repository for data collected in, at least cattle breeding related, research studies.

[35] International Committee for Animal Recording – www.icar.org.

[36] Beef Improvement Federation - http://www.bifconference.com.

[37] World Congress of Genetics Applied to Livestock Production - http://www.wcgalp.com.

ICAR, is focused on the practical and operational aspect of animal recording and genetic evaluations and is the one organisation that CBIN should be an active member of. All the others provide a forum for research sharing and should be participated in by CBIN's research, education, and extension collaborators.

Recommendation 19: **To facilitate innovation in Canadian beef cattle breeding:**

a. CBIN builds and maintains a close and effective working relationship with Canadian Universities, Colleges and extension agencies involved in animal breeding and genetics,

b. CBIN establishes an open information sharing relationship with the Canadian Dairy Network (CDN),

c. CBIN actively participates in the activities of the International Committee for Animal Recording (ICAR), and

d. **CBIN encourages and supports participation by its research and extension partners in world-wide innovation forums.**

16 Challenges/Threats/Weaknesses

CBIN is an ambitious concept and its realisation faces a number of major challenges. The potential existance of a viable CBIN will be seen as a potential threat to a number of existing stakeholders in the Canadian beef industry. The concept of CBIN does contain some weaknesses which need to be understood and steps taken to overcome them. The purpose of this section is to describe these challenges, threats and weaknesses and to identify strategies for ensuring they do not disrupt the realisaton of the potential benefits from genetic improvement of the national beef herd.

[38] International Society for Animal Genetics - http://www.isag.us/index.asp.

[39] American Society of Animal Science - https://asas.org.

[40] European Association of Animal Production - http://www.eaap.org.

16.1 Challenges

Challenge	Strategy
Decision making – during the next few years as CBIN is being formed there will be a number of policy decisions to be made. Currently a structure for making these decisions and ensuring they have the support of key stakeholders does not exist.	Establish an Interim CBIN Board – refer to recommendations 1, 2 and 4.
Funding – to establish CBIN and create the required information infrastructure a significant amount of capital funding will be required. A large part of this funding will not produce a short term cash flow sufficient to enable short borrowing or a "short term profit driven investment". Rather the investment will create an information infrastructure which will enable the Canadian beef cattle industry to realise genetic gain over the longer term – 10 to 50 years. When CBIN becomes operational there is potential for service income, however, even in the longer term, this will not be sufficient to cover all the costs of operating a fully effective CBIN.	Establish a three way funding partnership – Government, industry and services to provide the initial capital investment and the funding for ongoing operations – refer to recommendations 5, 6 and 7.
Information infrastructure – the current systems used to support cattle breeding decisions are primarily breed association based. The envisaged CBIN information system involves a high level of integration of data collected from a wide range of sources (commercial producers, research herds, seed-stock producers, feed-lots, meat packers, DNA testing laboratories and disease testing laboratories). It is also envisaged that information services will be provided to a range of service users through arrangements (yet to be determined) and potentially including commercial producers, researchers, seed-stock producers, feed-lots, meat packers, farm advisors, and veterinarians.	• Establish agreements with current data collection and data processing organisations – refer to recommendation 14. • Minimise data collection costs by avoiding duplication at all levels and developing streamlined data collection systems – refer to recommendations 13 and 15. • Develop a range of valuable information services including some to be provided on a fee paying basis to assist stakeholders in the Canadian beef industry to make better breeding and management decisions – refer to recommendations 12 and 16. • Establish a continuous improvement process – refer to recommendation 8. • Establish an effective communications network – refer to recommendation 18.
Genetic evaluations – are not currently used widely in commercial cattle breeding decisions. A core goal of CBIN is to provide genetic evaluation information which is used to make breeding decisions and which result in increased profitability for commercial producers. The challenge is: a. to transform the genetic evaluations used by both commercial producers and seed-stock producer so that they do accurately identify more profitable animals and, b. then to ensure they are widely used for this purpose.	• Establish a clear and agreed breeding objective for commercial beef producers and an associated genetic evaluation system – refer to recommendations 3, 9 and 10. • Establish a continuous improvement process – refer to recommendation 8. • Establish an effective communications network – refer to recommendation 18.

Challenge	Strategy
Increase the rate of Genetic gain in the commercial population – the current rate of genetic gain is sub-optimal partly as result of the current breeding scheme design being less than optimal. The challenge is to determine what is optimal and to move the industry to this position.	• Establish what is the optimal design – refer to recommendation 11. • Establish a continuous improvement process – refer to recommendation 8. • Establish an effective communications network – refer to recommendation 18.

16.2 Threats

Threat	Strategy
Non-participation by key stakeholders – if any of the key (Government, CCA, breed associations, feed-lots, packers) stakeholders decide not to participate in the estalishment of CBIN then its legitimacy and capability will be weakened significantly.	• Ensure all five are involved in the interim CBIN – refer to recommendation 2. • Ensure the interests of each stakeholder group are understood and considered in establishing the breeding goal and information infrastructure – refer to recommendations 3, and 9 for breeding goal, 8 and 11 for process and communications, and 12, 13, 14, 15, 16 and 17 for information infrastructure.
Economic down-turn – current beef prices are good thus creating a favourable environment for the CBIN initiative. A drop in beef prices would place pressure on CBIN funding.	Ensure CBIN operates efficiently and delivers effectively – refer to recommendation 2 (governance), recommendation 4 (priorites and thus flexibility to deal with funding fluctuations) and recommendations 8 and 18 for process and communications.
Rapid technology **developments** – the rapid rise of a technology not currently anticipated could disrupt the evolution of CBIN.	• Ensure CBIN is technology aware and able to respond – refer to recommendation 8 for the CBIN continuous improvement process and recommendation 19 for innovation. • Ensure a structure which enables the cattle breeding industry to evaluate and take up new technologies. This has been one of the big strengths of ICBF in relation to genomic technologies and it is argued that CBIN will have a similar capability and strategic strength.

16.3 Weaknesses

Weakness	Strategy
Previous effort failed – there is an amount of concern about the failure of previous effort and this is a weakness.	• Understand the reasons for failure and ensure they are not repeated – refer to recommendation 2 dealing with Governance, recommendation 8 dealing with process and recommendation 18 dealing with communication. • Look to other examples that have succeeded and learn from them. Recommendations 5, 6, and 7 dealing with funding and recommendation 19 dealing with innovation all anticipate that CBIN will be an active participant in international forums where experiences in the development of cattle breeding are being openingly and actively shared.
Starting from scratch – CBIN is envisaged as a new organisation and thus does not have existing arrangements and structures in place. This is likely to result in a slower start-up for CBIN.	• Build on experiences, resources and existing capability – refer to recommendation 17 in relation to information infrastructure. • Turn this into an advantage. To some extent, and this was the ICBF experience, a new start provides a good opportunity to establish new and better ways of operating.