Economic Overview of Manure Handling and Processing Options

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Introduction

Few conversations about economics reach unanimous agreement as the subject, by its very nature, is complex and multi-faceted. Conversations about politics, sex and religion suffer a similar fate. Each side strives to get their point of view across while ignoring or rejecting the opinion of others. My intention therefore is to take the discussion about the economics of manure management beyond the traditional scope of money to include other issues that impact on livestock production. I hope this approach stimulates your thinking about manure handling and processing, an increasingly important issue for livestock enterprises, the environment and society in general.

If you Google the words "economics" and "definition" you may be surprised by the number of results that are generated. My personal favourite from the long list is "The study of choice and decision making in a world with limited resources". (Source: *www.mcwdn.org/ECONOMICS/EcoGlossary.html*).

The words choice and decision making are what attracted me to this particular definition. The everyday choices and decisions we make in our businesses determine future results. Limited resources often determine the number of choices available to us which in turn influences the decisions we make. The challenge before us is to make wiser choices and decisions with our limited resources.

The primary reason making decisions and choices is difficult is because it involves risk. The reason many of us avoid risks is because the consequences can be significant and even catastrophic. The older you are the more likely you are to take fewer risks. Personal bankruptcy is not something we want on our resumé. How we deal with risk is often a personal choice. There is that word 'choice' again.

The management and disposal of livestock manure involves risk beyond the purview of the individual livestock producer since it impacts the environment and society in general. E. coli continues to make headlines and while contaminated spinach may be the topic of the day, the deaths attributed to the Walkerton fiasco have not been forgotten. The choices and decisions farmers make regarding how they dispose of their livestock manure no longer resides solely with the individual livestock producer. The economic, environmental and social risks attributed to improper containment, treatment and disposal of livestock manure can be significant. The challenge facing livestock producers is whether they are willing to acknowledge these risks exist and begin to develop risk mitigating strategies related to the disposal and treatment of their livestock manure.

▪ Economic Issues of Manure Management

Manure is a valuable source of plant nutrients but also a potential pollutant. The proper management of nutrients from organic sources such as animal manures, bio-solids, and plant residues is important in order to protect our country's environment and to have economically and environmentally sustainable livestock enterprises. The complexity of livestock production is further enhanced now that strict regulations regarding the disposal of Specified Risk Materials (SRMs) have been added to the menu. Today, economic issues related to manure handling and processing options go well beyond the subject of money or return on investment. Some of the new economic issues we need to be concerned about are discussed below.

▪ Manure Management Regulations

Economic issues relating to manure management cover a broad area of discussion. To start, let's examine the economic impact of manure management regulations. Our civil society acknowledges the fact that federal and provincial governments pass laws and establish regulations intended for the general good. The rule of law is what separates western counties such as Canada from counties run by dictatorships. Throughout Canada, there are an increasing number of federal and provincial rules and regulations that dictate the size and location of livestock operations and how manure from these enterprises is to be managed. These rules and regulations have a significant economic impact on livestock enterprises especially as they relate to the time invested by managers as they become knowledgeable about them.

If you visit the link on Alberta Agriculture, Food and Rural Development's web site (*http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/epw9908*), you will find the list of requirements for managing manure handling and disposal

as well as requirements for siting new or expanding livestock operations in Alberta. The Agricultural Operation Practices Act (AOPA) is just one of the extensive lists of new and emerging legislative requirements livestock producers must now follow. An extensive list of supplemental guides and sources of manure handling information for livestock producers is also provided.

A related link directs livestock producers to the Natural Resources Conservation Board website (*http://www.nrcb.gov.ab.ca/home/default.aspx*). for detailed information on what permits are required and how to apply for them Responsible livestock producers have no option other than to take the time to review, familiarize and comply with these and other regulations associated with manure management. Doing otherwise is a poor choice and impacts future decisions. The economic choices facing livestock producers regarding regulatory compliance is short term pain for long term gain. What might appear to be the least costly at the beginning often ends up costing more over the longer term.

▪ Economics of Small, Medium and Large Livestock Operations

Europeans spend a greater proportion of their disposal income on food than North Americans. We could have a lively discussion on that fact alone. Technological advancements in genetics, nutrition and animal health have resulted in increased productivity and efficiencies in animal production. Higher numbers of pigs weaned per sow mated and shorter days to market are two such examples. To a large extent, it has been productivity improvements and increased efficiencies that have kept food prices low. Vertical and horizontal integration have also had an impact although one could argue that producers have not befitted from increased efficiencies in the value chain to the same extent as consumers, processors and retailers.

The trend to fewer and larger hog production enterprises in Canada is well documented. When grain prices are depressed, raising pigs was considered one way to survive until prices improved. Production from these new operations soon created an oversupply of market hogs with a resulting rapid drop in producer prices. Later when these producers exited the industry, the problem was compounded until supply caught up to demand. Today, with high energy prices and attractive employment opportunities in the energy sector, more farmers have off farm income. Raising a few pigs is no longer as attractive as it once was.

The debate regarding size of livestock production units has to a large extent already been decided by our local communities and increasingly by animal

rights organizations. Growth in hog production is likely to continue in provinces where populations are small, and employment opportunities are limited. Even in these areas there will be a limit to the pace and level of growth. Economic reasons are unlikely to be the primary factors that determine the growth of hog production in western Canada. It will be the local populations' concerns about the impact on air, water and soil from manure disposal that determines support or resistance to new and expanded livestock enterprises. Acreage owners don't seem to mind the smell of horses but you can forget about raising pigs in areas adjacent to cities and towns.

Livestock producers considering future growth must look beyond the question of economics of small, medium or large operations and develop risk mitigation strategies that eliminate or at least reduce the potential of conflict with their neighbours well in advance of making the decision to expand. This involves choices about whether to relocate to a less populated area, and meeting with the people in the area most immediately impacted to involve them in decisions regarding how manure from the enterprise will be handled. This will involve characterization of social interactions within a community regarding the effect of concentrated animal feeding operations, economic factors of large- and small-scale animal production for rural communities, processes for developing regulations based on the social and scientific factors, how public perception is formed regarding animal production, fairness and consistency of regulation enforcement, and role of local communities in establishing regulations.

▪ Regulations for Animal Agriculture versus a Comprehensive Approach to Pollution Problems

A proactive and comprehensive approach to pollution problems before they happen makes economic sense. Too often regulations that drive change occur when someone gets sick or dies. How many people are hurt or killed in cities and towns before a four way stop sign gives way to a traffic light? The same logic can also be applied to livestock production. For example, is hog manure contained in properly constructed and maintained earthen manure storage (EMS) lagoon safer than concrete or steel? Many will argue that EMS is less costly but is that true if groundwater becomes contaminated irrespective of what caused the problem? Should it be the Department of Environment or the Department of Agriculture that develops the regulations for manure management? How should politicians address the competing demands of agriculture and other industries? To its credit, the livestock industry is not sitting idly by and ignoring manure related environmental problems. The hog and diary industries in particular have taken several initiatives supporting measures designed to mitigate environmental risks associated with manure management. More responsible manure handling and processing opportunities are generating renewed interest in biodigesters

and production of green energy. When combined with recent government policies supporting production of green energy, the future appears more encouraging.

■ The Economic Value of Air, Water and Soil in Determining the Costs for Implementing Waste Management Practices

How do you determine the true value of clean water, clean air and unpolluted soil? In Alberta, water quantity is becoming equally important as industry and the rapidly increasing population of our Province compete for finite water supplies. Cities and towns charge consumers for the water they consume but there are many older homes in Calgary that do not have water meters. Where is the incentive to conserve water when you are charged a flat fee irrespective of the amount of water you use? Irrigation of crops in southern Alberta is also a major consumer of water supplies. Without irrigation many farms would not survive. It is not a case of if, but when, water used for irrigation becomes limited and more costly. It won't be long before water is valued as a depleting resource. The amount of water used during mining of the oil sands is also drawing increased attention and concern.

Implementing waste management practices, such as more responsible and sustainable manure management practices or more efficient irrigation of crops, should be looked at as an investment rather than a cost. The challenge is how this investment can be shared so we all benefit. To start, those of us in cities can do many things to reduce our water consumption. Installing water meters is a good first step. Turning off lawn sprinklers is another. Xeriscaping yards to reduce water-consuming lawns may not look pretty but it saves on watering, mowing and adding to land fills.

Most farmers are environmentalists when it comes right down to it as they live and breathe it everyday. Valuing clean air, water and soil should not be seen as an academic exercise. They are scarce resources and we ignore them at our own peril.

■ The Role of Local, Provincial or Federal Policies and Their Impact on the Economics of Waste Management

Who should have the greatest input on the economics of waste management practices is not an easy question to answer. The Canadian way would be to establish a Royal Commission, invest several millions of dollars in public hearings and write a report that few people read. Another approach might be

to start charging the true costs of managing wastes in proportion to who produces them i.e. let market forces determine value. This might work if waste management was publicly regulated and contracted out to the private sector rather than publicly run. Cities like Calgary do not contract out these services bringing into question whether these are true or inflated costs.

Livestock enterprises must assess the economics of their waste management from several perspectives. They must assess the policies of all three levels of government when considering the practices they are by law, to follow. What used to be only a local concern can have national consequences. Deciding to shoot, shovel and shut up could end up shutting us out of important export markets. Responsible reporting and disposing of dead animals is as important to livestock producers today as is proper manure containment and treatment. Consumers have to be confident that our food supplies are safe both at home and abroad.

▪ Public and Private Financing for Implementing Environmental Practices

There is an increasing opportunity for a public and private partnership to attract investment in sustainable environmental practices including manure handling and processing. Increasingly, provincial and federal governments are introducing programs and policies designed to encourage the production of green energy. European countries and their governments have been leading this charge for many years. Instead of trying to pick winners, policies designed to support private sector initiatives in developing biodiesel, biogas and wind energy projects are gaining popularity. This is a good start. Investment in flow-through shares for the energy sector stimulated investment in that industry. A comparable program to encourage green energy production from processing of livestock wastes could achieve similar results.

▪ Responsible Choices and Better Decisions

Declining rural populations and increasing urbanization are forcing livestock enterprises and hog producers in particular to develop risk management strategies linked to manure disposal and processing opportunities. What is the cost of having a barn shut down because it is no longer welcomed in the community? EMS might be less costly to start, but it could also be the primary reason for odour complaints.

Williams and Bull, in their publication *Overview of Innovation in Manure Processing Technologies* lists several Environmentally Superior Technologies (EST) that livestock producers should consider when developing their risk

management plan They define EST as “any technology, or combination of technologies that (1) is permittable by the appropriate governmental authority; (2) is determined to be technically, operationally, and economically feasible for an identified category or categories of farms, and (3) meets the following performance standards:

- Eliminate the discharge of animal waste to surface waters and groundwater through direct discharge, seepage, or runoff;
- Substantially eliminate atmospheric emissions of ammonia;
- Substantially eliminate the emission of odour that is detectable beyond the boundaries of the parcel or tract of land on which the swine farm is located;
- Substantially eliminate the release of disease-transmitting vectors and airborne pathogens, and
- Substantially eliminate nutrient and heavy metal contamination of soil and groundwater.

The overview identified the following list of EST candidates:

- In-ground ambient temperature anaerobic digester / energy recovery / greenhouse vegetable production system.
- High temperature thermophilic anaerobic digester (TAnD) energy recovery system.
- Solids separation / constructed wetlands system.
- Sequencing batch reactor (SBR) system.
- Upflow biofiltration system.
- Solids separation / nitrification-denitrification / soluble phosphorus removal /solids processing system.
- Belt manure removal and gasification system to thermally convert dry manure to a combustible gas stream for liquid fuel recovery.
- Ultrasonic plasma resonator system.
- Manure solids conversion to insect biomass (black soldier fly larvae) for value-added processing into animal feed protein meal and oil system.
- Solids separation / reciprocating water technology system.
- Micro-turbine co-generation system for energy recovery.
- Belt system for manure removal.
- High-rate second generation totally enclosed Bion system for manure slurry treatment and biosolids recovery.
- Combined in-ground ambient digester with permeable cover / aerobic blanket-BioKinetic aeration process for nitrification-denitrification / in-

ground mesophilic anaerobic digester system (this project represents 3 farm sites).

- Dewatering / drying / desalinization system.
- Solids separation / gasification for energy and ash recovery centralized system (this project represents 3 farm sites).
- High solids high temperature anaerobic digester system, and
- Solids separation / mesophilic anaerobic digestion / membrane filtration-reverse osmosis system.

Livestock producers and their supply chain partners should proactively investigate whether any one of these technologies can be adapted to their production units. Livestock producers can no longer afford the gamble that land will always be available for manure disposal. As one example, the Cement Association of Canada has and is still funding research (at the PSCI and IRDA). This group has developed standards for farmers to ensure that its product (concrete) is properly specified and placed, done studies (with PSCI) on life cycle costs of alternative (and improved) approaches to barn design and manure management, and even helped to promote innovative IWMS installations (like Clear-Green's at Cudworth and DGH Engineering's installation north of Winnipeg). In my view, this is "enlightened self interest", since supply chain partners only benefit over the long term from a healthy, growing and sustainable industry.

A second excellent overview of the economics of manure handling and processing options is the paper entitled *Integrated Manure Biogas Systems: Impacts on Farms and their Rural Communities*. The author, Bowman, focuses specifically on the economic, environmental and social issues associated with the production of biogas from the anaerobic digestion of livestock manure. Bowman's vision of biogas production from organic feedstock such as livestock manure is similar to my own. Energy systems powered by biogas are viewed as an exciting opportunity for revitalizing rural economies under the right economic conditions. He mentions other benefits to the environment such as odour reduction and elimination of pathogens. The presentation identifies a number of major challenges facing intensive livestock production that all livestock producers should know about.

Conclusion

Some segments of our society are claiming that there are readily available alternative manure processing and management technologies that have been adequately developed and verified to the point that they can replace existing systems such as EMS containment. However, while there are a number of different technologies and management systems available, the practicality of

applying many of these alternative technologies is largely unproven at the present time.

For example, many promising alternative technologies generate solids but only limited viable markets have been identified or established for the end products. This limitation significantly impacts the economic feasibility of the technology especially for products intended for compost markets. In addition, some manure processing systems have not performed well under performance verification testing or are cost-prohibitive. Other potential replacement technologies are still in field trials and need further evaluation before any definitive conclusions can be reached. The present level of research, development, and demonstration efforts, however, provides optimism that innovative alternatives may be developed and proven practical in the future.

Waste management practices that generate economic, social and environmental benefits have value to both the public and private sectors. This is especially true with how livestock manure is managed on our farms. Other countries have seen what can happen to livestock production when manure from these operations is not properly handled or where livestock concentrations have exceeded local support. The choices we create and the decisions we make will determine the future of our livestock industries.

■ References

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