Beef - It’s What’s For Dinner?

BUILDERS

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While Silicon Valley technologists search for the science-crafted animal replacements to address the world's growing need for protein, they are ignoring the most impactful solution - bringing efficiency, process, and basic analytics to the existing $1.7 trillion industry.

The Problem

The UN Food and Agriculture Organization has estimated that by 2050, global meat production must increase from 270 to 470 million metric tons to meet demand. World population is expected to top 9 billion, and world income is expected to jump significantly[1]. Income is positively correlated with meat consumption[2], and while beef may not be the preferred protein that a global middle class family purchases, "a rising tide lifts all boats." At current production levels, the meat industry will have a difficult time satisfying protein demand.

To fill this gap, much of the technological focus has been on animal-protein replacements. Despite increased demand for alternative meat products, that market generated just $4.2 billion, a tiny fraction of the $1.7 trillion meat industry[3].

Consequently, we believe the solution is not to give up on the current system, but to make it better. Rather than focusing on the niche alternative-meat market, Builders VC is driving efficiency in the existing supply chain, which must evolve into a healthier, more efficient, and more sustainable industry to satisfy global protein demand.

[1] http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf

[2] https://ourworldindata.org/grapher/meat-consumption-vs-gdp-per-capita

[3] "Alternative proteins: The race for market share is on" by Zafir Bashi et. al., August 2019
https://www.mckinsey.com/industries/agriculture/our-insights/alternative-proteins-the-race-for-market-share-is-on

The Current System

Most American beef begins on small family-run cow-calf operations, with herd sizes averaging about 44 head per farm. Profits are small and highly variable, ranging from -$170 to $200/head, and so these farms must supplement with other income sources. Maximizing cattle production efficiency is not the primary focus.

Cow-calf operations breed, calve, grow, and wean calves from cows before selling or auctioning them to larger confinement feedyards. Feedyards often encompass over ten thousand head contained within a few hundred acres. There, animals are fed and cared for an additional 6-12 months.

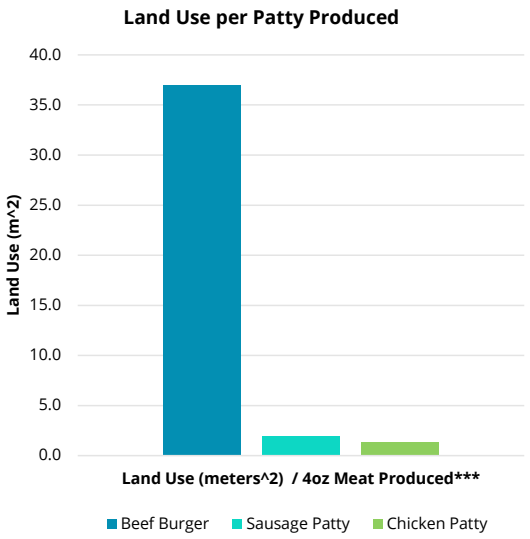
The goal of a feedyard is to grow muscle and fat on the animal as efficiently as possible. Synthetic hormones, antibiotics, and vaccinations are tools used to augment cattle health. Their use contributes to the efficiency of weight gain. It is paramount that the cattle stay healthy while they gain weight, though illness is common and challenging to detect.

Once the cattle are of a desirable weight and body composition, they are sold to the slaughterhouse, harvested, fabricated, and shipped to consumers.

Livestock Efficiency

Beef is one of the least efficient livestock species. For comparison, poultry and swine are more efficient than beef by orders of magnitude. For cattle to gain one pound of mass, it must consume 3 times as much feed as a chicken, or 1.7 times as much as a pig.[4] By nearly every efficiency metric, cattle are less efficient than all other livestock.

The reasons for this are largely biological. Cattle require more time to mature and, as larger animals, have higher caloric maintenance requirements. The greater challenge is that feed efficiency has not substantially improved since the 1950s - researchers estimate about 30% improvement. Compare this to poultry, which has improved 250% in the same time frame.[5]



[4] FTG (Feed to Gain) ratios are roughly 6:1, 3.5:1, and 3:1 for cows, pigs, and chicken, respectively.

[5] "Feed Efficiency in Feedlot Production" by James Byrne, February 28, 2018
http://www.omafra.gov.on.ca/english/livestock/beef/news/vbn0218a2.htm

Most of the progress has come during the feedyard production phase. The vast majority of animals spend their last months prior to slaughter growing at feedyards. The average economic scale of a feedyard makes them the most likely to adopt new technology.

Technology

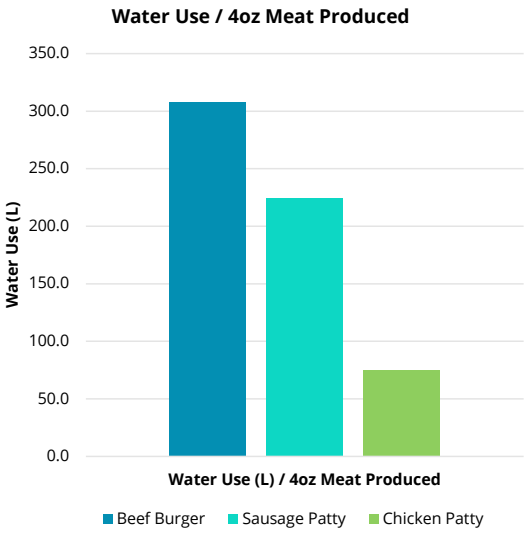
Driving efficiency in the animal supply chain can come from many different technologies:

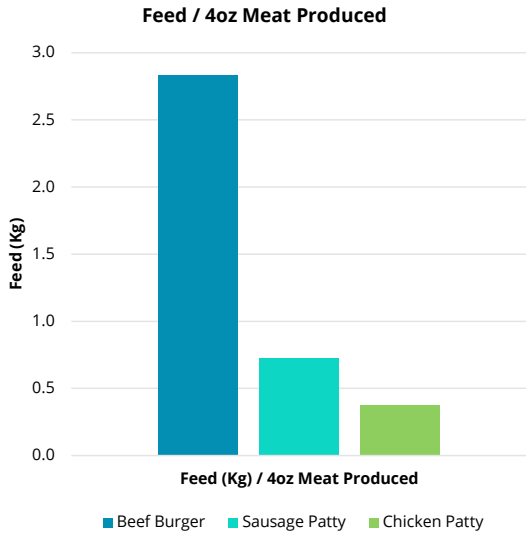
Many small and medium sized feedyards are struggling with negative gross margins and high variability year to year. Performance Livestock Analytics helps these feedlots better manage their operations. Their technology allows farmers to see daily performance and farm profitability, something previously only calculated at bi-annual reconciliations. Using bluetooth scale devices, a mobile data platform, and real-time feed prices, they allow feedyards to make data-driven decisions. This is crucial at a time when overall profitability is declining.[6]

Another issue is the efficiency of cow-calf operations. Often they do not focus on efficiency because cattle are not a substantial portion of income. However, Agriwebb is changing this. They have created farm management software that increases the efficiency of cow-calf operations and enables animal traceability. Resources are allocated more efficiently, and grazing becomes more effective. Agriwebb matches business goals with operational metrics.

On the biotech side, a lot can be done to create superior cattle. Ascus Biosciences utilizes a platform for microbial discovery to identify naturally occurring bacteria that increase nutrient uptake and overall health. Their technology has increased the milk fat concentration by 10% in dairy cows, and has demonstrated decreased mortality rates for other animals such as chicken.

Finally, beef is only one area of potential technology impact. Swine, dairy, poultry, and aquaculture all stand to benefit from increased efficiency. For example, Soma Detect is a company using spectroscopy to directly monitor dairy milk quality and the health of an animal at the stall. Their technology can monitor diseases before they are visible to the rancher, helping to decrease the use of antibiotics, and creating healthier animals. By raising the





[6] "Profit Tracker: Feeding Margins Continue Decline" by Greg Henderson, March 18, 2020
https://www.drovers.com/article/profit-tracker-feeding-margins-continue-decline

quality standard, Soma Detect will encourage the industry to focus on better treatment of animals and help reward higher quality producers with a price premium.

Whether solutions are to be found in operations technology, or in genetic improvement, there is a lot of potential growth in the livestock industry. While other industries readily adopted IoT years ago, only now can we see feedyards do the same. Technology is just beginning to penetrate this sector, with incredible potential for higher yields, growth optimization, and improvements in animal health.

Environmental Impact

Reducing the environmental impact of beef and all livestock must become a greater priority as consumers become more environmentally conscious, and regulators scrutinize environmental impact. However, the weighing of social benefits and costs of beef is extremely difficult.

The social benefits of beef are impossible to fully quantify. Cattle have the power to upcycle food waste into high quality protein, and produce organic fertilizer with the power to regenerate land. Though some land is unusable for agriculture, cattle are still able to graze. However, even these statements fail to capture the overall, immense benefits of beef to our civilization. Beef and animal husbandry are as old as civilization itself, and it is unlikely it will simply be done away with for purely environmental concerns.

On the other hand, we know that beef emits the most greenhouse gases of any livestock animal. Cattle are a very resource intensive animal: they use more land than almost all livestock animals by an order of magnitude[7]. Further it takes much more water[8], and much more feed to produce a pound of beef, relative to other animals.

However, environmental impact can vary greatly depending on how the cattle are handled[9]. The most sustainable systems depend on the climate and resources. Is a livestock production system using untapped grasslands for grazing, or deforesting to create new grasslands? How many pounds of food is each animal producing? What kind of feed are they eating? Is there a more

[7] https://ourworldindata.org/grapher/land-use-per-kg-poore

[8] https://ourworldindata.org/grapher/water-withdrawals-per-kg-poore

[9] "What does sustainability mean for beef?" by Sara Place, April 16, 2018
https://www.greenbiz.com/article/what-does-sustainability-mean-beef-sponsored

optimal use for the land? Production optimization aided by technology could yield significant impact while providing a long-term framework for managing necessary growth.

None of this is to say that these uncertainties should prevent action. To the contrary, the less we know about beef's potential environmental impact, the more we should be concerned, and the more we should try to improve it.

Supply Chain Risk

With the outbreak of the COVID-19 virus, it has become all the more apparent that supply chains can be very fragile. Beef is no different, and so it is worth discussing the different ways feedyards can mitigate risk.

Feedyards, in particular, face a lot of supply chain risk because their product is very perishable. In addition, because beef is a homogeneous commodity, feedyards are largely price-takers, putting them in a fragile position.

Further, the supply of cattle is subject to disease and pandemics. Investment in diversification, risk mitigation, insurance and supply chain technology could become very important as these risks become more acute in a globalized economy.

In addition, production labor is a problem and opportunity for beef. Prior to the pandemic, labor supply in feedyards and meat packing plants was very tight. The work is difficult, wages are low, and the rural geographies are not highly sought after. COVID-19 has put even more pressure on this tight situation. Some plants are already being forced to cut production as workers contract COVID-19. Further, social distancing within plants,will likely lead to a plummet in production[10].

The ability for communities to shelter in place is contingent on the continued supply of meat and other food products. Food production has always been a social/public good. Social distancing in a human pandemic amplifies the public dependence on food production technology and labor. How can food manufacturing retool to mitigate the risk of human labor? Incentives to mechanize and invest in robotics will likely spike higher.

[10] "Personal safety: Restless workers could break the meat supply chain" by Lisa M. Keefe April 2, 2020 http://www.micausa.org/personal-safety-restless-workers-could-break-the-meat-supply-chain/as

The food production industry now has at least two incentives to invest in non-human mechanization. Mechanization, via the reduced dependence on human labor, reduces the exposure to human pandemics. Mechanization is risk mitigation not just for the private businesses, but for governments as well. Ultimately, restricted production because of human labor hurdles will cause beef prices to rise. Higher prices will create the incentives for investments in production technologies.

Conclusion

Beef and livestock have never been considered "sexy" industries, especially for VC firms focused on the next big thing. However, these are massive, core industries. As the global protein supply is strained, the potential for long-term growth through sustainable, technology-driven solutions creates tremendous opportunities as global protein supply is strained. As with most antiquated industries, IT and biotech contain untapped benefits for these sectors. Entrepreneurs will be a critical part of fixing these laggard industries through technology. What problem could be more important than feeding the world?

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[4] http://www.motivedrilling.com/case-studies/eagle-ford-s-texas

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