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HERITAGE CHICKENS: THE CHALLENGE OF GENETIC SUSTAINABILITY

Marni Devlin Moses and Leanne Hedberg wrote this case under the supervision of Professor Joel Gehman solely to provide material for class discussion. The authors do not intend to illustrate either effective or ineffective handling of a managerial situation. The authors may have disguised certain names and other identifying information to protect confidentiality.

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The Poultry Research Centre (PRC) at the University of Alberta farm was an internationally recognized research, development, and learning hub. In 1986, the PRC began the Rare Poultry Conservancy Program as a way to maintain heritage chicken breeds. But years later, due to the global financial crisis, university funding was cut, and every department on campus was forced to either cut programs or find creative ways to finance them.

By 2014, the funding cuts posed grave concern for the heritage chicken program, which cost approximately $75,000[[1]](#endnote-1) per year to maintain and returned very little income. Dr. Martin Zuidhof, the academic leader of the PRC, felt that the birds were important enough to try to figure out a way to keep the program going. One option he considered was the development of a business model in which the program could pay for itself. Other options included scaling down the program to reduce costs and seeking other funding.

**THE POULTRY INDUSTRY**

Livestock production had grown to become the world’s largest user of land, through both animal grazing and the consumption of feed.[[2]](#endnote-2) Global consumption of animal products had increased over the preceding decades, especially in developing countries, with the poultry industry having grown at the fastest rate.[[3]](#endnote-3) The growth was largely due to increases in population and increased demands for animal products.

By 2014, the global poultry industry represented more than 90 million tonnes of chicken meat (see Exhibit 1). The increase in chicken meat production grew by nearly 60 per cent from 2000 to 2014, in contrast to a 6.3 per cent worldwide population growth over that same time period.[[4]](#endnote-4) Such rapid growth presented challenges in terms of the natural resource base required to support the increased poultry demand. This situation led producers to implement rigorous selection practices aimed at raising larger poultry, in less time, and with less feed and space. Essentially, chickens were selected and bred to amplify several characteristics: high egg production rates, fast growth, large size, and reduced food consumption.

Over time, chicken and other animal products became marketed as commodities, with little distinction between products from different producers. The outcome was a uniform chicken product marketed on the basis of traits that provided the greatest return on investment. With a growing demand for poultry, this production model made it possible for producers to raise chickens almost anywhere in the world. However, the focus on efficiency through targeted selection practices resulted in decreased genetic diversity in the poultry population and some unintended consequences, or externalities, including an increased incidence of animal disease and animal welfare issues.[[5]](#endnote-5)

Given the negative aspects of the commodity-based poultry model, an emerging consumer market desired poultry products that were not so uniform. Chickens that were farm-raised, organic, or fed a specific diet addressed a different and growing segment of the market—consumers who were concerned about commercial poultry practices and were willing to pay more for something different.[[6]](#endnote-6) Heritage chickens were not selectively bred; instead, they were descendants of the original breeds of chickens introduced by Spanish explorers, which resulted in unique characteristics. Providers of heritage chickens acknowledged the environmental and social considerations, thereby adding value to the product itself and to the industry as a whole. Heritage chicken providers were able to differentiate themselves from one another, creating a competitive advantage with a unique product in a niche market.

In addition to the development of niche markets, heritage chicken breeds had inherent value as a source of genetic diversity, which allowed a species to adapt over time to changing environments, such as changing weather patterns or the emergence of new diseases. The value of these chickens, therefore, increased as a result of their new market potential, and their potential to act as insurance against the adverse consequences of the commodified poultry industry.

**The U.S. and Canadian Poultry Industries**

The U.S. poultry industry sales value for 2014 was estimated at US$48 billion,[[7]](#endnote-7) representing a 9 per cent growth from the previous year (see Exhibit 2) and making the United States the world’s largest chicken producer. In contrast, in Canada, poultry and egg production was valued at $4 billion in 2013,[[8]](#endnote-8) with most production found in Ontario and Quebec.

By 2014, approximately 40 companies were involved in the U.S. poultry industry, practising vertical integration, which allowed producers to manage and ensure quality at each of the many steps in the supply chain.[[9]](#endnote-9) In 2012, the U.S. poultry industry represented 1.3 million jobs, US$63 billion in wages, and generated more than US$23 billion in taxes.[[10]](#endnote-10)

American chicken consumption was the highest in the world at 84.7 pounds (38.4 kilograms) per capita annually (see Exhibit 3). While consumption rates in developing countries were lower, they were growing at a faster rate than in developed countries.[[11]](#endnote-11) This growth represented both a significant opportunity and a challenge for the chicken industry—an opportunity to meet the growing demand and a challenge to maintain the health and safety standards required to ensure that chicken populations were sustainable.

**Industry Responsibility**

With the growth of the chicken industry, the responsibilities to address and mitigate the rising challenges were not completely clear. Companies that produced poultry needed to maintain the value of their product, while also considering issues of animal welfare, resource use, and consumer demand. Businesses played a role in shaping the economy by adhering to a set of goals and beliefs that governed their practice. If a company said that it aimed to act in responsible and sustainable ways, but then failed to act in ways that supported that goal, its credibility could be diminished. A company’s brand was critical to its future success, and, thus, its sustainability. Therefore, protecting that brand by adhering to a core set of values was important and a consideration for all business practices.

According to Valente and Crane, companies that worked in developing countries had an obligation to step into traditional government roles in providing services, infrastructure, and support.[[12]](#endnote-12) Their thinking appeared to hold some relevance for the poultry industry. Essentially, the criteria that determined whether a particular business was sustainable could change dramatically over time, which presented a need to continually evolve how businesses defined sustainability in the context of meeting current business needs without compromising the ability of future generations to meet their business needs. Consistent with an evolutionary perspective, the needs of the public were apt to change over time, creating pressure for adjustment in an attempt to meet those changing needs. Businesses could adapt in two ways: first, they could act as drivers of change by identifying such trends and opportunities, and second, they could become partners in the efforts to solve societal issues, especially given their prominent role in those issues.

**THE POULTRY SUPPLY CHAIN**

The poultry supply chain consisted of parent or grandparent stocks (i.e., chickens) that produced chicks, which were transported to pullet farms where they grew to approximately 20 weeks of age (see Exhibit 4). At that time, the chicks, now chickens, were artificially inseminated and moved to breeder farms where they started laying fertilized eggs at 26 weeks. These eggs then went to a hatchery, where they were raised for either egg production or broiler (i.e., meat) production. The chickens were given water and feed to maximize both their growth potential and their taste profile.[[13]](#endnote-13) The diet also included the use of antibiotics and enzymes to control disease and potential digestive problems. Broiler chickens reached their maximum weight by approximately 46 days, at which time they were slaughtered and sold.[[14]](#endnote-14) By that time, the next round of chickens was ready for the hatchery, and the cycle repeated itself.

Many poultry companies were vertically integrated to enable control over many of the steps in the supply chain. Although vertical integration allowed for cost control and product uniformity, it resulted in the evolution of a narrowly defined standard for chicken output. Uniformity, however, led to issues that could potentially span the entire industry (e.g., a salmonella outbreak), posing a major risk to consumers. In addition, vertical integration tended to constrain the development of innovative practices, which were often an outcome of market competition.[[15]](#endnote-15) Thus, a commodity market and high levels of vertical integration could lead to less investment in research and development and less competition with fewer competitors.

Commercial chickens had changed substantially over more than half a century. For example, compared with chickens in the 1950s, chickens in 2008 grew much larger and more quickly as a result of targeted and specific genetic-selection programs. This relatively short amount of time—less than 60 years, in which chickens had “evolved”—seemed unnatural, especially when compared with the length of time attributed to natural evolution, typically measured in thousands or millions of years. Despite the rapid change, commercial chickens had not necessarily evolved in all aspects of their growth and development, meaning that the evolution was not balanced (e.g., body sizes grew significantly, while leg size and the strength to hold the larger body sizes had not evolved commensurately).

**Supply Chain Challenges of Antibiotic Resistance**

The commercialized poultry industry had faced many challenges, including addressing animal welfare issues, the increased incidence of deadly disease, the reduction in genetic diversity, and increased product demand. While each of these areas had significantly affected the industry, antibiotic resistance featured prominently in the media. Antibiotic resistance, which was well documented in scientific literature,[[16]](#endnote-16) also made its way into mainstream media. Campaigns such as “Do Bugs Need Drugs?” highlighted how the overuse of antibiotics created resistant strains of bacteria. [[17]](#endnote-17)

The public, well aware of the potential issues with antibiotic use in poultry, increasingly demanded products not treated with antibiotics. Companies such as A&W Restaurants, Inc. responded by offering only antibiotic-free chicken and beef products, which created a large market for chickens raised without antibiotics.[[18]](#endnote-18) The practice of using only antibiotic-free poultry and beef was likely to become the norm among restaurants wanting to maintain their market share. This practice could alter the supply chain model by creating a non-commodity-like market, thereby revolutionizing not only specific aspects of the chicken supply chain but also the production capacity and the chicken products that were brought to market.

**HERITAGE CHICKENS**

The Livestock Conservancy was a U.S. non-profit agency with a mission “to protect endangered livestock and poultry breeds from extinction.”[[19]](#endnote-19) The Livestock Conservancy defined the unique characteristics of heritage chickens as follows:

* *American Poultry Association (APA) standard breed*: A heritage chicken must be from the parent and grandparent stock of breeds recognized by APA prior to the mid-20th century, whose genetic line could be traced back multiple generations, and with traits that met the APA Standard of Perfection guidelines for the breed.
* *Naturally mating*: Heritage chickens had to be reproduced and genetically maintained through natural mating (as opposed to artificial insemination).
* *Long, productive outdoor lifespan*: Heritage chickens had to have the genetic ability to live a long, vigorous life and thrive in the rigours of pasture-based, outdoor production systems. Breeding hens should be productive for five to seven years and roosters for three to five years.
* *Slow growth rate*: Heritage chickens had to have a moderate to slow rate of growth, reaching the appropriate market weight for the breed in no less than 16 weeks. This slower growth rate gave the chicken time to develop strong skeletal structure and healthy organs prior to building muscle mass.

Heritage chicken breeds differed markedly from commercial chickens. Commercial lines were relatively uniform in terms of their look and genetic profile. They were hybrids of different breeds that were chosen to cross-breed in an effort to amplify the most desirable commercial traits (e.g., egg production and growth rate). They did not mate naturally and grew primarily in indoor, high-volume facilities.

Heritage chickens were important because they represented a wide range of genetic diversity and different characteristics. Commercial lines had lost approximately 50 per cent of their genetic diversity, which limited their ability to adapt to changing conditions.[[20]](#endnote-20) More than 60 per cent of chicken breeds were extinct or endangered.[[21]](#endnote-21) Since the 1990s, 238 chicken breeds had been lost.[[22]](#endnote-22) To preserve the remaining genes, heritage chickens were maintained, in part to provide research opportunities to study various genes, the function of those genes, and their potential to solve future problems. The protection of heritage chickens also provided important options relative to changing consumer preferences and innovative problem-solving opportunities. In effect, heritage chickens were both a form of insurance against potential disease and a way to maintain copies of genetic material that would otherwise have been lost. In the same way that we link value to original works, such as paintings or documents, heritage chickens had the original copies of many genes, which led to their inherent value.

In addition to maintaining diversity, heritage chickens also offered opportunities to engage students in learning about genetics and history, not only from a scientific perspective but also regarding the business value they offered. The intersection of science and business education offered true learning opportunities about the natural world’s clear and measurable impact on the business world.

Heritage chickens offered an opportunity to connect with those who wanted to know more about the food they ate and where it came from, through public awareness and marketing campaigns for this new market. In terms of raising chickens, the commercial industry had such large production facilities that small farms faced challenges to enter the chicken market. However, a growing trend was the emergence of small-flock owners who were interested in raising their own chickens and entering the niche market for farm-raised heritage chicken. This market was not likely to affect global capacity issues related to food supply, particularly in developing countries. Yet there was a growing demand from consumers interested in animal welfare. The sale of heritage chicks represented another opportunity for growth.

**HYBRID MODELS**

The concept of a hybrid model of business had emerged as a different way to do business that addressed sustainability as part of the fundamental model. Haigh and Hoffman noted how the hybrid model was the next stage in sustainable business, in that it blurred non-profit social engagement with for-profit business techniques.[[23]](#endnote-23) In other words, a hybrid business combined both a profit motive and a social purpose. Hybrid companies valued their relationships with experts outside the company, including politicians, scientists, lay people, and others who were interested in the outcomes of the business. The idea that a hybrid model would lead to a stronger product or service model emerged as a potential competitive advantage.

In biology, the concept of a hybrid carried a different meaning. In the poultry industry, commercial hybrid breeds were a combination of desirable traits that had been selected to both provide the most economic benefit and meet consumer demand. Hybrid animals helped to amplify desirable traits in a profitable way. However, hybrid chickens had a lower amount of genetic diversity and, thus, less ability to adapt to changing environments. By comparison, heritage chickens maintained their genetic diversity and allowed for the retention of genes that were important, both then and likely for the future. However, there was a need for both hybrids and purebreds. The complex combination of genes generated almost endless possibilities for traits, but the retention of the original copies from which to allow for adaptability was critically important to the long-term sustainability of the industry. Hybrid and purebred chickens were thus both important.

**DECISION TIME**

What should Zuidhof do to preserve the Rare Poultry Conservancy Program? What type of business model would enable the program to pay for itself? Or should he consider scaling down the program? One final option might be to seek other funding.

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Exhibit 1: Global Poultry Trends: Chicken meat production, 2000–2014

(in millions of tonnes)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Region** | **2000** | **2005** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012E** | **2013F** | **2014F** |
| Africa | 2.8 | 3.3 | 3.7 | 4.0 | 4.2 | 4.5 | 4.6 | 4.7 | 4.7 | 4.8 |
| Americas | 27.1 | 32.7 | 35.0 | 37.4 | 36.7 | 38.6 | 39.9 | 40.4 | 41.2 | 41.9 |
| Asia | 18.6 | 22.4 | 25.0 | 26.2 | 28.0 | 29.1 | 29.8 | 30.3 | 30.7 | 31.2 |
| Europe | 9.3 | 10.9 | 11.6 | 12.1 | 13.3 | 13.9 | 14.6 | 14.9 | 15.2 | 15.5 |
| Oceania | 0.7 | 0.9 | 1.0 | 1.0 | 1.0 | 1.1 | 1.2 | 1.3 | 1.3 | 1.4 |
| **World** | **58.5** | **70.2** | **76.2** | **80.6** | **83.2** | **87.2** | **90.0** | **91.6** | **93.2** | **94.8** |

Note: E = estimate; F = forecast

Source: Created by authors using data from “Global Poultry Trends 2013—Asia Produces One-third of World’s Broilers,” The Poultry Site, September 2, 2013, accessed November 12, 2015, www.thepoultrysite.com/articles/2928/global-poultry-trends-2013-asia-produces-onethird-of-worlds-broilers/.

Exhibit 2: Value of U.S. Poultry Production, 2013 and 2014

(in THOUSANDs of dollars)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Broilers | Turkeys | Chickens | Eggs | Total |
| **2013**  **2014** | 30,761,669  32,724,667 | 4,839,562  5,304,537 | 87,939  96,557 | 8,678,859  10,166,321 | 44,368,029  48,292,082 |

Note: The data on broilers excludes states that produced fewer than 500,000 broilers; the data on chickens refers to the value of sales, not production.

Source: Created by the authors with data from United States Department of Agriculture, *Poultry—Production and Value: 2014 Summary*, April 2015, accessed April 2, 2017, http://usda.mannlib.cornell.edu/usda/nass/PoulProdVa//2010s/2015/

PoulProdVa-04-30-2015.pdf.

Exhibit 3: Per Capita Consumption of Poultry and Livestock,

1965 to Estimated 2016 (in Pounds)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | Beef | Pork | Total Red Meat | Broilers | Other Chicken | Total Chicken | Turkey | Total Poultry | Total Red Meat and Poultry | Commercial Fish and Shellfish |
| 1965 | 74.7 | 51.5 | 133.9 | NA | NA | 36.9 | 7.6 | 44.4 | 178.4 | 10.9 |
| 1970 | 84.4 | 55.4 | 145.1 | 36.5 | 3.7 | 40.1 | 8.1 | 48.2 | 193.4 | 11.7 |
| 1975 | 88.2 | 42.9 | 136.3 | 36.0 | 2.7 | 38.7 | 8.3 | 46.9 | 183.3 | 12.1 |
| 1980 | 76.4 | 56.8 | 136.1 | 45.2 | 2.1 | 47.4 | 10.2 | 57.6 | 193.7 | 12.4 |
| 1985 | 79.0 | 51.5 | 133.8 | 50.5 | 2.0 | 52.5 | 11.6 | 64.0 | 197.8 | 15.0 |
| 1990 | 67.5 | 49.4 | 119.4 | 59.0 | 1.7 | 60.6 | 17.5 | 78.1 | 197.5 | 14.9 |
| 1995 | 66.4 | 51.5 | 120.0 | 67.6 | 1.3 | 68.9 | 17.6 | 86.5 | 206.5 | 14.8 |
| 2000 | 67.5 | 50.8 | 120.2 | 76.6 | 0.8 | 77.4 | 17.3 | 94.7 | 214.8 | 15.2 |
| 2005 | 65.4 | 49.6 | 116.5 | 85.4 | 1.0 | 86.4 | 16.7 | 103.0 | 219.5 | 16.2 |
| 2010 | 59.4 | 47.2 | 107.9 | 81.8 | 1.0 | 82.8 | 16.4 | 99.1 | 207.0 | 15.8 |
| 2014 | 54.2 | 46.4 | 101.9 | 83.4 | 1.3 | 84.7 | 15.8 | 100.5 | 202.3 | NA |
| 2015 E | 54.3 | 49.7 | 105.2 | 88.8 | 1.3 | 90.1 | 15.5 | 105.6 | 210.8 | NA |
| 2016 E | 55.0 | 49.2 | 105.3 | 90.1 | 1.3 | 91.4 | 16.2 | 107.6 | 213 | NA |

Note: NA = not applicable

Source: Created by the authors using data from “Per Capita Consumption of Poultry and Livestock, 1965 to Estimated 2016, in Pounds,” The National Chicken Council, accessed November 10, 2015, www.nationalchickencouncil.org/about-the-industry/statistics/per-capita-consumption-of-poultry-and-livestock-1965-to-estimated-2012-in-pounds/.

Exhibit 4: Chicken Supply Chain

**Feed Mill**

Produces scientifically formulated feed for pullets and broilers

Source: Created by the authors using information from “Our Supply Chain and Antibiotics,” Tyson, accessed April 2, 2017, www.tysonsustainability.com/animal-well-being.

Endnotes

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