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JONAS BURBA

MASTER'S THESIS

SUSTAINABLE BUSINESS DEVELOPMENT IN THE POULTRY INDUSTRY USING JAPANESE MANAGEMENT MODELS

Kaunas 2025

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LIST OF ABBREVIATIONS

NGO – non governmental organization.

JIT – just in time production.

KPI – key performance indicator.

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INTRODUCTION

Relevance of the topic – in the modern era of agribusiness, the poultry farming sector is having an intensified pressure to adopt sustainable practices amid rising global demand and increasing environmental and ethical concerns. Poultry farming plays a crucial role in food security and the economy, yet traditional methods often raise sustainability challenges such as high resource consumption and ethical raising questions. It is therefore important to explore innovative approaches that encourage farmers to implement more environmentally responsible and efficient practices. In this context, Japanese management models – renowned for their emphasis on efficiency, waste reduction, and continuous improvement – offer a framework for guiding sustainable changes in poultry operations. Integrating these well-established management methods into poultry farming can provide a structured pathway to reduce waste, improve productivity, and enhance ethical standards, thereby aligning the industry with broader sustainability goals.

The application of Japanese management principles to sustainable poultry farming represents a new approach to the need of sustainability, and this specificity makes the topic particularly significant. To date, there is a small amount of research of agricultural sustainability and Japanese management models; most studies treat these domains separately. Only scarce academic work exists on how methodologies originally developed for manufacturing and business management– such as lean production, Kaizen can be effectively adapted to the poultry farming context. This gap in the literature underlines the importance of the present research. By addressing an under-explored field, the study contributes to a more comprehensive understanding of sustainability in agriculture and demonstrates how cross-industry management innovations can drive progress in traditionally resource-intensive sectors. Moreover, the timeliness of this need is seen, as industries worldwide seek strategies that balance productivity with sustainability, making the findings relevant to business.

Beyond its academic contributions, the relevance of this topic extends to several key stakeholder groups within the poultry industry and society at large. For poultry farmers, the insights from integrating Japanese management methods with sustainable farming practices can offer practical guidance and motivation for improving operational efficiency and animal welfare without increasing costs. The scientific and research community can also benefit, as the study provides an example of how established management frameworks can be repurposed to solve environmental problems, thereby broadening the discourse on sustainable agriculture with evidence-based management innovations. Policymakers and government regulators may likewise draw on the findings to inform the development of more effective policies and standards for ethical poultry farming. In particular, the evidence can support the crafting of regulations on animal housing,

resource use, and environmental impact measures that encourage the industry to adopt best practices. In summary, the thesis has multiple relevant points: it addresses a critical gap in research, offers practical solutions for improving sustainability in poultry farming through proven management changes.

Problem investigation level – the research conducted in this field (poultry farm sustainability using Japanese business models) is quite scarce and nonexistent. However, there is much research done if we separate the main topic into two parts – sustainability in poultry business and Japanese management sustainability.

To explain how to achieve sustainability in poultry farming there were works used by these researchers and legislations – Dawkins's (2016), EU Council Directive (1999), United Egg Producers (2010), Freire et al., (1996), Zotte, Cullere, Pellattiero, Sartori, Marangon, Bondesan (2021), Duncan (2001), Hartcher, and Jones (2017), Roderburg et. Al (2022), Castro et.al (2023), Lusk (2019), Muduli, Champati, Popalghat, Patel, and Sneba (2018).

To explain how Japanese management works in this article there were works used by these researchers - Palmer V S (2001), Dean M and Robinson A (1991) Brunet P (2000) Hamel, G., & Prahalad, C. K. (1996). Matsui, Y. (2007) Ohno, T. (2019 Choi, T. Y., Netland, T. H., Sanders, N., Sodhi, M. S., & Wagner, S. M. (2023). Esparrago Jr, R. A. (1988). Wakode, R. B., Raut, L. P., & Talmale, P. (2015). Agrahari, R. S., Dangle, P. A., & Chandratre, K. V. (2015). Hough, R. (2008 Sagi, D. S. (2015).

And lastly, to show that in the past there were efforts to adapt Japanese management models to the poultry industry there are references to the works by these researchers - Schrager (2018), Akagi (1993), Asahi Shimbum (1985), Kato et. al (2022), Kazancoglu, Ekinci, Ozen, and Pala (2021), Rother and Shook (1998), Asmudi, Rahmat, and Nofi (2018).

Literature used in the analytical part of the thesis - Little and Berrens (2004), Martelli (2009), Elson (1985), Appleby et al. (1992), Widowski and Duncan (2000), Lusk J. L. (2023), a survey done by European commission in (2016), Horne (2017), Sumner et al (2011), Zhang et al. (2023), Zhang and El-Mashad (2017), McGauran et al. (2020), Kazancoglu, Ekinci, Ozen, and Pala(2021), Amoretti et al. (2024), Estrada-Gonzales et al. (2020), Pelletier et al. (2014), Xin et al. (2011).

The essence of the problem – how to make poultry farming sustainable using Japanese management models?

The object of the thesis – sustainable Japanese management models in poultry farming

Aim of the thesis – to find out whether is it possible to use Japanese management models to

achieve better levels of sustainability in poultry farming industry.

Objectives of the thesis –

1. At theoretical levels to conceptualize what sustainability is and how is it beneficial for farmers in the poultry industry,
2. At theoretical levels analyze what Japanese models are good for achieving better sustainability levels in poultry management.
3. To examine how the Japanese management models were adapted to the poultry industry in the past.
4. To analyze literature that explains and shows examples on how sustainability is increased in the poultry industry.
5. To analyze literature and case studies on how Japanese management models were used to increase sustainability in the agriculture industry.
6. Empirically examine how can the Japanese management models be adapted to the poultry industry.

Structure of the thesis – the first chapter of the thesis "sustainable business in the poultry industry and the possibility of improvements using Japanese management models" introduces what are sustainable measures in the poultry industry and showcases how they are achieved by either going for a more ethical approach towards birds themselves or being more conscious about waste management. This chapter also introduces Japanese management models and shows how they could be used to achieve more sustainable measures by showing cases from real-life and theoretical approaches.

Second chapter of the thesis analyzes literature and case studies that show how to increase the sustainability efforts in the poultry industry. In this chapter, there are some case studies that show how sustainability efforts were raised used Japanese management methods in the poultry and other agriculture industry. With these findings it is possible to move to the practical part of the thesis.

Thesis and research methods – the analysis of the theoretical part of sustainability in the poultry industry and the Japanese management methods is done by the general scientific research methods: analysis of scientific literature and by analysis of used quantitative questionnaire survey.

Literature used in the thesis - The theoretical part of the master's thesis mainly used works by foreign authors and articles related to the concept of sustainable measures in the poultry industry and the concepts of Japanese management methods. The main authors of sustainability measures

are - Zotte, Cullere, Pellattiero, Sartori, Marangon, Bondesan (2021), Ian and Duncan (2001), Hartcher and Jones (2017), Rodenburg, Giersberg, Petersan, and Shields (2022), Castro, Chai, Arango, Owens, Smith, Reichelt, DuBois, Menconi (2023), Lusk (2019), Muduli, Champati, Popalghat, Patel, and Sneba (2018).

In the part about the Japanese management models the main authors are: Williamson (1997), Matsui (2007), Wakode, Raut, and Talmale (2015), Agrahari, Dangle, Chandratre (2015), Isac (2003).

In the analytical part of the thesis main literature used was by - Little and Berrens (2004), Martelli (2009), Elson (1985), Appleby et al. (1992), Widowski and Duncan (2000), Lusk J. L. (2023), a survey done by European commission in (2016), Horne (2017), Sumner et al (2011), Zhang et al. (2023), Zhang and El-Mashad (2017), McGauran et al. (2020), Kazancoglu, Ekinci, Ozen, and Pala(2021), Amoretti et al. (2024), Estrada-Gonzales et al. (2020), Pelletier et al. (2014), Xin et al. (2011).

The theoretical significance of the thesis -

1. The thesis contributes to the theoretical understanding of sustainability by examining how Japanese management models, such as lean production and Kaizen (continuous improvement), can be adapted to the poultry farming industry to achieve sustainability goals. This adaptation expands the theoretical framework of sustainability in agriculture by emphasizing the importance of operational efficiency, waste reduction, and resource optimization. The integration of these practices offers a novel approach to sustainability, which is often overlooked in traditional agricultural methods. The research highlights how applying manufacturing-based management techniques to agriculture can reduce environmental impact, enhance productivity, and contribute to sustainable farming.

3. The research presents a new theoretical model for the poultry industry, positioning sustainability as a strategic driver of performance. The model illustrates how the application of Japanese management models—such as Kaizen, Just-in-time, Kanban, 5S, and Newamashi—can directly contribute to achieving sustainability in the poultry sector. By adopting these lean practices, the poultry industry can achieve improved resource conservation, waste reduction, and enhanced environmental management, all of which are integral to driving sustainable business practices. The model bridges the gap between sustainable agribusiness practices and Japanese management techniques, showing how these manufacturing-based strategies can be successfully applied in agriculture. This theoretical framework not only provides new insights into achieving more cost-effective, sustainable farming practices but also ensures the long-term viability of the poultry industry, particularly in the egg-laying sector.

1. THEORETICAL BASIS FOR ADAPTATION OF JAPANESE MANAGEMENT MODELS TO ACHIEVE SUSTAINABILITY IN THE POULTRY INDUSTRY

PREFIX: *In this chapter, there will be an overlook of research papers that will explain what sustainability in the poultry industry is and what are unique Japanese management models. Then there will be a combination of the latter two to see if there are any ways to apply Japanese management models for the chosen category of poultry industry field – chicken egg farming.*

The urgent need to address environmental challenges has become increasingly apparent, calling for responsible resource management and long-term ecological balance. Everyday lot of businesses face a lot of different challenges such as – the reduction of costs, maintaining safety standards, and trying to appease government regulations or other government regulations to have their products or services allowed for international trade. These are also the challenges farmers and businessmen face in the poultry industry. One of the biggest challenges in 2024 for poultry farmers is animal safety standards, which are increasing yearly. But the biggest regulator for this is not the government but animal rights activists who are constantly asking for better animal safety standards. The easiest option would be to appease them and change the living standards for birds, but this option comes with a big price and an increase in cost per product. This option is available, and many poultry industry members are doing that, but some countries with terrible weather that is not suitable for birds are lagging. The first chapter of this thesis is about sustainable business in the poultry industry and will be about theoretical aspects of the poultry industry, sustainability in the industry, main theoretical ideas of animal welfare in the industry, and Japanese management models and their implementation in business.

In Japan, the business culture was created after World War Two. During that period businesses didn't need to be sustainable or caring about the environment or any other social factors. This Japanese business culture gave birth to a lot of management styles that are unique to Japan. However, because of their uniqueness, they were adapted to other countries' business management styles to create and manage businesses differently than their counterparts in the rest of the world. But can the Japanese management style be adapted to manage a somewhat niche business like poultry farming? A business facing a unique challenge – to be sustainable but profitable to not go bankrupt.

Knowing the situation farmers face to meet sustainability quotas and the possibility of meeting them using Japanese management models the third subchapter explores ways it was done before, and if there were no instances of doing that to egg laying business the research centers around other fields of poultry farming seeking connections to egg farmers.

1.1 Agricultural sustainability and egg-laying business sustainability

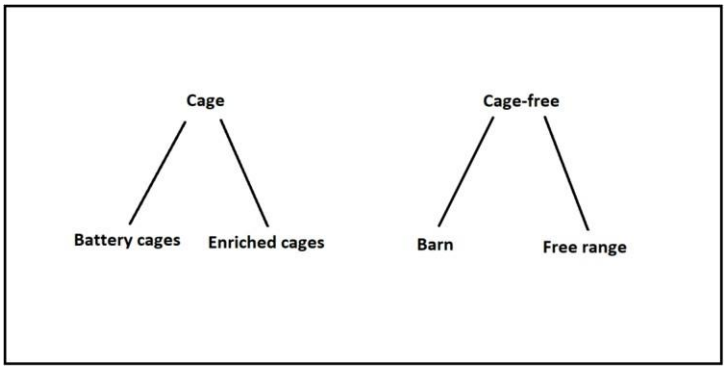
To understand sustainable farming there should be a clear understanding of what sustainability is. The most well-known definition is in the Brundtland report: “Humanity can make development sustainable - to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.” However, this is not a clear definition of what sustainability is in the agricultural industry.

Sustainability in the agricultural industry comes in a couple of ways. Firstly, it can be said that sustainability in agriculture is an ethical way of farming and keeping the animals, secondly, it can come as sustainability from keeping the planet clean and generating less waste.

Ethical farming – puts a lot of pressure on the farmer because he needs to ensure that a high level of animal welfare is maintained on the individual farm tools. Therefore, it is needed to monitor how successfully the farmer is looking after his animals and to provide advice about where there are problems on how the relevant management routines need to be altered. However, in his decision-making, the farmer has to consider not just animal welfare but how to produce the products efficiently, at competitive cost. The farmer is also faced with public concerns other than animal welfare. He may need to consider how his activities affect nature and the environment. He may have to take steps to prevent zoonosis and consider other aspects of food safety. And sometimes what is good for animal welfare may conflict with these other goals. Conflict can arise in connection with production costs. A central dilemma in modern animal production is that what is good for animal welfare – for example, sufficient space provisions for example in the egg business – is not always economical. However, there are potential conflicts between animal welfare and the other goals as well. To take just one case, outdoor production systems for poultry may have clear advantages in terms of animal welfare, but they can also be less than optimal when it comes to preventing losses of ammonia or controlling the spread of salmonella, campylobacter, and other zoonoses. This is taken from Dawkins's (2016) article about animal welfare and ethical farming.

To further explain how this ethical farming impacts the egg business, it is necessary to understand the basics themselves. The poultry industry has many branches. From the egg business to the poultry meat business. In this paper, the focus will be on the egg business because hens are kept alive longer than in the meat business. This means that animal welfare is a more important factor for animals who live longer and are kept in different environments longer, but this does not mean that birds that are kept for meat production should be kept in worse conditions. Also, scientific literature has more insights and more studies done on birds that are kept alive longer as it is easier to do studies with samples that just endure more time.

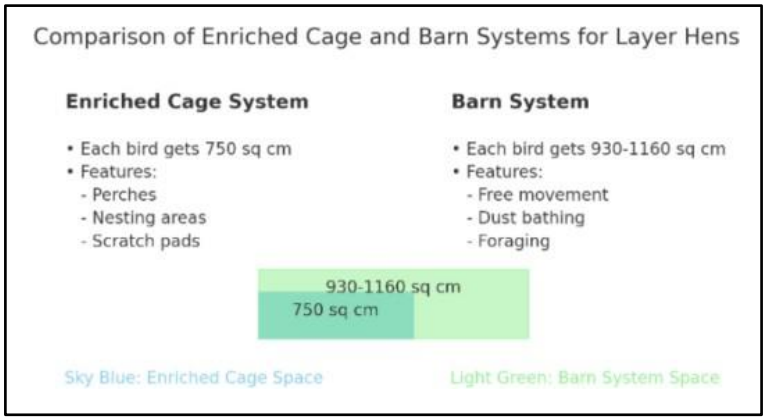
In the egg business, hens live on farms in two different ways. They are called caged or cage-free. These systems branch out to other different branches shown in the picture below.



Source: created by the author

Figure 1. Cage and cage-free system branching.

In different countries and regions, different laws define what types of housing for hens are allowed by law. For example, in the EU which only allows enriched cages or better systems there has to be at least 750 cm² of cage area per hen. In cage-free systems, there must be no more than 9 laying hens per m² usable area according to the EU Council Directive (1999). The EU laws are very strict in terms of how hens are kept. In the USA for example hens are kept in worse conditions called battery cage systems. According to United Egg Producers standards which are required to follow if an egg farmer wants to sell his eggs to anyone hens are required to have a 67 in² minimum of flooring space per hen. In the metric system, this would be converted to ~ 432 cm² of cage area per hen. In cage-free systems, the minimum requirement is one ft² squared which is ~ 929 cm². Information from United Egg Producers (2010). "Animal Husbandry Guidelines for U.S. Egg Laying Flocks"



Source: created by the author

Figure 2. Comparison of enriched cage and barn systems for layer hens

The space for each hen is not the only difference between caged and cage-free systems. Birds who live in cages have less free movement as they only move in their confined spaces. This does not interfere with egg laying but interferes with other needs of the birds such as foraging and dust bathing. Cages prevent hens from foraging, a behavior that normally occupies over half of a chicken's waking time budget. Dustbathing is also prevented by cage confinement, as the cage floor made from wire and loose litter cannot be provided. Dustbathing functions to remove ectoparasites and is thought to be motivated by positive affect. Nesting for egg laying is also different in cage-free environments as ethology research over the past several decades has extensively documented the behavioral needs of hens and confirmed that these cannot be accommodated in cages. Most prominently, cages prevent hens from expressing nest-site selection and the range of nesting behavior that is physiologically tied to egg-laying. A hen nearing oviposition may inspect 25 or more different potential nesting sites (Freire et al., 1996) and enter several before finally choosing one in which to lay her egg. The physiological mechanism that triggers egg production is the same trigger for laying behavior, a biological safeguard to ensure the egg is laid in the right place. So overall the bird should be in a cage-free environment but there are downsides for the farmers as this increases the farming costs and harms the safety of the bird. When hens are kept in cages it is easier to contain them to prevent the spread of diseases also in free-range environments which are even better than another cage-free alternative – barn, they can get in contact with wild birds that spread avian flu which is deadly for the birds.

There are many arguments and different opinions on how the birds should be kept. Some researchers say that the housing type does not matter for hens as the quality of the egg does not change whether it comes from a cage-free or caged system according to Zotte, Cullere, Pellattiero, Sartori, Marangon, Bondesan (2021). Some say that is even better for hens to be kept in caged systems (Duncan (2001) some argue that keeping hens in cages is a great concern for animal welfare and birds should not be kept in cages because it is not ethical and not sustainable for the future.

Historically, animal welfare has been defined by the absence of negative experiences such as disease, hunger, thirst, stress, or reduced fitness. Hens in cage systems have the lowest risk of contracting and transmitting infectious diseases and severe feather pecking. They also suffer fewer fractures during the laying period, which is likely due to the lack of environmental complexity in these systems. However, hens in conventional cages experience extreme behavioral restriction, suffer the poorest musculoskeletal strength of all housing systems, and have the highest number of fractures at depopulation. They also experience the highest rate of some non-infectious diseases, including fatty liver and disuse osteoporosis, compared with housing systems which allow greater

opportunities for behavioral expression and exercise according to Hartcher, and Jones (2017).

Roderburg et. Al (2022) organized a workshop during the 54th Congress of the International Society for Applied Ethology, held virtually in August of 2021 and the topic was “Developing animal behavior and welfare: Real solutions for real problems.”. During the workshop, there were 92 total participants. And there was a post-conference survey. Thirty-five participants completed the survey, with 24 self-identified as ethologists (69%) and 11 as non-ethologists (31%). Eleven people marked both ethology and animal science and one marked both NGO and ethology. Of the non-ethologists, 2 were government employees, 4 were animal scientists, 1 was an egg producer and 1 was a representative of an NGO. After the survey the results were positive for cage-free systems while during the workshop the participants had to discuss challenges that are created for farmers that use cage-free systems however the participants saw the challenges and provided solutions for them. Such as one of the challenges that is created by cage-free housing is the question of whether it is sustainable for the environment. However recent research is demonstrating the importance of feed composition and manure management as key factors in life cycle analyses. For example, in a 2021 comparison of different types of egg production systems in Canada, organic (cage-free) systems had the lowest GHG emissions compared to battery cages, enriched cages, single-tier barns, aviaries, and free-range systems, largely because of the feed composition. So, the potential for cage-free systems to perform well on environmental impacts is a rich area for further exploration.

When it comes to sustainability poultry production continues to play an increasing role in providing safe, nutritious, and affordable animal protein to the growing global population because of its shorter lifecycle and high feed efficiency when compared with other livestock species. Sustainability in livestock production is often associated with economics and the environment. It considers the efficiency with which livestock animal species can best utilize the planet's resources (raw materials, energy, land, and water), transforming them into high-quality animal protein while focusing on financial success, meeting consumer expectations, and minimizing its impact on the planet.

But in the same article, Castro et.al (2023) writes that not only sustainability towards the planet is important but also animal welfare comes into check. Society is now demanding more systems that are perceived as animal-friendly, which is related to the social pillar of sustainability that considers the ethical values of the society we live in. He and his colleagues say that consumers are one of the reasons for the push for welfare for better living standards for egg-laying hens. Nonetheless, the importance of science-based welfare practices in poultry production is unquestionable. An animal treated with good welfare, that is, free of disease/stress, provided adequate management

practices and nutrition, has a better chance of expressing its maximum potential. With fewer challenges, animals have better livability, improved health, and disease resistance, and use nutrients more efficiently toward producing eggs.

But this is only an opinion from the researchers and academics, however in an article by Lusk (2019), there was a survey done on cage-free eggs by consumers in the US. There is only one negative thing with cage-free eggs, they are more expensive than caged eggs, due to less production per space of land. In Lusk's survey, there were 1000 egg consumers asked a simple question: “Which carton of eggs would you buy?” With the picture below:

Source: Lusk, J. L. (2019). Consumer preferences for cage-free eggs and impacts of retailer pledges. Agribusiness, 35(2), 129-148.

Figure 3. Survey variants.

After this survey, the results were that 59% of respondents chose option B, 36% of respondents chose option A and 4% chose not to buy anything. But after this question respondents had another but similar question. What would your choice be if option B was removed? The results were that 83% of consumers will choose option A and 17 will choose option C. Meaning that the number of buyers who will not buy anything will increase by 13%. This means that about 13% of respondents only care about the product's price and will not choose a higher-priced option because it is not affordable for them. This survey also shows that 24% of buyers don’t care about the price and will still buy eggs.

Overall, the opinions by researchers are somewhat towards the cage-free:

Table 1

Researchers and their opinions about cage-free housing

Researchers	Opinion
Zotte, Cullere, Pellattiero, Sartori, Marangon, Bondesan (2021).	Based on research on nutritional values of the eggs, cage or cage-free does not impact anything that much and if there is impact it is minimal.
Ian J. H. Duncan (2001)	Duncan supports cage-free but also says that keeping birds in cage can be good too because of increased hygiene, smaller social friction, ease of management, and lower costs.
Hartcher, K. M., & Jones, B. (2017)	Positive opinion towards cage-free housing as it is better towards social aspects of birds.
Rodenburg, T. B., Giersberg, M. F., Petersan, P., & Shields, S. (2022)	Positive opinion towards cage-free housing. During their workshop, there were some challenges opposing the cage- free housing but according to them, they can be easily fixed.
Castro, F.L.S., Chai, L., Arango, J., Owens, C.M., Smith, P.A., Reichelt, S., DuBois, C. and Menconi, A. (2023)	Positive opinions towards cage-free housing but ecological sustainability might be an issue due to the increase in space needed for this type of housing.
Lusk, J. L. (2019)	Neutral opinion toward cage-free housing but the consumer demand will be smaller due to increase of prices.

Source: created by the author

At the beginning of this subchapter, there is a mention of sustainable waste management in the poultry business. This is a common problem that arises in this type of business. However, managing this correctly can lead to better sustainability levels for the company.

According to Muduli, Champati, Popalghat, Patel, and Sneba (2018). The poultry industry produces large amounts of waste including solid waste and wastewater. The solid waste consists of bedding material, excreta (manure), feed, feathers, hatchery waste (empty shells, infertile eggs, dead embryos, and late hatchlings), shells, sludge, abattoir waste (offal's, blood, feathers, and condemned carcasses) and mortality. This waste if taken not right can go back to the environment and can lead to contamination. In their article, they see possible ways of managing it but the ways are only suggestions as there is no right answer for good and environmentally sound poultry management now. Here are the ways of utilizing waste from poultry:

1. Poultry feathers can be treated chemically or biologically with microbes to improve the nutritive value of feather wastes which can be used as animal feed. They can also be biologically converted into feed supplements, biodiesel, biodegradable plastic, and organic fertilizer.

2. The offal's are utilized by various methods like rendering, incineration, burial, controlled landfilling, composting, and anaerobic digestion. Rendering produces meat-bone meals which may be used as animal feed or fertilizer. Composting reduces pathogens. Compost is used as soil conditioner or fertilizer.

3. Poultry litter contains carbon, nitrogen, phosphorous, chlorine, calcium, magnesium, sodium, manganese, ferrous, copper, and arsenic. It is used as a very good source of fertilizer. Methane gas produced from poultry litter is converted into electricity using patented technology.

Altogether, poultry wastes can be effectively utilized if properly treated to reduce the ill effects and a range of value-added products like fertilizer, biodiesel, animal feed, electricity, bone meal, and biodegradable plastic can be produced.

Japan's management of waste can be used to increase sustainability, and therefore there this thesis will explore Japanese management models. These models will not only be good for waste management but also for ethical purposes as they can be used in ways to make animals live more comfortably.

1.2 Japanese management models

Kaizen is one of the Japanese management models that focuses on sustainability through everyday self-improvement for the company. This is the definition of Kaizen by Palmer (2001). It is a compound word involving two concepts: Kai (change) and Zen (for the better). The term comes from Gemba Kaizen meaning 'Continuous Improvement' (CI). Continuous Improvement is one of the core strategies for excellence in production and is considered vital in today's competitive environment (Dean and Robinson, 1991). Kaizen originated in Japan in 1950 when the management and government acknowledged that there was a problem in the current confrontational management system. Japan sought to resolve this problem in cooperation with the workforce. The groundwork had been laid in the labor contracts championed by the government and was taken up by most major companies, which introduced lifetime employment and guidelines for the distribution of benefits for the development of the company. This contract remains the background for all Kaizen activities providing the necessary security to ensure confidence in the workforce – Brunet (2000). For Suzaki (1987) Kaizen is a philosophy widely practiced in

manufacturing and quality circles. As the name implies, it relies on the idea that there is no end to making a process better. Each incremental improvement consists of many phases of development.

Kaizen directly focuses on lowering costs this is explained by Williamson (1997) “the target costing and Kaizen costing concept, one of the manufacturing techniques, which has been developed in Japan. Target costing is a process of ensuring that the products are designed in such a way that the company can sell them cheaply and still make a fair profit. Kaizen costing focuses on the value and profitability of the manufacturing phase, both of new and existing products. Kaizen costing activities should be a part of the process of business improvement continuously, with improvements in quality, product functionality, and service jointly. Kaizen activities and targets may vary depending on the type of cost. Combining target costing and Kaizen costing provides a basis of the total life-cost management, managing cost throughout the product life cycle.”

With these sources and their explanations, we can say that Kaizen is a process that fully works towards maintaining costs with workers and managers taking their initiative to improve the quality of their job with minimal everyday improvements.

Just-In-Time (JIT) is a management model used in Japan that focuses on the idea of producing the necessary items in the necessary quantities at the necessary time and eliminating all sources of waste in operations.

To make JIT production work, many other things should be done; leveled master schedule, small lot size, setup time reduction, multi-functional workers, JIT layout and equipment, perfect quality, autonomation, supplier relations, etc. This formulation was laid down by Matsui (2007).

From a competitive strategy perspective, a deliberate production system is often seen as a source of core competence, that is, a mighty weapon for improving delivery performance and reducing manufacturing costs. Hamel and Prahalad (1994) listed many examples where an integrated technology or skill builds up core competence. One way to attain a competitive advantage in manufacturing industries is to exploit excellent production and inventory control systems and secure the position of cost leadership.

On one side it is seen that JIT production works for businesses and this practice is used by many companies, for example Toyota Ohno (2019) to keep their production in stock but on the other side this production and management style can have its downsides:

The Covid-19 pandemic and other recent disruptions in the early 2020s led to sections in the business press blaming just-in-time (JIT) practices for operational failings. Consequently, there are calls for moving away from JIT toward holding more inventory as preparation against future

disruptions. Choi et.al (2023) however in their findings Choi and his colleagues say that the reason JIT practices failed in the 2020s was not that the management style is wrong but because the whole practice has moved away from its original form.

With these sources and their explanations, we can say that JIT is a great management style for sustainability as it removes unnecessary parts and keeps waste at a minimum especially when dealing with products that have limited shelf life. However, this style of management has its problems when dealing with supply chain issues.

Kanban. As above there is an explanation of just in time management system there should be an explanation of the Kanban system which is a part of JIT. Kanban should not be classified as its management style because it only has a small meaning to the whole operation.

Kanban (also sometimes known as lean manufacturing) in Japanese means a card. The Kanban system utilizes cards to authorize production and move material between different working operations. A Kanban may not necessarily be a card it can have various forms such as a verbal command, a flag, a colored ball, or a hand gesture.

For example, Kanban is used in Toyota's manufacturing process like this: the card signals the need to move material within a manufacturing or production facility or move materials from an outside supplier to the production facility. The card indicates the signal that there is a depletion of product, parts, etc. When received the Kanban will faster the replenishment of product. More consumption and this demand for more products are signaled by the Kanban card. In Toyota manufacturing Kanban also used the bin system:

1) One bin is on the factory floor.
2) One bin is the factory store.
3) One bin is at the supplier.

“So, it contains a removable card containing the product details and other relevant information. When the bin on the factory floor is empty, the empty bin and its card are returned to the factory store. The factory store replaces the empty bin on the factory floor with the full bin from the factory store, containing the card. The factory store sends the empty bin with its card to the supplier. The supplier's full product bin, with its Kanban card, is delivered to the factory store and the supplier keeps the empty bin. Thus, the process will never run out of product and could be described as a closed loop in that it provides the exact amount required so there will never be an oversupply” Wakode, R. B., Raut, L. P., & Talmale, P. (2015). This system attacks the recurring problems in manufacturing such as long set-up time, quality of the product, leftovers from production,

nonuniform production speed, confusion in the sequences of production, and faulty deliveries.

As Esparrago (1988) says a lot of people misconception Kanban as just in time production philosophy but Kanban is only a subsystem of a larger operation. JIT may or may not use Kanban in its operation, but Kanban can only be used in a JIT structure.

With these sources and their explanations, we can say that Kanban is a good sustainability measure as it decreases waste with unnecessary actions in production. Also, Kanban is good at attacking

recurring problems in manufacturing that can make the manufacturing less productive meaning this will contribute to less unsustainable actions.

5S methodology is a foundation of lean manufacturing systems. 5S is an approach to organize, order, clean, standardize, and continuously improve a work area. 5S is not just about housekeeping, It is one of the efficient working tools of Lean Manufacturing. The program gets its name from five activities beginning with the letter S, which was derived from five Japanese words. The words are Seiri, Seiton, Seiso, Seiketsu, and Shitsuke, which when translated means Sort, Set in Order, Shining, Standardize, and Sustain. It is a tool for cleaning, sorting, organizing, and providing the necessary groundwork for workpiece improvement. (Agrahari, Dangle, Chandratre, 2015)

The steps of 5S are as follows:
1 Sort (Seiri) - Sorting is the first step-removing all surplus items from the work center that are not needed for the immediate continual operations (Hough,2008). At this stage, it is decided what is needed and what is not. Any item or tool that is unaccounted for out of place or unnecessary needs to be documented. The benefits of this S are process development by cost reduction, stock confinement, better usage of the workplace, and prevention of losing tools. (Agrahari, Dangle, Chandratre, 2015).

2 Set in Order (Seiton) - taking the stored items and putting them where they best support the function they provide. Workers should be motivated to place items at their point of use and improve the workplace's visual management. Before and after photos should be taken to document progress and explain activity benefits are of key importance at this stage. One important advantage of setting in order is that everything needed for the job is visible (Samuels, 2009). The benefits of this S are process growth, increasing efficiency, and shortening of the time required for searching things. (Agrahari, Dangle, Chandratre, 2015).

3 Shine (Seiso) - once the unneeded is thrown away and sorting and set in order has taken place, it is now time for the sanitizing phase. A cross-functional team should agree on what the cleaning standards need to be (Samuels, 2009). This is sometimes referred to as the shine or sweep stage

where teams thoroughly remove clutter and fix equipment or building components (Hough 2008). 5S projects that are almost entirely focused on cleaning and painting, prevent recording the valuable information that can be gained from assessing it. The benefits of this S are improved working conditions for workers, the number of customers due to a clean environment, and machine maintenance costs. (Agrahari, Dangle, Chandratre, 2015).

4 Standardize (Seiketsu) - after the organizing and cleaning of a production area, the area must be maintained. This stage requires that the improvements of the previous three phases are maintained. That is why organizations develop standardized procedures, rules, and expectations for maintaining continuous activity in all of the areas shift by shift and crew. The benefits of this S are the standards for the company were raised, workers had fewer injuries, material wastage was reduced, travel time of materials was reduced. (Agrahari, Dangle, Chandratre, 2015).

5 Sustain (Shitsuke) - The advantages of the four 5S phases mentioned above are clear and measurable. But without self-control and sustainability components, the 5S program's effectiveness is short-lived, and things will deteriorate or return to their previous disorganized state. (Liu, 2006). The benefits of this S are worker participation increase, worker absenteeism is lower, all work following all the necessary procedures, and improvement in inter-worker relations. (Agrahari,Dangle, Chandratre, 2015).

With these sources and their explanations, we can say that adapting the 5S methodology to production can make production more effective. Better production can be good for maintaining good sustainability measures as there is less wasted time and less waste in general. One of the 5S points is directly associated with better sustainability – Seiso. With Seiso methods applied correctly, a manufacturing facility will have less waste and better-quality products. This not only helps sustainability but also improves the morale of the workers and creates better profit margins.

Newamashi - In a business context, the concept of “Nemawashi” helps to lay the groundwork to make a good decision by integrating the key issues and concerns of stakeholders into a recommendation or a proposal before making it an official decision. It is a consensus-building technique before the meeting that aims at removing obstacles in decision-making or approval of a proposal from the audience. The "Nemawashi" process involves people using unofficial meetings to get approval to speed up the process and ensure that everyone is on the same page. Additionally, this approach aligns with the cultural norms of Japanese collectivist society. Sagi (2015).

In Japanese business, decisions are rarely made by a single person due to the emphasis on the group. A middle manager will typically suggest sending a document outlining the decision to everyone it might impact.

The Japanese decision-making system has many advantages and disadvantages. It permits important decisions to be made by managers in the area closest to the issue without upending the chain of command hierarchy. However, within the organization, there is hardly any room for lateral consultation between employees of various divisions.

Moreover, the ring-sho is extremely slow when compared to direct top-down decision-making. If a proposal is accepted, it is usually implemented quickly, since all relevant parties are aware of the proposal and have at least nominally approved it before its adoption. Isac (2003).

With these sources and their explanations, we can say that Newamashi will not contribute to sustainable development as much as other management methods and models, but it will greatly contribute to getting new ideas into business more effectively. But Newamashi is not a perfect method to apply new ideas to business as its downside – slow speed of implementation is not a good quality of it.

1.3 Japanese management models and their use in poultry farming

From the previous chapters, according to researchers cage-free egg farming is sustainable and more ethical than cage housing systems. But there is always room for improvement, and this is what could be done with the Japanese way of management. Continuing the thesis there is a need to explore how is it possible to combine these two methods and to see if there was ever research done for this, and if there is a lack of research look for possible improvements.

The best option to see where the Japanese way of management was applied to the poultry industry is to see whether it was applied in the Japanese poultry industry itself. According to Schrager (2018), the history of the Japanese poultry industry goes back to the late 1800s when samurais were abolished and some of them went poultry farming. In his article, Schrager does not only talk about how the poultry industry started in Japan but also its features. Japan's poultry business is very similar to the ones in other Western countries as Japan. In the 1960s Japanese poultry farmers imported chickens from the USA and imported their management strategies according to Akagi (1993). Also, it has some features of sustainability in them too. For example, the leading integrators in Miyazaki prefecture each have their slaughterhouses. After integrators collect grown broiler chickens and deliver them to the slaughterhouse, growers must clean their soiled structure before they receive the next batch of new chicks in around ten days. In Miyazaki's broiler chicken clusters, most growers can subcontract the cleaning to companies that transport the chicken waste to special biomass power plants, of which Miyazaki prefecture has two. These power plants help dispose of chicken waste and receive significant government subsidies. Both facilities emphasize their role in promoting environmental sustainability. These power plants that use chicken waste are a good

feature that is good for the environment because they utilize waste. This works well with one of the management models – 5S Seiri. In the same article, Schrager quotes Komai's article from 2012 that talks about management techniques that made chickens more productive but there were no exact management techniques mentioned so management and poultry in Japan was implied but not talked about what was implied.

In Schrager's dissertation, there are some ideas about cage and cage-free poultry housing in Japan. Asahi Shimbum (1985) writes about a really expensive and high-class chicken meat called Hinai-dori in his newspaper article. He writes that this expensive chicken is now being kept in cages to reduce costs, but this would probably lead to loss of flavor. So, there was an understanding back in the 1990s that keeping chickens in cages is not good for them.

From this source by Schrager (2018), the conclusion is that poultry farming in Japan was shaped by samurai and the USA's influence and there are some hints to using Japanese management models like 5S, but it is very minimal. Also, the Japanese are somewhat environmentally friendly, but this is kept to a minimum. So from this source, it is impossible to get a clear answer of Japanese management models used in poultry farms. There has to be some further research done.

In an article from Kato et. al (2022) it is said that currently there is no need for cage-free farms for eggs in Japan as Japanese consumers are not even familiar with the term – animal welfare (only 30% of consumers even heard about it), so higher costs of eggs would even deter the consumers from buying more sustainable eggs as there is no need for that. So if there is no need for a sustainable egg there are a lot of cage-housing egg farms in Japan meaning there are no current methods of managing it the Japanese way, so it is safe to say that it is not a good option to look for the Japanese way of management for the poultry industry in Japan itself. But maybe the methods have been applied elsewhere?

One study that applied Kaizen management models lead to finding out that the models show some improvements in sustainability. In a study done by Estrada-Gonzales et al. named "Decreasing the environmental impact in an egg-producing farm through the application of LCA and lean tools." (2020) implementing eco efficient schemes through Kaizen can result in the adjustment of the consumption/power ratio in the equipment. Through this it would be possible to obtain a 49.5% reduction in the farm's total energy consumption without compromising the current production process. There would also be an average saving of 56.3% in environmental impacts for the electrical cost of egg production.

Another study by Kazancoglu, Ekinci, Ozen, and Pala (2021) shows the application of Kaizen in turkey farming in Turkey to attain better results in sustainability by fixing food waste and waste

of turkey meat. In their study, they choose the study's methodology to include Kaizen, as part of it. The blueprint for including Kaizen was picked by Rother and Shook (1998) and the steps are like these:

1) Selecting the product family.
2) Modeling the current state of the map.
3) Analyzing waste and proposing continuous improvement events, known as kaizen.
4) Modeling the future state map.
5) Making a work plan and composing it.

Their application of Kaizen focused on changing shift hours, late collection of turkeys, possible improvements in loading procedures using handling equipment, and the use of trailer trucks.

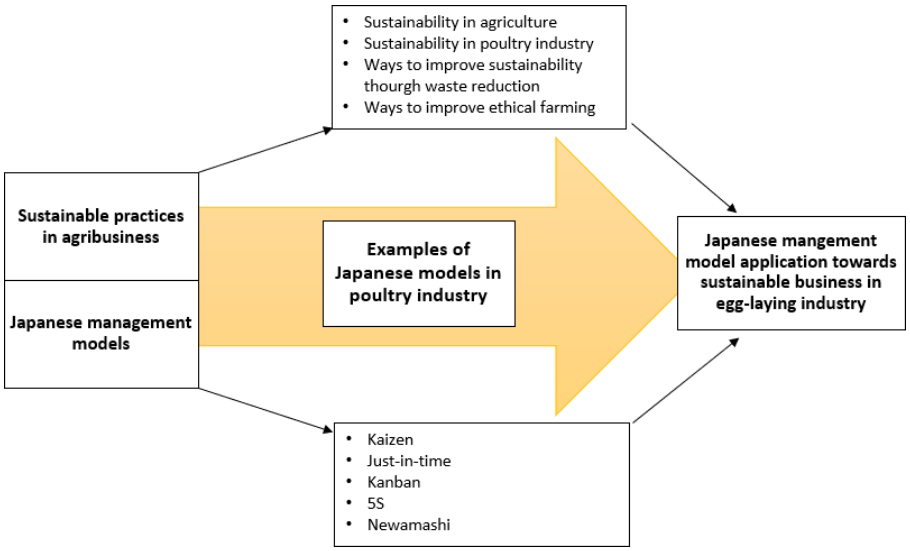
Their results show that storage and retrieval systems are an essential process in food supply chain operations and should be managed properly. With improvements in handling equipment, the efficiency and effectiveness of the food supply chain operations also improve by eliminating injuries that occur during animal capture with the use of proper handling equipment. It was shown that the transportation process is crucial in food supply chains. Proper transportation processes lead to improvements in current capacity, convenient loading, and unloading, etc. Also, they say that this study was conducted in only one sector. However, the proposed methodology is generic and can be extended to other industries in the food sector. This practice almost with the same procedures can be applied to the egg business.

Other research done by Asmudi, Rahmat, and Nofi (2018) on Peking-ducks meat farms had a hypothesis that using Japanese just-in-time and kanban models can lead to more efficiency and also make the farm more eco-green. With their research, they made a simulation company named Prima Duckinndo inc and they applied JIT. In their simulations using the JIT waste reduction approach which would utilize Kanban, they had their focus points on work balance, WIP, location, Kanban location, Kanban types, lot sizes, and PM analysis. As this was a fictional company, they couldn’t get accurate or even inaccurate real-life results but in further comments, researchers didn’t write that this approach was not good so that means that it would be beneficial to use this.

Also in their paper suggestions part Asmudi, Rahmat and Nofi say that this was also only applied to a single industry of poultry farming, and with that it is still a concept not a true business case, so with this in mind, it is possible to say that JIT and Kanban worked on paper but not for egg business and still needs more research done.

In conclusion, all of the sources above give the intention that there is a way of making the egg business more sustainable using Japanese management methods but there are no clear sources of evidence of using them in the egg business. The sources above are about other poultry farming methods – ducks, chicken meat, and turkey meat. Their waste and keeping systems are very similar to egg layer hens but there is still a need to see if it is possible to do that.

Theoretical model:



Source: created by the author

This theoretical model explains how two unrelated things: Japanese management models and sustainable practices in agribusiness can be combined to create a new effective, in terms of sustainability, and working enterprise management culture. This is explained through examples of Japanese management model adoption in the poultry industry. Also to understand further Japanese management models are explained (kaizen, just in time, kanban, 5S, newamashi), with that the most common practices that improve sustainability measures in the poultry industry were also explained. This all leads to the final aim of the thesis that is to find out whether is it possible to use Japanese management models to achieve better levels of sustainability in poultry farming industry.

This theoretical part explores how to achieve better sustainability in the poultry industry using Japanese management models. In the first subchapter, it is written that it is possible to achieve that either by limiting waste or using more environmentally and ethically better ways of housing hens. This part especially goes into details about keeping egg-laying hens as they are kept longer so it is possible to see the ethical effects of better housing in the long term. The second part of the theoretical analysis explores how Kaizen, JIT, Kanban, 5S, and Newamashi can make business more sustainable and goes into detail about them. The last subchapter explores how the above-

mentioned ways of Japanese management styles have been adapted to the poultry industry in the past but the examples are not about egg-laying hens but about other species of birds so there is still no clear answer to the question can Japanese management methods improve poultry industry if the subject is egg- laying hens? This question can and will be explained in the upcoming chapters. But there is a clear definition, if this was applied to other birds it is possible that the models can be applied and work well with egg-laying hens too.

2. ANALITICAL BASIS FOR ADAPTATION OF JAPANESE MANAGEMENT MODELS TO ACHIEVE SUSTAINABILITY IN THE POULTRY INDUSTRY

This chapter explores works of different authors regarding the sustainability and ethicalities of different bird housing systems and Japanese management model implementation to these businesses. As well this chapter will delve in to more Japanese management models and their sustainability efforts.

2.1 The analysis of sustainability and ethicalities of different housing systems in the egg production industry

In the first chapter of the thesis, it is said and shown by the scientific literature that there are two ways a poultry farm can become more sustainable. It is either from becoming more ethical in terms what is done to the birds on those farms or by having a farm be more sustainable through its waste management and other sustainable ways of keeping the farm.

Findings from multiple authors and studies regarding ethical farming of birds were evaluated. The main focus of the research was to understand how ethical poultry farming it is nowadays and how can be improved or is the improvement even necessary. In order to get a comprehensive look at these seventeen studies from 1985 to 2023 including different opinions and even covering various breeds of birds and three different methods of keeping birds were selected and analyzed.

In the first part of the thesis, the ethical approach of keeping birds and the possibilities of more sustainable waste and energy management is analyzed by the articles of - Dawkins (2016), Zotte, Cullere, Pellattiero, Sartori, Marangon, Bondesan (2021), Duncan (2001), Lusk J. L. (2019). Patel et al.(2019)These articles are reinforced by studies of - Little and Berrens (2004), Martelli (2009), Elson (1985), Appleby et al. (1992), Widowski and Duncan (2000), Lusk J. L. (2023), a survey done by European commission in (2016), Horne (2017), Sumner et al (2011), Zhang et al. (2023), Zhang and El-Mashad (2017), McGauran et al. (2020) which delve in to the topic more than the authors before.

Marian Dawkins in her article “Animal welfare and efficient farming: is conflict inevitable?” (2016) writes about the conflict between efficient, competitive farming and animal welfare, and is it possible to combine these two. In her article she mostly writes about all animals but when talking about birds she mentions one specific problem: one way to reduce the cost of poultry products is to allow and increase the density of the birds kept in one place, but this stocking increase is associated with negative welfare effects such as birds becoming lame, greater bruising and scratching. So, this creates a problem – what is more important, financial gain or the welfare of

the animals? There is a way to fix this problem without even addressing the welfare of the animals. To alter the relationship between welfare and efficiency by selective breeding of animals who are more resistant to less ethical farming (higher resistance to health problems and reduced tendency of feather picking). But this fix of a problem is rather extreme and would take a lot of time. So Dawkins suggests that increasing the welfare of the animals is worth the investment of funds and the decrease of income because of these reasons: 1) reduced mortality – makes the birds live longer meaning they will be useful longer if the topic is about egg laying hens. 2) improved health – means that the birds will produce more eggs. 3) improved product quality – better quality off eggs as the chickens don't feel stress as much. 4) improved resistance to disease and reduced medication – meaning that the chickens will be in production of eggs longer and there will less money spent on medicine. This point as pointed by the author is speculative as there is no way to check this as Dawkins makes this point based on growing body of evidence that stress in the wild is linked to better immune system in birds and there is no way right now to make that link accurately. 5) lower risk of zoonoses – these illnesses can cause a lot of money spent of fixing them especially as it is seen in the US as of 2024 with the bird flu. 6) Farmer and producer satisfaction – most farmer are proud in looking after their animals and producing healthy products but it is hard to quantify this effect in the financial terms. 7) higher prices from customers – customers nowadays are willing to pay more for eggs that are raised in better conditions. But these answers come from surveys and the situation in the markets is a bit different according to Little and Berrens (2004) and Martelli (2009).

So all in all Dawkins makes a final point that the current systems are not working as efficiently (due to all of the implementations mentioned above needing a lot of money to work and there is a high level of uncertainty that the welfare increase can actually help the farmer make higher profits) to make the farmer profitable and also for his farm to have high welfare standards, so there is a problem right now that needs to be fixed in the future, but animal welfare is important.

Zotte et. al in their article "Is the farming method (cage, barn, organic) a relevant factor for marketed egg quality traits?" (2021) concluded a study that a farming method has an effect on the egg. The study evaluated the physicochemical and sensory traits of marketed table eggs, deriving from different farming methods (cage, barn, and organic) and sampled in different marketing periods (June, July, September, October). A total of n=540 eggs (n=45 eggs/farming method/sampling period) of "medium" weight-grading were purchased and subjected to physical measurements (shell, yolk, and albumen physical traits). Results highlighted that eggs physical traits often differed among the farming methods considered: organic eggs had the lowest albumen pH ($P < 0.001$) and the highest albumen proportion ($P = 0.004$), whereas barn and cage eggs had

the highest yolk proportion (P = 0.026). Barn eggs had the heaviest shell proportion (P = 0.011), which did not however imply higher resistance to penetration and compression tests. As expected, egg color differed according to the farming method with cage eggs displaying the highest overall yolk color intensity (a*, b* and yolk color FAN; P < 0.001), followed by barn and organic eggs. The egg marketing period demonstrated to be a relevant factor in determining egg physical attributes too. Surprisingly, organic eggs showed constant albumen, yolk and shell physical characteristics, and yolk color traits, whereas barn and cage eggs displayed a certain variability in these terms. Cage eggs showed the highest protein (P = 0.001) and barn eggs the highest lipid (P = 0.003) contents, whereas cholesterol content was only affected by the research period in all three farming methods. Organic eggs were the richest in moisture (P = 0.003), in polyunsaturated fatty acids (FA) of both n-6 (P = 0.011) and n-3 series (P < 0.001), whereas cage ones had the highest saturated (P = 0.030) and monounsaturated (P = 0.018) FA. Among the considered sensory traits, farming method only affected the yolk color intensity, which was the lowest in organic eggs and, for cage and barn eggs, it decreased during the research period.

The results from the experiment show that organic eggs were the most distinguishable among the three considered farming methods (cage, barn and organic). They showed peculiar physicochemical traits, such as yolk color intensity, proximate composition, and fatty acids profile, with sensory traits being mainly unaffected. Differently, eggs from barn and cage systems presented very similar characteristics to what was expected. With this study in mind the main takeaway can be that Barn and cage systems don't differ at all in terms of the chemical characteristics of the egg, but eggs from those systems had a variety of differences between their chemical characteristics but in organic eggs the variety of differences was smaller. Also, organic eggs were richer in albumin and less rich in yolk color.

Duncan in his article "The pros and cons of cages" (2001) writes about advantages and disadvantages of the cage systems.

In the advantages section Duncan names that cages provide increased hygiene, small group size, ease of management (which is actually a disadvantage if the farmer has to check all the cages containing for example 4 birds instead of barn systems that can provide an easier inspection - For example, with a flock of 30 000 hens in a modern aviary, a manager would be able to walk slowly through the birds looking in corners and nest boxes for sick or injured birds and, in 30 minutes, be confident that more than 90% of the birds had been seen. Inspecting a flock of 30000 hens in cages each containing four birds in 30 minutes would involve examining 250 cages per minute or more than four cages every second.) absence of litter problems and better economic standpoint for farmer - the cost of egg production from battery cages stocked at the rate of 450 cm2/hen

(recommended in the UK) and considered this to be 100%. Keeping hens in traditional deep litter systems (7-10 hens/m2) worked out at 18% more, whereas modern aviaries, percheries or multi-tiered systems (20 hens/m2) were slightly more economical, but still 543% above that of conventional multi-bird cages. The costs in semi-intensive systems (1000 hens/ha) and free range (400 hens/ha) were much greater being 35% and 50% more, respectively, than the cost in cages. Many different factors account for the reduced costs associated with cages.

On the disadvantages section of his article Duncan names these disadvantages: Lack of space for the birds, lack of exercise which can cause fatigue and bone weakness, lack of nesting opportunities as named which will lead to less laying of eggs due to birds not having a nesting place, lack of dust bathing opportunities which can cause frustration as it is known that birds gain please from this. This information comes from Widowski and Duncan article "Working for a dustbath are hens increasing pleasure rather than reducing suffering?" (2000). In the conclusions of the article Duncan writes that there is no objective way of carrying out an audit on the advantages and disadvantages and it is left to the public to decide whether or not to pay more for eggs that are produced from non-cage systems.

Lusk in his scientific study "Consumer preferences for cage-free eggs and impacts of retailer pledges." (2019) finds that people are less likely to buy eggs that come from free range farms due to their prices. This information could mean that the public Duncan writes about is not in favor of the barn and better welfare systems. As consumers are more likely to buy cheaper eggs as this food product is not a premium food and is considered to be one of the cheapest forms of protein it is more consumed by people who are on a budget. Lusk on his study did a survey on consumers and found out that out of 1000 people that answered the question: "Which carton of eggs would you buy?" pictured below:

Source: Lusk, J. L. (2019). Consumer preferences for cage-free eggs and impacts of retailer pledges. Agribusiness, 35(2), 129-148.

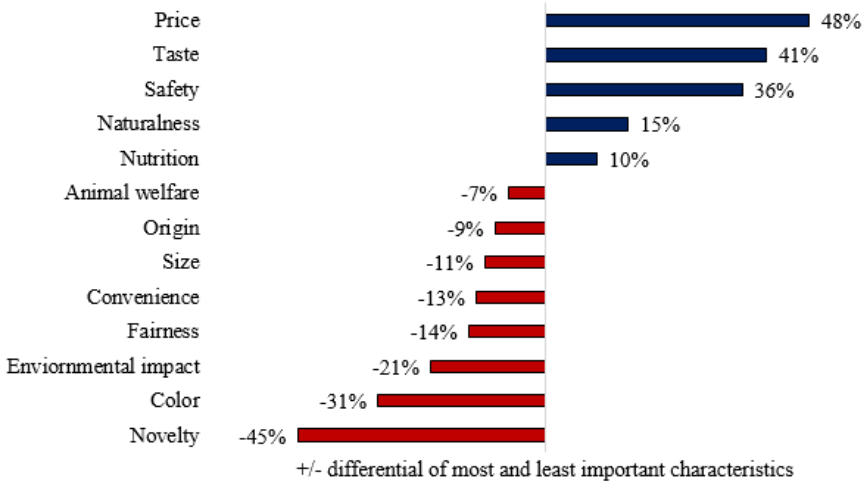
Figure 4. Survey variants

60% of respondents chose option B, 36% of respondents chose option A and 4% chose not to buy anything. After this question respondents had another but a similar question. "What would your choice be if option B was removed?" The results were that 83% of consumers will choose option A and 17% will choose option C. Meaning that the number of buyers who will not buy anything will increase by 13%. This means that about 13% of respondents only care about the product's price and will not choose a higher-priced option because it is not affordable for them. This survey also shows that 24% of buyers don't care about the price and will still buy eggs.

So from what is known from the articles above is that in the articles of Duncan (2001) Dawkins (2016) and it is found that the welfare of the birds is hard to calculate due to the pros and cons for the farmers and the consumers. The answer of this question is left for the consumers to decide but when looking at Lusk's article it is seen that only 13% of the consumers would stop buying eggs even if their price increases 4.5 times meaning that removing the option of eggs that come from birds kept in cage environments only effects 13% of consumers but also from this study it is shown that with both options available 61% of consumers who buy eggs are more likely to buy the cheaper alternative.

Another article also reinforces this claim. Lusk et. al. in a newer article named "Egg producer attitudes and expectations reviewing the transition to cage-free production: a mixed-methods approach" (2023) reinforces his claim that consumers of eggs are more driven than prices. In the figure below from the survey out of 971 correspondents 60% said that the price is the most important factor and 12% said that it is not as important, this makes the 48% we can see in the picture below. Also, during the survey animal welfare is even in the negative 7% meaning that after the survey combining the answers more people don't care about animal welfare than people that care about it.

Figure 1. Attributes that Are Most and Least Important to Consumers When Buying Eggs

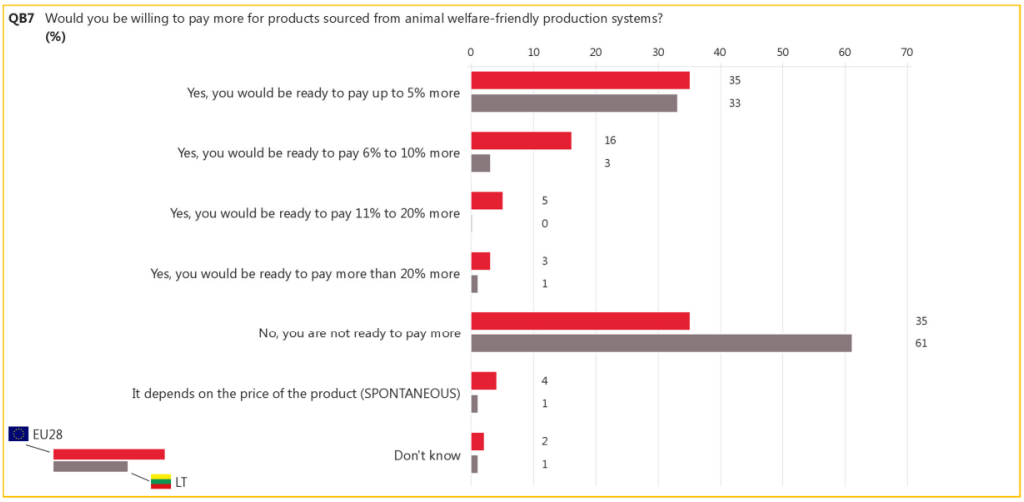


Source: Caputo, V., Staples, A.1 J., Tonsor, G. T., & Lusk, J. L. (2023). Egg producer attitudes and expectations reviewing the transition to cage-free production: a mixed-methods approach Poultry Science, 102(11), 103058.1

Figure 5. Survey answers about the importance of attributes when buying eggs.

Following this newer survey, it is seen that animal welfare is not important to the customer in the USA and the price is the most driving factor for them.

In the EU the situation is a bit different. From the survey done by European Commission in the 2016, which asked 27.672 people 35% of consumers would not like to spend more for products that are animal welfare friendly, but this is different across all the EU countries and as we can see in the Lithuanian side that 61% of consumers would not like to spend more money for animal friendly products. This study was done not only on poultry products but for all animal related products but the question about spending and animal welfare can be attributed to poultry also because it is known from the articles above that changing the welfare of poultry also has an effect on the price of eggs.



Source: Eurobarometer (2016). Attitudes of Europeans towards animal welfare

Figure 6. Survey answers about what amount of people would be willing to buy eggs from animal welfare friendly production systems.

Table 2

Correspondents opinions on buying sustainable eggs

Author	Year	Main idea of the surveyors	Percentages
Lusk et al.	2019	If given the option buyers would buy the cheaper non sustainable option.	60% of respondents chose option B, which is not sustainable but cheaper.
Lusk et al.	2023	Price is the most important factor when buying	60% of correspondents said that price is the most important factor.
European commission	2016	Europeans would pay more; Lithuanians would not pay more	59% of Europeans would pay more, 37% of Lithuanians would pay more.

But what is the actual price difference between caged system eggs and more ethical alternatives? In the article by Horne named "Competitiveness of the EU egg sector, base year 2015. International comparison of production costs." (2017) it was calculated that the cost in EU for a conventional (cage) egg is 88 cent per kg.

	EU	USA	UKR	ARG	IND
Total costs inclusive labour	87.7	66.8	68.7	75.1	78.0
Total costs exclusive labour	83.7	64.6	66.5	72.1	75.9
Hen cost at 20 weeks	18.7	13.7	15.3	16.4	14.3
Feed	50.3	39.5	44.1	48.3	59.7
Other	5.7	3.1	4.2	3.5	5.2
Labour	4.0	2.2	2.2	3.1	2.1
Housing	9.0	8.0	6.8	5.5	1.7
General	0.9	0.8	0.5	0.5	0.6
Manure disposal	0.3	0.0	0.0	0.0	0.0
Revenue spent hen	-1.2	-0.5	-4.5	-2.1	-5.5

Source: Horne, P. V., & Bondt, N. (2017). Competitiveness of the EU egg sector, base year 2015. International comparison of production costs. Wageningen Economic Research report (2017-062).

Figure 7. Cost of egg production in various countries Eur cent per kg .

A pack of L size eggs (one L size egg is $63g \leq x < 73g$, and usually for calculations it is said that the L size egg is 63g) costs – 59 cents in EU for the farm to make including labor costs which differ thought the EU, but in US the cost is 44 cents for the farm in the cage system. In barn systems the costs are bigger:

	NL	DE	FR	UK	ES	IT	DK	PL
Total costs inclusive labour	100.2	101.4	102.0	111.1	98.3	102.1	113.2	97.0
Total costs exclusive labour	92.6	93.7	93.3	105.4	92.7	97.2	103.2	95.0
Hen cost at 20 weeks	20.9	21.2	21.5	25.1	21.7	21.2	25.6	22.8
Feed	52.7	54.0	53.1	56.8	53.3	55.9	54.9	55.0
Other	6.8	6.9	7.8	8.1	7.2	7.4	8.0	7.1
Labour	7.6	7.7	8.8	5.7	5.6	4.9	10.0	2.0
Housing	11.1	11.5	11.3	14.3	10.8	10.6	12.7	11.4
General	1.6	1.6	1.4	1.7	1.4	1.3	1.7	1.2
Manure disposal	1.5	0.7	0.0	-0.6	-0.3	1.5	0.4	-0.3
Revenue spent hen	-2.0	-2.3	-1.9	0.0	-1.4	-0.7	-0.1	-2.2

Source: Horne, P. V., & Bondt, N. (2017). Competitiveness of the EU egg sector, base year 2015. International comparison of production costs. Wageningen Economic Research report (2017-062

Figure 8. Cost of egg production in various EU countries Eur cent per kg.

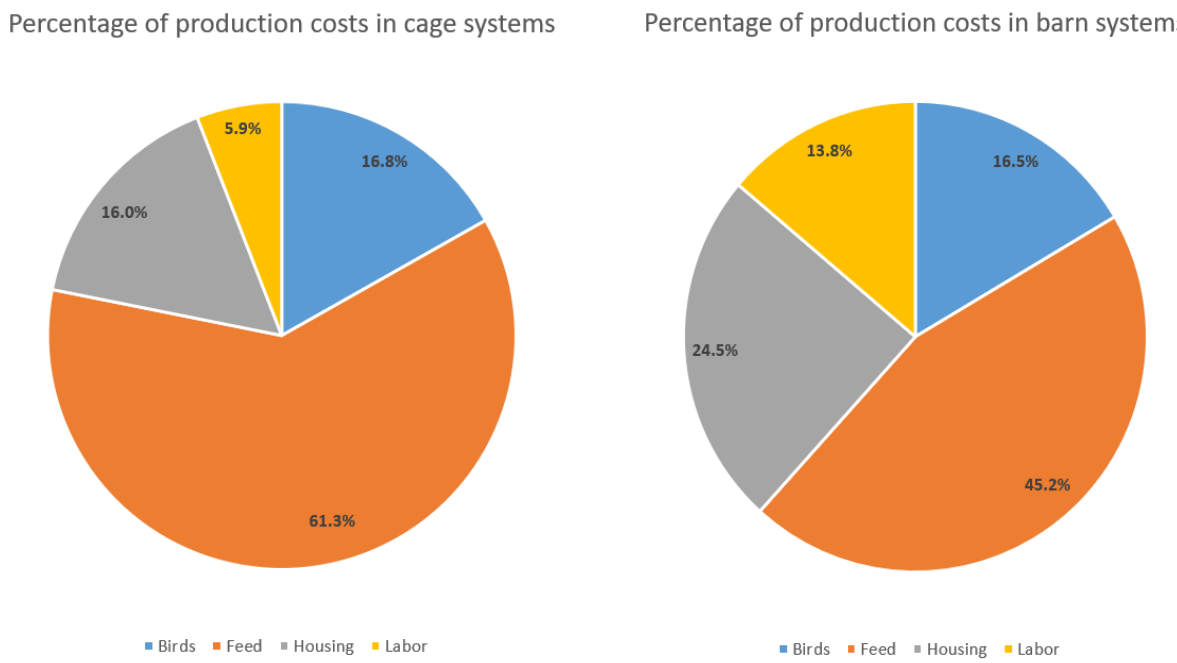
The data provided in the article is only on EU countries, but they show that the average price for the biggest egg producing EU countries is 103.16 cents per kg of eggs with shells meaning that the in a carton box of 10 eggs is 68 cents. This means that for the farmer it is 14% more costly to produce barn eggs in EU than cage eggs.

In an article by Sumner et al. named "Economic and market issues on the sustainability of egg production in the United States: Analysis of alternative production systems" (2011) on egg production facilities show how the costs are dispersed per a dozen of eggs compared between cage systems and barn systems

Item	Cage production system range and median ($ per dozen)	Noncage production system range and median ($ per dozen)
Pullets[2]	0.09 to 0.11 0.10	0.14 to 0.17 0.155
Feed	0.28 to 0.45 0.365	0.35 to 0.50 0.425
Housing[3]	0.05 to 0.14 0.095	0.09 to 0.37 0.23
Labor[4]	0.03 to 0.04 0.035	0.07 to 0.19 0.13
Sum of the itemized costs and difference at the midpoints	0.595	0.94
Sum of the itemized costs and differences at the low costs	0.45	0.65
Percentage cost difference based on the sum of items		
Total cost[5]	0.57 to 0.92 0.745	0.97 to 1.13 1.05
Percentage cost difference		

Source: Sumner, D. A., Gow, H., Hayes, D., Matthews, W., Norwood, B., Rosen-Molina, J. T., & Thurman, W. (2011). Economic and market issues on the sustainability of egg production in the United States: Analysis of alternative production systems. Poultry science, 90(1), 241-

Figure 9. thorough analysis of cost of egg production in two different systems of keeping ($ per dozen of eggs).



Source: created by the author

Figure 10. comparison of percentage of production costs in cage and barn systems .

These percentages and the table indicate that production costs for dozen of eggs is higher in barn systems in these metrics:

- The birds costs are 55% higher in barn systems.
- Feed costs are 16% higher in barn systems.
- Housing costs are 142% higher in barn systems.
- Labor costs are 271% higher in barn systems.

In order to cut costs in barn systems the farmer who would implement changes should start off with looking to lower the costs in labor first to the maximum then housing costs. But as the articles above explain it would be very hard to cut the costs as they mainly come from the reason that the farm has less space to fit the birds in, and more free space for the birds to roam arround. Meaning that the bird costs increase comes only from having less birds, housnig cost increase per dozen eggs also comes from larger housing needed for the birds to fit and also accommodate the classification standarts of less birds per square meter. The only way to cut the costs is through lowering the cost per dozen in labor but this could also be hard labor itself only accounts for 13.8% of the total cost. And this cost side can't be nulified as a farm can't function without its workers. These finding means that it is really hard and probably not cost efficiant to cut the cost of produciton of dozen eggs that come from barn systems.

In the first chapter of this thesis, it is shown that not only being more ethical for the animals is a part of sustainability that can be achieved by the farmers but also waste management can play a role in being more sustainable. This can also lower the costs of the farm or even gain additional income for it.

Patel et. al in an article "Poultry waste management: An approach for sustainable development. (2019) write that there are multiple ways of using waste from the egg farm. In their article they describe the methods and then describe how they can be adopted by farmers. In another article Zhang et al. in an article named "A Review of Poultry Waste-to-Wealth: Technological Progress, Modeling and Simulation Studies, and Economic- Environmental and Social Sustainability" (2023) use those methods and show how they can help farmers to earn more income and be more sustainable and environmentally conscious. For example, using poultry waste for fertilizer production is ideal not only because of its rich nutrient content but also due to its low cost and availability of materials. Zhang and El-Mashad in a book "Waste management in egg production" (2017) found that during a three-year application of manure compost, crop yields tended to increase, particularly in the second and third years, with an average growth rate of 7–15%. This is good for farmers who raise their own crops that feed the chickens and is not only effective but also contributes to circular economics. When poultry litter and manure are utilized as an organic fertilizer, the associated costs for the collection and transportation of waste material are estimated to be approximately 30 to 50 British pounds (about 36 to 60 US dollars) per ton, and the cost generated in the conversion process, especially in the composting process, can be very cost-effective and environmentally friendly. In fact, agricultural products fertilized by organic matter are sold at almost double price compared to those grown using chemical fertilizers, which means more profit can be derived from organic fertilizer production utilizing poultry litter and manure if they are sold by farmers. Biochar can be used as a soil conditioner to improve soil quality, and it can be sold in the market at an average price of 150 British pounds (about 180 US dollars) per ton, indicating its great economic potential. To summarize, lower production costs and higher product prices make organic fertilizer production utilizing poultry waste an attractive option in agricultural production. In addition, poultry waste can also be utilized in other industries. For instance, McGauran et al. in an article "Incorporation of poultry eggshell and litter ash as high loading polymer fillers in polypropylene" (2020) estimated that the total profits to the polymer industry would be 1,96 million British pounds if poultry bones, meal, and feathers were used as materials for production in the United Kingdom, indicating the possibility of improving the economic benefits of both the polymer and poultry industries.

One of the industries that can be made more sustainable is the polymer manufacturing industry.

The polymer industry is very environmentally damaging, but changing production to use waste such as carcasses of dead birds can turn this very damaging production to less damaging. In the UK, it is estimated that about 1697 tons of dry poultry waste are generated every day. When using poultry waste (mainly poultry bones, meal, and feathers) to produce polypropylene feedstock, the required energy input is about 47.0–65.5 MJ for producing 1 kg of polymers, which is 30% to 50% lower than that required by the conventional methods, resulting in a reduction of 40% to 60% of emissions of CO2 equivalent, and a total of 6645 t CO2 equivalent could be saved per day through the use of poultry bones, meal, and feathers.

So, from all the sources above it is possible to say that keeping hens in cages is not good for animals, but alternatives cost more, and there is a considerable proportion of consumers who are not willing to pay the price. In the EU about 35% in US about 13%. So that means that the price difference is a monumental issue for the customer. Looking at the raw data and cost increases for the farmer is it possible for the farmer to use Japanese management models to decrease the costs of making a 10-egg pack lower than 14% increase to be more appealing to the customers that are looking only at the price level of the product? Or should the Japanese management models only be used to increase the ethicality and sustainability aspects and have hope that the customers would choose the higher priced product.

2.2 The analysis of Japanese management models and their sustainability measures in poultry industry

In the second and third chapters of the thesis it is said and showed by the scientific literature what are specific Japanese management styles (Kaizen, just in time, Kanban, 5S methodology, Newamashi) and how could they impact poultry industry to be more sustainable. Findings from multiple authors and studies regarding management and their methods were evaluated. These models were explained by Palmer V S (2001), Dean M and Robinson A (1991) Brunet P (2000) Hamel, G., & Prahalad, C. K. (1996). Matsui, Y. (2007) Ohno, T. (2019 Choi, T. Y., Netland, T. H., Sanders, N., Sodhi, M. S., & Wagner, S. M. (2023). Esparrago Jr, R. A. (1988). Wakode, R. B., Raut, L. P., & Talmale, P. (2015). Agrahari, R. S., Dangle, P. A., & Chandratre, K. V. (2015), Hough, R. (2008), Sagi, D. S. (2015).

These models and their adaptations were evaluated by Schrager (2018), Kato et. al (2022), Kazancoglu, Ekinci, Ozen, and Pala (2021), Asmudi, Rahmat, and Nofi (2018). As the adaptation of these models was evaluated a question arises. Can these models be used to lower the costs and make more ethically produced eggs more appealing to the customer that only cares about the price? Also, can these models be more ethical and sustainable for the birds?

Kazancoglu, Ekinci, Ozen, and Pala in their article “Reducing food waste through lean and

sustainable operations: A case study from the poultry industry." (2021) did their research into adaptation of the Japanese model Kaizen in a turkey farm. From their findings adapting lean practices to this farm reduced the logistical aspects due to less time needed for loading and unloading the produce. Also applying lean practices makes less waste. In their study the turkey farm they used did not apply any lean model practices and did not apply FIFO methods for loading. They did not do this because the turkey farm didn't have any agreements with their supplier. Researchers first had to convince the suppliers to change the time of the day for pickups. After discussions between the company and the supplier, if the supplier starts collecting turkeys around 2 a.m. instead of 8:30 p.m., and the company introduces shift working and starts the slaughtering process at 5 a.m. instead of at 7 a.m., waiting times would reduce by around 3.5 hours. Therefore, the suggested initial improvement areas would be to change collection times and introduce shifts in the company. Another improvement would be with regard to the tying and loading process, for which automatic handling equipment could be adopted. Manual handling is used in the current system, which results in extra effort on the part of employees and increases the stress level of the turkeys. Technological handling equipment can help eliminate movement waste, and also reduce processing time. An example of such equipment would be the TA 800 Turkey Loader, which would reduce processing time by 40%, improve both worker and animal welfare, reduce stress-related costs, and increase loading speed. An investment in this system would decrease the tying and loading process by 1167 seconds. One of these important contributions to sustainable food operations covers the working conditions of suppliers and the company. With shifts being introduced into employee working hours, the efficiency of the process improves because of increases in the productivity and dependency of the workers. Moreover, as a result of the analysis, it is seen that due to the difference between the working conditions of the company and the suppliers, animal welfare decreases. With the suggestion of a time change resulting from the introduction of the lean method, it is expected that the animals will not be woken at night and that related stress levels will be avoided. It is expected, therefore, that animal welfare will increase. Improvements in working conditions in the company and the supplier and increasing animal welfare are crucial contributions to social sustainability in food operations. In addition to the social benefits, lean approaches also contribute to the savings by reducing costs. The study's suggestions not only reduce personnel costs, but also reduce vehicle maintenance costs, because of the improvement in costs, and the increase in company efficiency. Therefore, these improvements contribute towards economic sustainability in food operations. Also, one of the most important contributions of this study is that it reduces and minimizes waste in food supply chains by considering environmental issues. The waste generated during the turkey collection stage by vehicles is minimized. Carbon emissions are also reduced through improved vehicle use and

capacity.

This study was done on turkeys and their meat products, but as the improvements were made to the logistical parts of the organization this model can be adapted to egg production.

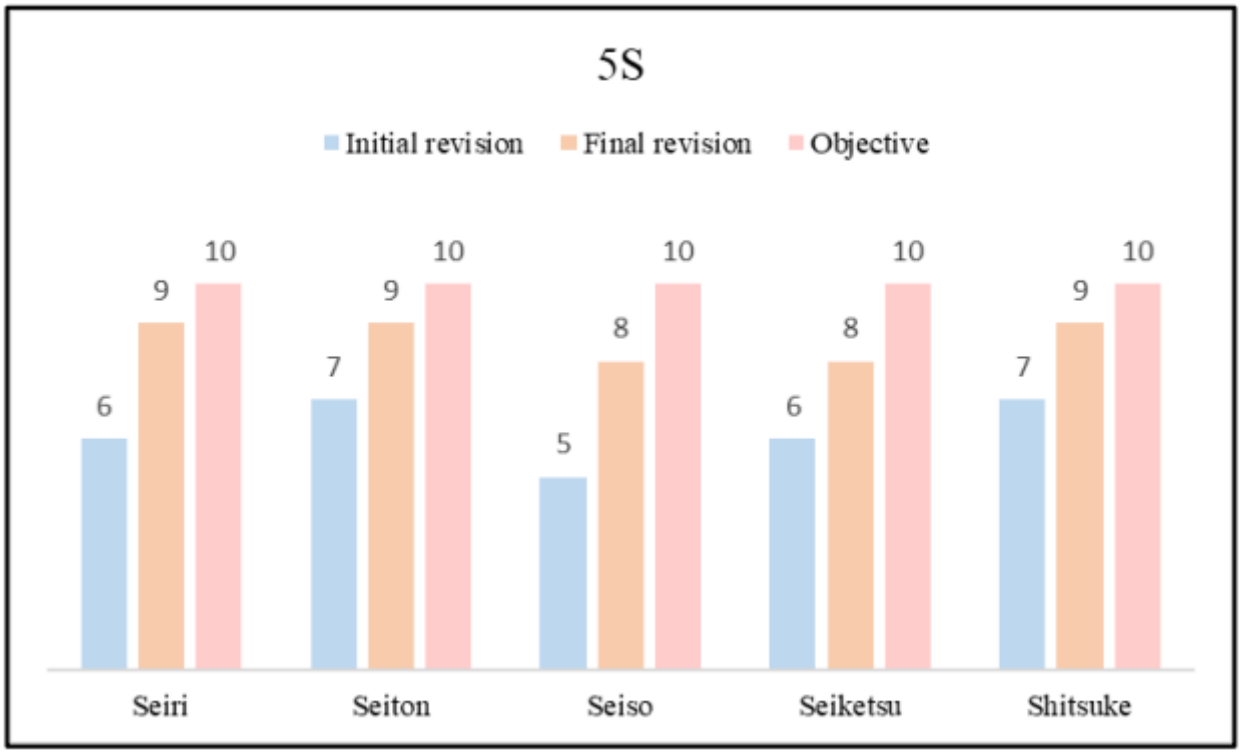
5S model adaptation to egg production was done by Amoretti et al. named “Production model based on lean manufacturing and systematic layout planning to reduce waste in a company in the poultry sector: a case study” (2024). Their study was done on a egg production facility where the researchers were allowed to introduce the 5S management model in their organization of the work area. This was done by taking photos and videos, in order to be able to evaluate the initial situation. After this the 5S methods were implemented through phases. The implementation phases were: classification, where unnecessary items must be eliminated to facilitate the workplace. Secondly, this organization, placing the elements in the right place with the help of signs and colors that help better identification. Third, clean, so that dirt does not disrupt the workplace. Fourthly, standardize, here the operator must carry out the activities at a constant pace, here there must be supervision from the plant manager to be able to properly use the tool. Finally, commitment and discipline, this phase is essential, as it implies changes in the behavior and commitment of the team. The figure below shows how the dispatch of the commercial eggs was organized after the implementation.

Source: Amoretti-Magallanes, M. S., Carpio-Montesinos, P. A., & Corzo-Chavez, J. A. (2024). Production Model Based On Lean Manufacturing and Systematic Layout Planing To Reduce Waste in a Company in the Poultry Sector: A Case Study. International Journal of Environmental Pollution and Remediation, 12, 43-51.

Figure 11. Egg organization example after the implementation of the 5S model.

Also in their study researchers used Kanban to implement visual management of the production facility. The created tool was named Visual management. This tool was used with the objective of disseminating production information. This was done through a qualitative field study. This pilot test was done with the plant operators, the production manager and the researchers. Where it could be observed that the operators waste time waiting for the cardboard boxes to be able to sort the

eggs, looking for any tools they need or wandering around, since they are not aware of the time lost and what affects the total production. This is done in three stages: Training operators and plant managers, implementation of signaling and standardization and continuous improvement. The methods were implemented with great success as seen in the graph below:



Source: Amoretti-Magallanes, M. S., Carpio-Montesinos, P. A., & Corzo-Chavez, J. A. (2024). Production Model Based On Lean Manufacturing and Systematic Layout Planing To Reduce Waste in a Company in the Poultry Sector: A Case Study. International Journal of Environmental Pollution and Remediation, 12, 43-51.

Figure 12. The success rate of implementation of the 5S methods in the facility

Overall by carrying out the analysis and diagnosis using the 5S engineering tools, visual control and Kanban tools, it helped improve the efficiency of the company, since in the part of order, cleanliness and operator training it improved from 62% to 86% effectively and the loss in eggs was reduced approximately from 0,96% to 0,82% of the technical gap.

With the decrease in loss of eggs due to the implementation of Kanban tools in the farm the prices in barn egg production costs in EU can be calculated with these formulas:

Loss before=0.63kg×(0.96%×103.16 cents/kg)

Loss after=0.63kg×(0.82%×103.16 cents/kg)

Cost Reduction=Loss before−Loss after

Cost Reduction = 0.09 cent per pack of 10 L size eggs.

This cost reduction is miniscule, so the price change won't be felt by the customers.

With the authors concluding that the main answer whether to be more sustainable and ethical with the chickens is left for the consumer to decide and with the answer that Japanese management models don't provide much change in the cost. But how about increasing the sustainability aspects using Japanese management models?

Applying Kaizen methods can lead to some improvements in sustainability. For example reduction in energy consumption. In a study done by Estrada-Gonzales et al. named "Decreasing the environmental impact in an egg-producing farm through the application of LCA and lean tools." (2020) implementing eco efficient schemes through Kaizen can result in the adjustment of the consumption/power ratio in the equipment. Through this it would be possible to obtain a 49.5% reduction in the farm's total energy consumption without compromising the current production process. There would also be an average saving of 56.3% in environmental impacts for the electrical cost of egg production.

Kanban method application can be assed across all of the US egg industry. Almost all of US egg production facilities use Kanban management style without even acknowledging it and the effects are very positive for the environment. A landmark study highlighted that the U.S. egg industry has significantly reduced its environmental footprint over the last fifty years, achieving 71% lower greenhouse gas emissions and using 32% less water to produce a dozen eggs. These improvements have been facilitated by better management practices, including methodologies like Kanban that streamline operations and enhance resource efficiency. This was taken from Pelletier et al. article named" Comparison of the environmental footprint of the egg industry in the United States in 1960 and 2010 (2014).

Another way Kanban can increase the sustainability and also effectivity of the company is through implementation of Just in time production (another Japan management model mentioned and explained in the first part of the master's thesis). With the implementation of JIT Xin et al. find in their article named "Environmental impacts and sustainability of egg production systems" (2011) that it was possible to create a operational strategy that can lead to a decrease in resource wastage by approximately 10-20%, particularly in feed management and energy use, thus enhancing sustainability in egg production.

Also Kaizen can be applied to other fields of agriculture. In a study by Ramos et. al named "A

Model Utilizing Green Lean in Rice Crop Supply Chain: An Investigation in Piura, Perú" (2021) it is found that an ineffective rice farm with the implementation of Kaizen methodology was able to turn 95% of their waste from rice that could've been wasted to make a fertilizer.

Another way lean manufacturing with kanban model of implementation helped to reduce waste and energy consumption was when a team or researchers introduced the new models and changes in a food manufacturing plant in Egypt. The study done by Salah and Mustafa named "Integration of energy saving with lean production in a food processing company" (2021) found that the company after the implementation of the model reduced the production of waste from 216 ton/month to 56.88 ton/month. Also, with the implementation of the new model energy waste was reduced from 47.779 kWh/month to 13.510 kWh/month.

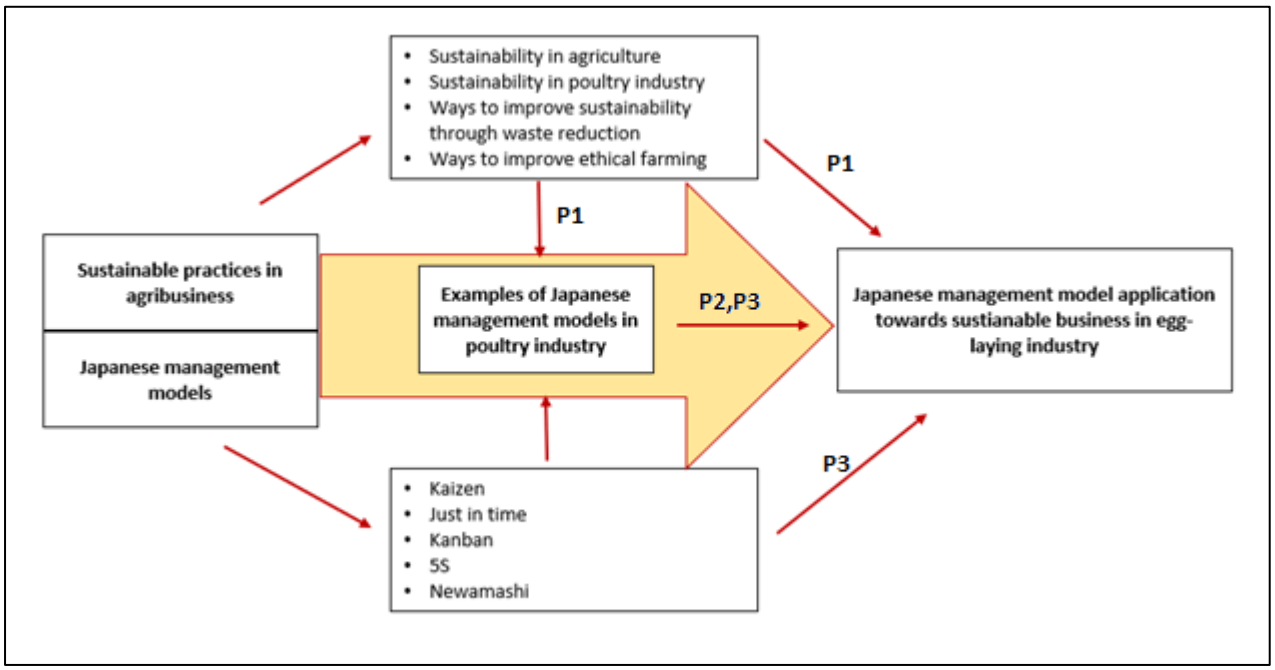
With all of these findings it is possible to determine how Japanese management models helped the sustainability measures in the companies it was implemented into:

Table 3

Sustainability increases in industries where Japanese management models were introduced

Authors	Year of publication	Business unit	Field where sustainability was increased	How much did the Japanese models helped percentagewise
Estrada-Gonzalez, I. et. al.	2020	Egg production farm	Reduction of energy consumption.	49.5% reduction in the farm's total energy consumption.
Pelletier et al.	2014	Egg production facility	Lower greenhouse gas emissions, water savings.	71% lower greenhouse gas emissions and 32% less water to produce a dozen eggs, during the course of 50 years of using Japanese management models.
Xin et al.	2011	Egg production facility	Decrease in waste production	Resource wastage decreased by 10-20%, particularly in feed management and energy use.
Ramos et. al	2021	Rice farm	Decrease in waste production	95% of waste from rice turned into fertilizer.
Salah and Mustafa	2021	Food processing facility	Decrease in waste production	73.66% decrease of waste generation and 71.724% decrease of wasted energy.

Analytical model:



Source: created by the author

This analytical model explains how propositions were created during the analysis of the literature and the case studies of sustainable practices in the poultry industry and Japanese management models. With this analysis three propositions were raised. Propositions were raised from these Sources: Proposition nr.1 – from the main idea found in sources that is shown in the table 2. Proposition nr.2 – from the in depth case study of a egg processing facility where Japanese management models were implemented study done by Amoretti et al. named “Production model based on lean manufacturing and systematic layout planning to reduce waste in a company in the poultry sector: a case study” (2024). Proposition nr.3 – from the main ideas found in sources that is shown in the table 3. Here are the propositions:

P1 – Cage free systems are sustainable but not appealing for the customer.

P2 – Correct implementation of Japanese management models could impact the pricing of eggs lowering the production costs.

P3 – Japanese management models could impact the sustainability of the poultry production positively.

The analysis presented in this thesis underscores the complexities surrounding sustainability and ethical practices in the poultry industry. It reveals that while ethical and sustainable practices in bird housing systems are beneficial, they come with significant cost implications that are often a deterrent for consumers and producers alike. The data illustrates that consumers primarily

prioritize price over animal welfare, though there is a minority willing to pay more for ethically produced eggs.

The adoption of Japanese management models, such as Kaizen, 5S, and Kanban, offers potential pathways to improve sustainability and efficiency in poultry operations. However, their cost-saving impacts, while notable in logistical and operational contexts, appear limited in reducing the substantial price disparities between cage and alternative farming methods. These models, however, do contribute to enhanced resource management, reduced waste, and improved workplace organization, which align with broader sustainability goals.

Furthermore, innovative waste management strategies, including the conversion of poultry waste into fertilizers and other industrial byproducts, showcase the potential to offset costs and promote circular economic practices. These approaches highlight a promising avenue for improving sustainability without solely relying on adjustments to bird housing systems.

From these conclusions a question and a problem could be made that could potentially be answered in the later part of the thesis. Could customers be persuaded to change their buying habits with the shown changes in animal welfare and waste management after the adoption of Japanese management models. And also, could the farmers be persuaded to change their housing systems or adopt Japanese management models after showing the potential changes of waste management and sustainability?

3. EMPIRICAL REASERCH ON THE ADAPTATION OF JAPANESE MANAGEMENT MODELS TO ACHIEVE SUSTAINABILITY IN THE POULTRY INDUSTRY

This chapter of the thesis provides research methods, research data analysis, a discussion of the results and evaluation of the research results.

3.1 Research methodic:

Aim of the Research:

The aim of this research is to explore sustainable business practices in the poultry industry, particularly focusing on the adaptation of Japanese management models to enhance sustainability in egg-laying businesses.

Objectives of the Research:

1. To examine the sustainability of different housing systems in the poultry industry.
2. To analyze the application and potential benefits of Japanese management models in improving sustainability in poultry farming.
3. To assess the ethical implications and effectiveness of Japanese management models in the poultry industry.

Research methods. This research implemented a qualitative method through interviews which is suitable for exploring complex and phenomena which is sustainability and efficiency of Japanese management models in poultry farming. These topics involve subjective perceptions and intricate strategic decisions, which are best explored through qualitative data. This approach facilitates a deep understanding of how individuals within organizations conceptualize, implement, and experience sustainability practices and the potential benefits of integrating Japanese management models in the poultry industry.

Purposive sampling and sampling frame. In recent years, the poultry industry has faced increasing pressures to adopt sustainable practices, driven by both consumer demand for ethically produced products and regulatory frameworks aimed at reducing environmental impact. This shift has prompted the need for skilled professionals who are not only knowledgeable about sustainable farming practices but also familiar with innovative management techniques that align with global sustainability goals.

The purposive sampling strategy for this research is designed to capture the most relevant participants. First, the selected specialists must be deeply involved in sustainability and

management practices within the poultry industry, particularly those with expertise in innovative technologies and ethical farming practices. Additionally, these participants should be actively working in poultry companies that are implementing sustainable practices at a global level, ensuring they have experience with international market dynamics and regulatory frameworks.

Researched informants. Informants will be chosen based on their roles in the European or global departments of their organizations, as their insights are directly relevant to the specific challenges and strategies involved in integrating sustainability into poultry farming. Their roles likely provide them with comprehensive insights into the integration of sustainability strategies within the poultry industry. This targeted selection ensures that the study captures informed views from individuals who are not only knowledgeable about but also responsible for managing and advancing these sustainability initiatives. In this research there are 5 participated companies they will be grouped in the table later on.

Five CEO's and sales managers, each with extensive experience in their respective companies and actively pursuing higher sustainability standards in response to increasing consumer demand, participated in a series of interviews conducted in April/May 2025. The interviews aimed to explore the integration of sustainability practices within their organizations and how these practices influence overall management strategies. The questions focus on the challenges and strategies related to sustainability, animal welfare, and the potential use of Japanese management concepts like Kaizen, JIT, Kanban, and 5S to enhance efficiency and sustainability in egg production. The study seeks to gain insights into how these managers perceive and address the growing need for sustainable practices in the industry. Due to strict confidentiality agreements, the identities of both the specialists and the companies they represent cannot be disclosed.

Interviews, conducted via phone calls and were done on 2, 5, and 9 May, 28th of April and had a collective duration of 2 hours and 15 minutes.

Interview Protocol. The interview protocol for this research was developed around key categories that explore the integration of sustainability practices and management strategies in the poultry industry. Based on the studies of Dawkins (2016), Hartcher, K. M., & Jones, B. (2017), Palmer (2001), Wakode et al. (2015), Matsui (2007), Agrahari et al. (2015), Estrada-Gonzales et al. (2020) the protocol emphasizes categories such as sustainability and animal welfare, the role of Japanese management concepts in poultry farming (including Kaizen, JIT, Kanban, and 5S), and the impact of sustainability on poultry farming efficiency. These categories reflect a holistic approach to embedding sustainability in poultry farming and its effect on organizational performance. The questions aim to capture insights into how sustainability practices, including the adoption of

Japanese management methods, can improve the sustainability and efficiency of egg production.

The table and the questions are split into 6 categories:

1. Farming practices
2. Welfare and ethics
3. Japanese management concepts
4. Application of Japanese management models
5. Organizational integration
6. Performance and future prospects

Table 4

Questions for the interviewers

Category	Question	Reasoning
Farming practices	Could you describe your company's current poultry farming setup (cage, barn, free-range, etc.)	To understand the farming system used in the company and its sustainability impact.
	What are the main sustainability challenges your company faces in egg production (e.g., waste, energy, animal welfare)?	To identify key sustainability barriers within the company's operations.
Welfare and ethics	How important is animal welfare in your company's decision-making, and how do you balance it with economic constraints?	To assess how animal welfare is prioritized alongside economic pressures for the company.
	What do you see as the most significant barriers to adopting more "ethical" or "environmentally friendly" farming methods?	To uncover obstacles preventing the adoption of more sustainable practices.
Japanese management concepts	Have you ever heard of any Japanese management concepts (Kaizen, JIT, Kanban, 5S) in your professional experience, or are these ideas new to you?	Assess how familiar is the correspondent with Japanese management concepts that could improve sustainability.
	Which aspects of Japanese management (e.g., continuous improvement, waste reduction, standardized processes) do you think are most relevant to poultry farming?	To determine which Japanese management methods could be applicable in the company.
Application of Japanese management models	Could Kaizen's 'continuous improvement' philosophy help optimize labor, feed usage, or animal-care routines in your company?	To explore how continuous improvement can enhance efficiency and sustainability in the correspondents company.
	What potential do you see for JIT or Kanban systems to reduce waste in egg production (e.g., feed inventory, packaging, or supply logistics)?	To explore how JIT and Kanban could improve the farm.
	The 5S methodology emphasizes organized, clean, and standardized	To assess the impact of 5S on efficiency and hygiene in poultry farming.

	workspaces. Could that reduce contamination risks or improve efficiency in a poultry environment?	
Organizational integration	Given that Kaizen, JIT, Kanban, and 5S could impact the production process do you see overall that those management models could improve the efficiency of the farms?	To understand how the farmers think about implementing the models economically?
	Could you foresee any conflicts between Japanese models' focus on constant improvement and the unpredictable nature of livestock farming (e.g., disease outbreaks)? nature of livestock farming (e.g., disease outbreaks)?	To explore how Japanese methods can adapt to the unpredictable nature of poultry farming.
Performance and future prospects	What key performance indicators (profit, mortality rate, feed efficiency) would you track to measure 'success' if you adopted these management methods?	To identify the performance metrics for evaluating the success of management methods.
	How quickly do you think changes would have to show results (e.g., improved sustainability or profit) before you deemed them worthwhile?	To understand the expected timeframe for seeing tangible results from implementing changes.
	Looking five years ahead, do you see Japanese-style continuous improvement or lean methods playing a role in shaping a more sustainable egg industry overall?	To evaluate the long-term potential of Japanese management methods in shaping a sustainable poultry industry.

Questions for sales managers and CEO's, within poultry farming companies are to be investigated how their companies look at and contribute to sustainability in their practices and their opinions on how the Japanese management models could help to increase sustainability in their operations of poultry farming companies.

3.2 Data analysis and the discussion of the results

Qualitative insight form interviews with five European leading egg poultry farm sales and rnd managers are synthesized in this section to depict how sustainability and ethical farming and possibility of implementing Japanese management models is viewed in their companies. The comparative nature of the analyzed data allows for a deeper understanding of current industry practices in the European market and views on ethicality on birds. The information presented in TABLE describes the major characteristics of the companies researched. Size, operational range, size of their bird fleet and current practices on ways how they keep their birds are on the list.

Table 5

Characteristics of Interviewed Organizations.

Respondent	Location	Number of layers	Housing type for hens
1.	Western Europe	2.5 million	Cage, barn, free range
2.	Eastern Europe	15 million	Cage, barn
3.	Scandinavia	100 thousand	Barn, free range

4.	Eastern Europe	5-6 million	Cage, barn
5.	Western Europe	2-3 million	Cage, barn, free range

Further the 6 key categories (Farming practices, welfare and ethics, Japanese management concepts, application of Japanese management models, organizational integration, performance and future prospects) derived from empirical scholars' research and insights from industry professionals will be analyzed. In the tables these categories will be analyzed in parts named – subcategories.

Also in the tables which will be used to analyze the informants answers will be split by answers from specialist in different poultry farms they will be grouped by their farming methods and how they keep the birds: mixed approach (cage, barn, free range), cage and barn (a common group for companies that work in Eastern Europe) and barn and free range (most ethical way of keeping the birds) this is done due to the different opinions held by informants of those companies that show their view on farming methods.

Farming practices. Marian Dawkins in her article "Animal welfare and efficient farming: is conflict inevitable?" (2016) states that some companies choose to be ethical towards how to keep their animals and some companies choose to be less ethical due to cost increases, and the fact is it's impossible to increase the ethical farming without increasing the costs. So this category will delve into deciding which companies had the possibilities to increase their ethicalities and which couldn't.

Combining insights from informants' answers of first category questions within the poultry industry. We find differences in farming practices but all of the companies claim that they care about ethical farming and they find different challenges in approaching the fully ethical farming ways.

These responses provided by representatives of the companies within the poultry industry allow to see how different farming methods face different challenges. The answers provided could be grouped into three categories - 1. companies that have mixed approaches to farming (cage, barn, free range) which allows them to experience every ethical farming problem at once but also maximizes their output for different consumers who would like to have different options from cheap to ethically raised hens. 2. Companies that have a mixture between cage and barn raised eggs. 3. Companies that have barn and free range eggs. Then following the responses, we can see their main sustainability challenges and most significant barriers to approaching more ethical farming.

Table 6

Farming practices and related costs

Subcategories: / Farming styles:	Increased costs	Market demand
Mixed approach		1st interviever - It is very important until the customer decides to not buy from us anymore due to high prices.
Cage/Barn	2nd intervewer - The barrier is money. It costs a lot to build a new farm and we don't know if it will pay after. A lot of risk. 4th interviewer - Energy price and grain price and problems with war.	
Barn/Free range		

Poultry industry companies that have a mix of barn and cage farming methods have concerns with their products having increased costs and thus not being competitive in the market. Other companies that already use more ethically friendly methods also say that the market is not ready to be fully ethical in terms of raising the hens 100% free range due to the fact there are many customers that would like to still buy cheaper products and they would just lose their market share to the competitors that would not switch to fully ethical approaches.

Welfare and ethics. Hartcher, K. M., & Jones, B. (2017). Write that cages restrict hens' ability to perform natural behaviors such as perching, nesting, and dustbathing, leading to extreme behavioral limitations and stress. The lack of space and environmental complexity in these systems prevents hens from experiencing positive affective states, raising serious ethical questions about their welfare.

Within the poultry industry the outlook on ethics seems to be similar. Every company representative claim that they care about the ethical farming methods and try to achieve the most ethical goals in their farming. This could be due to the fact that the media and animal rights activists are very demanding for more ethical ways to farm. But the outlook on customers is mixed. These responses allow for two different subcategories to emerge. One is where the industry representatives claim that they care about ethical farming, but the customer wants the cheapest product available.

The other subcategory includes answers from companies that claim that their decision making in their practices is dictated by the need to achieve more ethical farming practices and also claim that

the customers also choose more ethically raised eggs and the price increases are not a problem for them.

Table 7

Answers about how consumers react to price changes

Subcategories: / Farming styles:	The consumer cares about the price	The consumer cares about ethical farming
Mixed approach	1st interviewer - Demand from customer is the main challenge. 5th interviewer - We don't see any problems with having more ethical ways of housing it's the customers they want sometimes cheaper products and we can give it to them.	
Cage/Barn	2nd interviewer - The market says that it wants cheap eggs so we do it as cheap as we can	
Barn/Free range		3rd interviewer - Animal welfare is important for our company. We don't balance it we just care about our hens and our customers care about it too.

Poultry industry company that only provide eggs from cage/barn farming methods claim that the price is the reason why it won't switch to more ethical methods and if it would change they would make themselves at a position where they would lose market share to other companies that are willing to provide more cheaper products. While the company that provide more ethically raised eggs say that their consumers are not inclined by the price changes to buy less and that they care about ethicalities of how the egg was raised. Also companies that use ethical farming methods such as free range and also cage say that they also won't change to fully free range due to demand of the market for cheap eggs.

Japanese management concepts. Within the poultry industry Japanese management models are crucial. As the methods and their applications provide a great deal of positives to the farmers that utilize them. Kaizen, as defined by Palmer (2001), is a philosophy that promotes continuous, incremental improvements, with a focus on making everyday small changes for better efficiency and sustainability. The Kanban system, explained by Wakode et al. (2015), uses visual signals to regulate inventory and workflow, ensuring materials are produced only when needed and minimizing waste. Just-In-Time (JIT), according to Matsui (2007), focuses on producing goods in

the necessary quantities and at the necessary time, reducing costs and inventory while improving operational efficiency, though it may face challenges during supply chain disruptions. Additionally, 5S, described by Agrahari et al. (2015), is a system for organizing the workplace to reduce waste, increase productivity, and ensure sustainability through a cycle of sorting, organizing, cleaning, and maintaining workplace standards.

Company representatives that work in the industry almost all were familiar with Japanese management methods, some even provided Japanese management methods that were not discussed in this masters thesis.

Kaizen and lean producing subcategory shows that egg producers know about Japanese management models but only about this particular model. The second subcategory – other Japanese management models will include poultry egg producers that know about other Japanese management models.

Table 8

Answers about Japanese management models

Subcategories: / Farming styles:	Kaizen and lean management	Other Japanese management models
Mixed approach	1st interviewer – At our facilities we do kaizen and the Toyota method.	1st interviewer – At our facilities we do kaizen and the Toyota method. 5th interviewer - Its not new for me I have heard, about them yes.
Cage/Barn	2nd interviewer - I only have heard about lean	
Barn/Free range	3rd interviewer – only Kaizen	

This category and company group is a partial one for the analysis as it only shows crucial information that without the direction of the interview would've been different. Also this category shows producers do have knowledge about Japanese management models but only about Kaizen and lean management styles except for one which uses Toyota way. From here some other ideas start to merge – do egg producers know about the benefits of Japanese management and how it could help poultry farmers.

Application of Japanese management models. Overall this category features how did the respondents feel and think about the different 3 Japanese models presented and explained how it could benefit them overall performance vise and ethical farming vise and whether it is feasible to have them in their egg farms.

This category has three subchapters that represent how the representatives think about each of the

described Japanese management model to them and whether it is viable in their egg farming facilities.

The first subcategory named Kaizen delves into how the informants replied about Kaizen management applications. The second named JIT and Kanban delves into how the informants think about JIT and Kanban management styles applied in their farms. The third subchapter named 5S delves into how the representatives replied about 5S management style application for their poultry farms.

Table 9

Opinions about different proposed Japanese management models

Subcategories: / Farming styles:	Kaizen	JIT and Kanban	5S
Mixed approach	1st interviewer - Yes we do it now and it helps with optimization of labor other things – not so much. 5th interviewer - I think It could help with waste and optimization of labor.	1st interviewer - We would do that if the competition also does it and the workers try to do it too. 5th interviewer - Maybe it would help with more organization leading to less time wasted and less resources wasted on being productive	1st interviewer - Yes, maybe it could but I would need some time and do some checks before I could answer this question correctly.
Cage/Barn	2nd interviewer - Lean is maybe good for waste. 4th interviewer - Maybe help with waste.	2nd interviewer - Just in time is how we manage our products but we don't have a name for it we just call it FIFO. 4th interviewer - Maybe less waste on the floor I don't know. But if it more organized maybe we would lose less eggs in the process of colleting.	2nd interviewer - we would need to try it to see but I think yes it could help to have this organization. But we are organized now so I don't know how it could help us. 4th interviewer- Efficiency yes if the waste is reduced.
Barn/Free range	3rd interviewer - Kaizen is good we do it at our farms it helps us with organization and less waste		

From these answers there could be said that kaizen could be appropriate for most of the industry due to – good management of waste and increased organization for the workers. JIT and Kanban are less known in the industry and most of the answers were unsure about the possible benefits of

these particular Japanese management models but interviewers think it could help with waste, organization and prevention of loss of eggs in the production. 5S method is the most unknown and the interviewers were unsure about how it could help, only one interviewer who work in cage/barn company tells that it could help with efficiency if the waste is reduced. From these answers it could be said that Kaizen could help the most.

Organizational integration. Study by Estrada-Gonzales et al. (2020) demonstrated that applying Kaizen management models in an egg-producing farm led to a 49.5% reduction in energy consumption and a 56.3% saving in environmental impacts related to electrical costs, showing that Japanese management practices can improve sustainability in the egg farming industry.

As talked about above the representatives were informed and gave their answers about Japanese management styles and their possible applications and current applications of them in their representative companies. But this category focuses on what possible challenges could arise from implementation of these Japanese management models in their companies.

The first subchapter named possible benefits of Japanese management implementation shows how different poultry industry company representatives see the possible benefits of implementing Japanese management models that were introduced to them before.

The second subchapter shows how different poultry industry company representatives see possible challenges of implementing Japanese management models that were introduced to them before due to the unpredictable nature of poultry industry as it is animal farming industry which has specific risks which cannot be controlled such as disease outbreaks and grain price hikes due to bad seasons.

Table 10

Possible benefits and challenges of adapting Japanese management models

Subcategories: / Farming styles:	Possible benefits of Japanese management implementation	Possible challenges of Japanese management implementation
Mixed approach	1st interviewer - and it helps with optimization. 5th interviewer - yes it has a lot of potential in this industry. With waste management and with organization.	1st interviewer - Employee engagement is very important to make these methods successful, if they wont participate it will not work. 5th interviewer - I think there could be some obstacles related to workers learning the new systems, maybe at first this would not work perfectly but maybe in

		some time I could see this working. Also I think there could be some issues with the technical implementations if there would be any but that's just a guess.
Cage/Barn	2nd interviewer - Lean is maybe good for waste 4th interviewer - Maybe less waste on the floor I don't know. But if it more organized maybe we would lose less eggs in the process of colleting.	2nd interviewer - there could be problems you know if we put so much (accountability) on the workers. Could not work maybe. Maybe money if it costs a lot 4th interviewer - Ofcourse if we want this new thing to work the people who work should also do it. If we just tell them and they wont do it then what's the point.
Barn/Free range	3rd interviewer - Kaizen is good we do it at our farms it helps us with organization and less waste.	3rd interviewer - You know this system is Japanese and workers at our facility they are not Japanese we have different cultures we see work as a different thing.

From these answers it could be said that the biggest challenge no matter the housing style is the worker engagement to apply and not to forget to apply the new implemented Japanese models. But also across the whole industry there are claims and acknowledgements that the implementation of the Japanese models especially Kaizen could help the reduction of waste and it has positive potential benefits.

Performance and future prospects. As all the representatives had all answered their opinions and were given short information's about the benefits of implementing all the Japanese management models that are discussed in this masters thesis in this last category there were given questions to asses how they would calculate the benefits of implementation, what could the possible time frame to see the benefits and to asses how they see the industry in the upcoming five years – whether it is needed or no.

Form these answers there are 3 subcategories created. The first one named – KPI (key performance indicators) asses how would the companies track the benefits of implementing Japanese management models. As this is needed to see the data of the benefits so the companies can make a decision based on facts and could calculate the need for more implementation in the future.

The second subchapter named time frame – states how fast the companies would like to see the benefits arise from the implementation of the Japanese management models, based on this the companies who would implement or assist with the implementation of the Japanese management

models with equipment to keep track of the progress and etc. could present the poultry industry companies with the most viable solution for their needs.

The third subchapter named future prospect – delves in to how the company representatives feel about the overall need for the Japanese management in the industry and whether it is a viable in the upcoming years or just a waste of time.

Table 11

Answers about keeping up the performance of adapted Japanese management models

Subcategories: / Farming styles:	KPI	Time frame	Future prospects
Mixed approach	1st interviewer - Waste reduction. We work every month we make pictures and we decide if it did work. Some month it does some not. 5th interviewer - I think time could be measured, if there is more eggs packed than before in the same time we could count this as a potential KPI to check to see if this works.	1st interviewer - Depending the people in the system. But to see it work we could wait for half a year maybe. 5th interviewer - Maybe a year or two.	1st interviewer - No, we are hoping to change this way. We started good but this is getting a more and more redundant 5th interviewer - potentially yes
Cage/Barn	2nd interviewer - On how much it pays of. Probably waste reduction yes. We can count it easy. 4th interviewer - Waste reduction as an indicator. Maybe profits later from less waste generated and less eggs lost.	2nd interviewer - Well it is hard to know but I think a year. 4th interviewer - Couple months and we will see more money if it works.	2nd interviewer - Lean is everywhere I see, others maybe. But I haven't heard any of our colleagues in this business doing it so I don't know.
Barn/Free range	3rd interviewer - Profit yes. And waste reduction too	3rd interviewer - Lean worked from the start I don't think we should wait to see, if we do something new it should work ASAP.	3rd interviewer - Lean should be everywhere now I believe

Across the industry the opinion on KPI's, time frames and possible future prospections for Japanese management is different and spilt. Companies in the mixed farming category think that the best KPI to see if the new implemented models are working is taking pictures and to see if there are more eggs packed than before, in the cage/barn category waste reduction is a KPI, in the most ethical barn/free range category generated profit and waste reduction is a KPI. For the time frames to see if the new implemented models are working the answers are split from the immediate need to see if they are working for up to a year or two, so there is no common ground, and this could be just a personal opinion of the individuals that were interviewed. Potential for the future is high for lean management implementation in the poultry industry, but one interviewer was not keen for this.

3.3 Evaluation of the research results

This section discusses the results of the propositions testing obtained during the analysis of the interview data which revealed some revelations that the industry does not have knowledge about Japanese management models that are mentioned and explored in this thesis but see potential of positives if their farms would implement it. All three propositions were supported but there is a lot of doubts from the industry representatives. Each proposition is discussed in more detail below.

H3 – Japanese management models could impact the sustainability of the poultry production positively.

Proposition 1. Cage free systems are sustainable but not appealing for the customer.

Confirmed. Based on the answers from the interviewers who work in the poultry industry the main idea presented by them, is that the customers are not in favor of this and will go and buy from their competitors who are offering cheaper options if they make a full switch from cage to cage free, this makes cage free systems not appealing for the customers. Only one interviewer out of 5 who is currently cage free disagrees with this opinion.

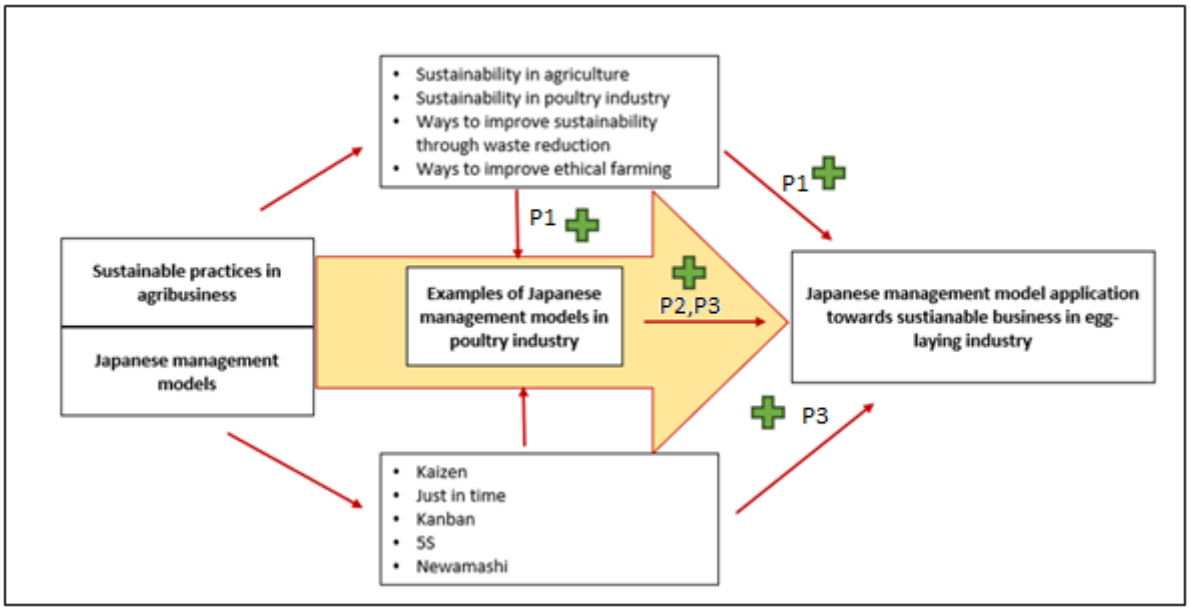
Proposition 2. Correct implementation of Japanese management models could impact the pricing of eggs lowering the production costs.

Confirmed. Poultry industry representatives are not sure but see a possible way that waste could be managed better and in turn less eggs would be wasted if the Japanese management models were implemented. One out of five representatives replied that they currently have one of the 3 Japanese models that are mentioned in the thesis and they are not happy with them, but this is not to because of the model or wrong implementation but due to the low worker commitment to do them fully.

Proposition 3. Japanese management models could impact the sustainability of the poultry production positively.

Confirmed. Poultry industry representatives see a way that correct implementation of the Japanese management models could provide more sustainability due to less waste created if they would work. But there are many doubts about this and the representatives are not sure themselves. There are many doubts because the poultry industry representatives are not known with the Japanese management models and from their answers there was a lot of intrigue to present them with more information on how this could work to achieve better sustainability and farm efficiency.

In the figure below is an empirically validated model of the thesis with updated propositions:



Source: created by the author

Figure 13 Analytical model with confirmed propositions

The research model in Figure 13 has been updated following our findings: three propositions were confirmed, emphasizing the benefits of adapting Japanese management models to poultry industry to achieve less waste and in conclusion better sustainability. Ethicalities of raising hens with the adaptation of Japanese management models according to the answers would not be affected.

The research on the adaptation of Japanese management models in the poultry industry reveals that integrating sustainability practices through these models can lead to positive outcomes, such as increased efficiency and reduced waste. The application of Kaizen, JIT, Kanban, and 5S has potential to improve sustainability by optimizing labor, feed usage, and waste reduction. However, the study finds that while industry representatives acknowledge the benefits of these models, the implementation faces challenges such as worker engagement and cultural differences. The

sustainability of cage-free systems is limited by customer demand for cheaper products, indicating that full ethical farming transitions may not be viable for many companies. Overall, the research confirms that, with the correct implementation, Japanese management models could enhance sustainability and profitability in the poultry sector, though there are uncertainties about their widespread adoption due to industry-specific constraints.

CONCLUSION

1. The theoretical analysis demonstrates how the integration of Japanese management models can significantly contribute to enhancing sustainability within the poultry industry, particularly in egg production. These models, including Kaizen, Just-In-Time (JIT), Kanban, and 5S, promote continuous improvement, waste reduction, and streamlined operations, which align with the growing need for sustainable practices. The focus on ethical farming, animal welfare, and environmental responsibility is crucial for the future of poultry farming, as businesses face increasing pressure from both regulators and consumers to meet sustainability and ethical standards. However, despite the clear potential for these management practices to improve efficiency and sustainability, the application of these models within egg production is still underexplored. While previous research has shown success in other areas of poultry farming, such as meat production, further investigation is needed to determine their full applicability and effectiveness in the egg-laying sector. This analysis highlights the importance of adapting Japanese management methods to the unique challenges of egg production, suggesting that, if properly implemented, these models could lead to significant advancements in the sustainability of the poultry industry.

2. The analytical chapter presents a detailed examination of empirical research, drawn from various studies, on the sustainability and ethical considerations in poultry farming, particularly in egg production, and the potential integration of Japanese management models. Key findings reveal that while ethical farming systems, such as cage-free environments, provide clear welfare benefits, they also come with significant cost implications that pose challenges for both consumers and producers. The research underscores a critical gap in the industry's ability to balance sustainability with consumer price sensitivity, as highlighted by multiple studies indicating that a large portion of consumers prioritize price over animal welfare. Additionally, the analysis shows that Japanese management models like Kaizen, JIT, Kanban, and 5S, although effective in reducing waste and improving operational efficiency, offer only limited potential for decreasing the cost differences between cage and alternative farming methods. These models, however, contribute to the broader sustainability goals by optimizing resource management, reducing waste, and enhancing workplace organization. The findings highlight a strategic dilemma: while the implementation of Japanese management practices could significantly improve sustainability in the poultry industry, further research is needed to determine whether these improvements can convince both consumers to opt for ethically produced eggs and farmers to adopt these methods.

3. The empirical research involving five leading poultry companies across Europe reveals distinct approaches to sustainability and the integration of Japanese management models in egg

production. Companies a farming approach which involves cage struggle to balance ethical practices with market demands for lower prices, while those focused-on barn and free-range systems prioritize animal welfare but face price sensitivity from consumers. Japanese management models like Kaizen are recognized for improving efficiency and waste reduction, though the application of JIT and Kanban is lesser known and met with doubts. Despite these challenges, the research indicates that Japanese models have the potential to enhance sustainability by optimizing labor, reducing waste, and improving operational efficiency. However, the industry faces barriers, such as worker engagement and external factors. Ultimately, while Japanese management practices offer promising benefits, their adoption requires overcoming cultural and operational hurdles to achieve both sustainability and profitability in the poultry sector.

Jonas Burba (2025). Tvaraus verslo vystymas paukštininkystės pramonėje, taikant japoniškus vadybos modeliu. Magistro baigiamasis darbas. Kaunas: Vilniaus universitetas Kauno fakultetas, 73p.

SANTRAUKA

Temos aktualumas. Tvarumo klausimas ir aktualumas yra labai svarbus, nes paukštininkystės pramonė susiduria su vis didesniais iššūkiais, siekdama užtikrinti tvarumą ir etiškų praktikų diegimo galimybes. Tuo pačiu metu didėja vartotojų poreikis įsigyti ekologiškus, etiškai auginamus produktus, tačiau išlieka kainų problematika. Šiuolaikiniai valdymo modeliai, tokie kaip Japonijos metodai (Kaizen, JIT, Kanban, 5S), siūlo galimybes efektyviau valdyti išteklius ir sumažinti atliekas, tačiau jų pritaikymas paukštininkystės sektoriuje reikalauja papildomo tyrimo ir pritaikymo pagal specifinius pramonės poreikius.

Darbo objektas. Japoniški vadybos valdymo modeliai paukštininkystės.

Darbo tikslas. Išsiaiškinti, ar įmanoma taikyti Japonijos valdymo modelius siekiant geresnio tvarumo lygio paukštininkystės pramonėje.

Darbo uždaviniai:

1.Teoriniu lygmeniu įvertinti, kas yra tvarumas ir kaip jis naudingas paukštininkystės ūkininkams.
2. Teoriniu lygmeniu išanalizuoti, kokie Japonijos modeliai yra naudingi siekiant geresnių tvarumo lygių paukštininkystės valdyme.
3. Išnagrinėti, kaip Japonijos valdymo modeliai buvo pritaikyti paukštininkystės pramonėje praeityje.
4. Išanalizuoti literatūrą, kuri paaiškina ir pateikia pavyzdžius, kaip tvarumas buvo didinamas paukštininkystės pramonėje.
5.Išanalizuoti literatūrą ir atvejų tyrimus, kaip Japonijos valdymo modeliai buvo naudojami tvarumui didinti žemės ūkyje.
6. Empyriškai patikrinti galimybes įvedant Japoniškuosius valdymo modelius į paukštininkystes įmones.
Darbo struktūra ir apimtis. Magistro darbą sudaro įvadas, 3 dalys bei išvados. Pagrindinės dalys aprašytos 49-tyje puslapių, įskaitant 13 paveikslų, 11 lentelių, taip pat pateikiamas 1 priedas. Naudoti 50 literatūros šaltiniai.

Tyrimo modelis empiriškai patikrintas remiantis penkiais, skirtingus regionus ir auginimo metodus atstovaujančius paukščių pramonės, atstovų intervių atsakymais. Tyrime pabrėžiama, augintojų nuomonės apie naujovių įvedimus ir kaip yra svarbu atsižvelgti į pirkėją.

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APPENDIX

First interview.
22 minutes phone conversation 05/02. CEO of a western Europe egg farm. Size of the farm – 2.5 million hens.

1. Could you describe your company's current poultry farming setup (cage, barn, free-range, etc.)

From cage to organic, all of it.

2. What are the main sustainability challenges your company faces in egg production (e.g., waste, energy, animal welfare)?

Getting, the management to accept the need for sustainability.

3. How important is animal welfare in your company's decision-making, and how do you balance it with economic constraints?

It is very important until the customer decides to not buy from us anymore due to high prices.

4. What do you see as the most significant barriers to adopting more "ethical" or "environmentally friendly" farming methods?

Demand from customer is the main challenge.

5. Have you ever heard of any Japanese management concepts (Kaizen, JIT, Kanban, 5S) in your professional experience, or are these ideas new to you?

At our facilities we do kaizen and the Toyota method.

6. Which aspects could be potentially good in poultry?

Kaizen lean Toyota way is good, others I don't know never tried.

7. Could Kaizen's 'continuous improvement' philosophy help optimize labor, feed usage, or animal-care routines in your company?

Yes we do it now and it helps with optimization of labor other things – not so much.

8. What potential do you see for lean or Kanban systems to reduce waste in egg production (e.g., feed inventory, packaging, or supply logistics)?

We would do that if the competition also does it and the workers try to do it too.

9. The 5S methodology emphasizes organized, clean, and standardized workspaces. Could that reduce contamination risks or improve efficiency in a poultry environment?

Yes, maybe it could but I would need some time and do some checks before I could answer this question correctly.

10. Given that Kaizen, JIT, Kanban, and 5S all rely on staff collaboration, how do you see the role of employee engagement in making these methods successful on your company?

Employee engagement is very important to make these methods successful, if they wont participate it will not work.

11. Which obstacles (technical, cultural, financial) might arise if you tried to implement these

Japanese methods in your organization?

That people have to keep that in mind that we trying to do this method and to not try to stay doing what they did before.

12. Could you foresee any conflicts between Japanese models' focus on constant improvement and the unpredictable nature of livestock farming (e.g., disease outbreaks)?nature of livestock farming (e.g., disease outbreaks)? Yes or no?

Yes, if there would be a disease like the bird flu and if any method that we are doing like the Kaizen or Toyota way would be in the way of fixing everything we would stop it. But right now the only problem is the people.

13. What key performance indicators (profit, mortality rate, feed efficiency) would you track to measure 'success' if you adopted these management methods?

Waste reduction. We work every month we make pictures and we decide if it did work. Some month it does some not.

14. How quickly do you think changes would have to show results (e.g., improved sustainability or profit) before you deemed them worthwhile?

Depending the people in the system. But to see it work we could wait for half a year maybe.

15. Looking five years ahead, do you see Japanese-style continuous improvement or lean methods playing a role in shaping a more sustainable egg industry overall?

No, we are hoping to change this way. We started good but this is getting a more and more redundant we need another system we keep in mind the Toyota but getting in the real world from the paper is and competitors that do it too well they are adjusting the system.

Second interview.

32 minute conversation phone conversation 05/05. Head of export sales of eastern Europe egg farm. Size – 15 million hens across the whole holding group.

1. Could you describe your company's current poultry farming setup (cage, barn, free-range, etc.)

Cage and Barn

2. What are the main sustainability challenges your company faces in egg production (e.g., waste, energy, animal welfare)?

We don't have any sustainability challenges.

3. How important is animal welfare in your company's decision-making, and how do you balance it with economic constraints?

It is important. Animals activists always attack our company for this making not true videos but we do nothing wrong. The market says that it wants cheap eggs so we do it as cheap as we can but we don't do bad things to our birds.

4. What do you see as the most significant barriers to adopting more "ethical" or "environmentally friendly" farming methods?

The barrier is money. It costs a lot to build a new farm and we don't know if it will pay after. A lot of risk.

5. Have you ever heard of any Japanese management concepts (Kaizen, JIT, Kanban, 5S) in your professional experience, or are these ideas new to you?

I only have heard about lean. What are the others you are saying?
Brief explanation of Kaizen, JIT,5S)
Oh, these I have heard. It's similar to lean. No we don't do it at our farms.

6. Which aspects could be potentially good in poultry?

Lean is maybe good for waste. Just in time is how we manage our products but we don't have a name for it we just call it FIFO.

7. Could Kaizen's 'continuous improvement' philosophy help optimize labor, feed usage, or animal-care routines in your company?

Yes as I said lean could be good for waste.

8. What potential do you see for lean or Kanban systems to reduce waste in egg production (e.g., feed inventory, packaging, or supply logistics)?

Yes again.

9. The 5S methodology emphasizes organized, clean, and standardized workspaces. Could that reduce contamination risks or improve efficiency in a poultry environment?

What is 5S again. Ah, well we would need to try it to see but I think yes it could help to have this organization. But we are organized now so I don't know how it could help us (more).

10. Given that Kaizen, JIT, Kanban, and 5S all rely on staff collaboration, how do you see the role of employee engagement in making these methods successful on your company?

Yes of course all workers should know that we are doing this new thing, and they would need to do it. But I think there could be problems you know if we put so much (accountability) on the workers. Could not work maybe.

11. Which obstacles (technical, cultural, financial) might arise if you tried to implement these Japanese methods in your organization?

Maybe money if it costs a lot. I don't know.

12. Could you foresee any conflicts between Japanese models' focus on constant improvement and the unpredictable nature of livestock farming (e.g., disease outbreaks)?nature of livestock farming (e.g., disease outbreaks)? Yes or no?

Maybe but I would need to think about this. Could you send me the results of your thesis after its done so I can see?

13. What key performance indicators (profit, mortality rate, feed efficiency) would you track to measure 'success' if you adopted these management methods?

On how much it pays of. Probably waste reduction yes. We can count it easy.

14. How quickly do you think changes would have to show results (e.g., improved sustainability or profit) before you deemed them worthwhile?

Well it is hard to know but I think a year.

15. Looking five years ahead, do you see Japanese-style continuous improvement or lean methods playing a role in shaping a more sustainable egg industry overall?

Lean is everywhere I see, others maybe. But I haven't heard any of our colleagues in this business doing it so I don't know, maybe if you talk to them and we all change it we see some big improvements (laughs).

Third interview.

19 minute conversation phone conversation with Scandinavian owner of a poultry farm. On 04/28. Size of the farm – 100 thousand hens and other local farmers.

1. Could you describe your company's current poultry farming setup (cage, barn, free-range, etc.)

We do barn, but we work with local farms who have free range.

2. What are the main sustainability challenges your company faces in egg production (e.g., waste, energy, animal welfare)?

I don't know we never had any issues with this.

3. How important is animal welfare in your company's decision-making, and how do you balance it with economic constraints?

Animal welfare is important for our company. We don't balance it we just care about our hens and our customers care about it too.

4. What do you see as the most significant barriers to adopting more "ethical" or "environmentally friendly" farming methods?

For us I don't know. For other companies probably investment into new farms.

5. Have you ever heard of any Japanese management concepts (Kaizen, JIT, Kanban, 5S) in your professional experience, or are these ideas new to you?

Only Kaizen, others are new to me.

6. Which aspects could be potentially good in poultry?

Kaizen is good we do it at our farms it helps us with organization and less waste. So yes this Kaizen is good for poultry farms.

7. Could Kaizen's 'continuous improvement' philosophy help optimize labor, feed usage, or animal-care routines in your company?

Yes I just answered.

8. What potential do you see for lean or Kanban systems to reduce waste in egg production (e.g., feed inventory, packaging, or supply logistics)?

Yes lean helps with waste. This other one I don't know.

9. The 5S methodology emphasizes organized, clean, and standardized workspaces. Could that reduce contamination risks or improve efficiency in a poultry environment?

If it helps it helps but I don't know.

10. Given that Kaizen, JIT, Kanban, and 5S all rely on staff collaboration, how do you see the role of employee engagement in making these methods successful on your company?

Kaizen yes the workers need to do it themselves we have some times problems when workers just forget about it. You know this system is Japanese and workers at our facility they are not Japanese we have different cultures we see work as a different thing.

11. Which obstacles (technical, cultural, financial) might arise if you tried to implement these Japanese methods in your organization?

Worker problems I just said.

12. Could you foresee any conflicts between Japanese models' focus on constant improvement and the unpredictable nature of livestock farming (e.g., disease outbreaks)?nature of livestock farming (e.g., disease outbreaks)? Yes or no?

No I think if there is good kaizen working in the company it could help to minimize the bird flu I think.

13. What key performance indicators (profit, mortality rate, feed efficiency) would you track to measure 'success' if you adopted these management methods?

Profit yes. And waste reduction too maybe I don't know.

14. How quickly do you think changes would have to show results (e.g., improved sustainability or profit) before you deemed them worthwhile?

Lean worked from the start I don't think we should wait to see, if we do something new it should work ASAP.

15. Looking five years ahead, do you see Japanese-style continuous improvement or lean methods playing a role in shaping a more sustainable egg industry overall?

Lean should be everywhere now I believe. In the future I don't maybe we will see more of this new methods but I don't know.

Fourth interview.

30 minute conversation on the phone with an eastern European egg farm sales manager. Done on 05/09. Farm size – 5-6 million birds.

1. Could you describe your company's current poultry farming setup (cage, barn, free-range, etc.)

Barn and cage. Free range soon.

2. What are the main sustainability challenges your company faces in egg production (e.g., waste, energy, animal welfare)?

Energy price and grain price and problems with war.

3. How important is animal welfare in your company's decision-making, and how do you balance it with economic constraints?

We don't see this as a problem for us but yes because of these animal activists yes we care about our chickens.

4. What do you see as the most significant barriers to adopting more "ethical" or "environmentally

friendly" farming methods?

Money. New farm costs money and it's a risk. What if bird flu happens?

5. Have you ever heard of any Japanese management concepts (Kaizen, JIT, Kanban, 5S) in your professional experience, or are these ideas new to you?

No, this I never heard.

6. Which aspects could be potentially good in poultry?

Maybe they could be good.
Brief explanation of how they could be good.
Ah yes then with waste yes and maybe longer shelf life of eggs.

7. Could Kaizen's 'continuous improvement' philosophy help optimize labor, feed usage, or animal-care routines in your company?

Maybe help with waste.

8. What potential do you see for lean or Kanban systems to reduce waste in egg production (e.g., feed inventory, packaging, or supply logistics)?

Maybe less waste on the floor I don't know. But if it more organized maybe we would lose less eggs in the process of colleting.

9. The 5S methodology emphasizes organized, clean, and standardized workspaces. Could that reduce contamination risks or improve efficiency in a poultry environment?

Efficiency yes if the waste is reduced.

10. Given that Kaizen, JIT, Kanban, and 5S all rely on staff collaboration, how do you see the role of employee engagement in making these methods successful on your company?

Ofcourse if we want this new thing to work the people who work should also do it. If we just tell them and they wont do it then what's the point.

11. Which obstacles (technical, cultural, financial) might arise if you tried to implement these Japanese methods in your organization?

I don't know maybe that workers don't do it?

12. Could you foresee any conflicts between Japanese models' focus on constant improvement and the unpredictable nature of livestock farming (e.g., disease outbreaks)?nature of livestock farming (e.g., disease outbreaks)? Yes or no?

I don't know maybe no.

13. What key performance indicators (profit, mortality rate, feed efficiency) would you track to measure 'success' if you adopted these management methods?

Waste reduction as an indicator. Maybe profits later from less waste generated and less eggs lost.

14. How quickly do you think changes would have to show results (e.g., improved sustainability or profit) before you deemed them worthwhile?

Couple months and we will see more money if it works.

15. Looking five years ahead, do you see Japanese-style continuous improvement or lean methods playing a role in shaping a more sustainable egg industry overall?

I don't know you tell me you know more about this (laughs).

Fifth interview.

32 minute interview done on phone with a western European egg farm representative (senior position not clear if CEO or a COO) done on 05/09. Farm size ~2-3 million hens.

1. Could you describe your company's current poultry farming setup (cage, barn, free-range, etc.)

We have everything we work with a lot of companies that send us eggs and they have all the housings.

2. What are the main sustainability challenges your company faces in egg production (e.g., waste, energy, animal welfare)?

I don't know but we don't have any problems with this.

3. How important is animal welfare in your company's decision-making, and how do you balance it with economic constraints?

Our chickens are very important for us yes.

4. What do you see as the most significant barriers to adopting more "ethical" or "environmentally friendly" farming methods?

We don't see any problems with having more ethical ways of housing it's the customers they want sometimes cheaper products and we can give it to them.

5. Have you ever heard of any Japanese management concepts (Kaizen, JIT, Kanban, 5S) in your professional experience, or are these ideas new to you?

Its not new for me I have heard, about them yes.

6. Which aspects could be potentially good in poultry?

I don't know from what side we look at this. If we are talking about ethicalities then I don't see how it could help but otherwise yes it has a lot of potential in this industry. With waste management and with organization.

7. Could Kaizen's 'continuous improvement' philosophy help optimize labor, feed usage, or animal-care routines in your company?

I think It could help with waste and optimization of labor as you said.

8. What potential do you see for lean or Kanban systems to reduce waste in egg production (e.g., feed inventory, packaging, or supply logistics)?

Maybe it would help with more organization leading to less time wasted and less resources wasted on being productive.

9. The 5S methodology emphasizes organized, clean, and standardized workspaces. Could that reduce contamination risks or improve efficiency in a poultry environment?

I don’t know about 5S I cant answer this question.

10. Given that Kaizen, JIT, Kanban, and 5S all rely on staff collaboration, how do you see the role of employee engagement in making these methods successful on your company?

Yes employee engagement would be critical for this to work of course.

11. Which obstacles (technical, cultural, financial) might arise if you tried to implement these Japanese methods in your organization?

I think there could be some obstacles related to workers learning the new systems, maybe at first this would not work perfectly but maybe in some time I could see this working. Also I think there could be some issues with the technical implementations if there would be any but that’s just a guess.

12. Could you foresee any conflicts between Japanese models’ focus on constant improvement and the unpredictable nature of livestock farming (e.g., disease outbreaks)?nature of livestock farming (e.g., disease outbreaks)? Yes or no?

No I don’t think so, these implementations could even help if there is less waste and more organization.

13. What key performance indicators (profit, mortality rate, feed efficiency) would you track to measure ‘success’ if you adopted these management methods?

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I think time could be measured, if there is more eggs packed than before in the same time we could count this as a potential KPI to check to see if this works.

14. How quickly do you think changes would have to show results (e.g., improved sustainability or profit) before you deemed them worthwhile?

Maybe a year or two.

15. Looking five years ahead, do you see Japanese-style continuous improvement or lean methods playing a role in shaping a more sustainable egg industry overall?

I don’t know about this personally as I’ve only been in this industry for a couple of years, but potentially yes why not?