Louvain School of Management

# Aligning Market Needs with Technological Advancements in Belgium's Equestrian Industry:

## Toward an Autonomous and Sustainable Horse Stable

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Résumé :

Ce mémoire traite des défis de l'industrie équestre belge, mettant l’accent sur l'intégration technologique, la durabilité et le bien-être animal. De nombreuses écuries actuelles subissent des coûts élevés, des infrastructures obsolètes, un confort insuffisant et un impact environnemental important. Face à ces défis, cette étude propose des modèles innovants d’écuries intégrant l'alimentation automatisée, le nettoyage automatique, la ventilation intelligente, des marcheurs automatiques et des solutions numériques de gestion. Le bien-être équin est optimisé grâce à des technologies de suivi sanitaire, des régimes alimentaires individualisés, et des paddocks paradise variés. La durabilité repose sur des pratiques circulaires, notamment le recyclage du fumier et l’utilisation de matériaux écologiques pour la construction. L’analyse financière comparant les modèles traditionnels, automatisés, écologiques et axés sur le bien-être du cheval démontre leur faisabilité économique et une meilleure efficacité opérationnelle. Cette approche moderne réduit les coûts, améliore le bien-être animal et minimise l’impact environnemental, établissant ainsi de nouvelles normes sectorielles.

Abstract

This thesis addresses challenges in Belgium's equestrian industry, emphasizing technological integration, sustainability, and equine welfare. Many existing stables suffer from high costs, outdated facilities, poor comfort, and significant environmental impacts. To address these issues, the research proposes innovative stable designs integrating automated feeding, cleaning systems, smart ventilation, horse walker systems, and digital barn management solutions. Equine welfare is prioritized through health-monitoring technologies, individualized feeding regimens, and paradise paddocks with diverse terrains. Sustainability is achieved by incorporating circular practices, particularly manure recycling and eco-friendly construction materials. Financial analyses comparing traditional, automated, ecological, and horse welfare-oriented models highlight economic feasibility and improved operational efficiency. This modern approach reduces costs, enhances horse wellbeing, and minimizes environmental impact, setting new standards for the industry.

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Foreword

This thesis represents the culmination of an extensive exploration into the current and future challenges faced by Belgium's equestrian industry, particularly regarding technological advancement, sustainability, and animal welfare. Having long been passionate about the equestrian world, I have personally observed many of the difficulties professionals face daily, from high operational costs and outdated infrastructures to growing concerns about comfort and the health of horses.

The primary objective of this work is to propose practical and innovative solutions to modernize horse stables in Belgium. By incorporating significant technological advancements, adopting environmentally sustainable practices, and placing equine welfare at the heart of decision-making, this thesis aims to provide a clear vision of the potential evolution of the sector.

I would like to express my sincere gratitude to my husband, Dr. Yann Danlée, for his invaluable advice, constant availability, and encouragement throughout this project. I also extend my thanks to the professionals within the equestrian sector who generously contributed their expertise and valuable insights, making this research richer and more comprehensive. I also wish to dedicate this work to my unborn sons, whose presence has given me strength and purpose during the completion of this thesis.

In the end, I dedicate this work to all those committed to improving horses' living conditions and advancing this fascinating industry toward a more autonomous, sustainable, and welfare-conscious future.

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# 1. Introduction

The equestrian industry in Belgium has long held a prestigious place in both sport and leisure, supported by a deep-rooted cultural appreciation for horses and a robust network of riding schools, competition venues, and private stables. However, despite the industry's strong heritage and continued popularity, many existing equestrian facilities are struggling to keep pace with evolving market demands and technological advancements (Kjellberg, 2022). A significant portion of stables still operate using outdated infrastructure, offer limited services, and lack the innovation necessary to meet the expectations of modern horse owners and riders (Wheeler, 2008).

By aligning market needs with the latest in technological and welfare-focused advancements, the aim is to reimagine what a horse stable can offer both for humans and horses. There are several compelling reasons why autonomous and sustainable equestrian centres are relevant.

**High costs** - The establishment and maintenance of equestrian facilities require significant investment. With infrastructure, land and care costs continually rising, many stables remain accessible only to the wealthy. This particularly concerns Belgium where all equestrian centres are managed by private; unlike for example France where the municipalities provide better support to stables through aid in kind or indirect personnel (Chevaux, s.d.). A rethinking of design, energy use, and operational efficiency could help lower the financial barrier and create more inclusive access.

**Lack of comfort** - Many Belgian stables were built decades ago and have not undergone significant renovations since. This often results in environments that are not only uncomfortable for riders and staff but also suboptimal for horses. The absence of modern amenities, poor insulation, inadequate ventilation, and inefficient workflows all contribute to user dissatisfaction and high operational burdens.

**Health and wellbeing of the horse -** There is a growing body of research and innovation in equine health, nutrition, biomechanics, and mental well-being. However, these insights are not yet fully integrated into most stables' daily operations or design. By embedding evidence-based care practices into stable infrastructure and services, facilities can significantly enhance the quality of life for horses, improve performance outcomes, and reduce veterinary costs.

**Ecology** - Sustainability has become a crucial consideration across all sectors, and the equestrian world is no exception. Traditional stables can have a significant ecological footprint, through excessive energy and water use, waste production, and land degradation. Today, there is both a need and an opportunity to incorporate environmentally friendly practices into stable design and operation such as renewable energy sources, water recycling systems, eco-friendly materials, and biodiversity-enhancing landscaping.

This work explores how a new model of horse stable, designed with sustainability, technological integration, and equine welfare at its core, can address these challenges. Through a comprehensive analysis of current facilities, market expectations, and emerging innovations, the project aims to develop a proposal that is not only economically viable but also sets a new standard for the future of the Belgian equestrian industry.

# 2. Proposed solutions

## 2.1. Implementing automated systems

The equestrian industry in Belgium is characterized by high operational costs, primarily driven by labour-intensive processes, resource management inefficiencies, and the growing demand for quality animal care. The integration of automated systems in equestrian facilities is a powerful strategy for reducing operational costs and improving efficiency. Through the implementation of technologies such as automatic feeders, stall cleaning systems, horse walkers, smart environmental controls, and barn management software, stables can optimize their operations, minimize labour costs, and ensure the highest level of care for horses. These advancements align with the evolving demands of the equestrian industry in Belgium and contribute to the long-term sustainability, efficiency, and inclusivity of equestrian facilities. The targeted automation solutions can significantly reduce staffing needs and streamline daily stable operations, ultimately contributing to cost savings and enhanced operational efficiency.

### 2.1.1. Automatic feeders

Automatic feeding systems are increasingly being implemented in modern livestock industries due to their efficiency and cost-saving potential. These systems dispense grain and hay at predetermined times and quantities, reducing feed waste and ensuring horses receive a consistent and appropriate diet. This can significantly improve cost-efficiency and reduce the risk of overfeeding or underfeeding (Janocha, Kryszak, & Rozewicz, 2017) (Harris, 1999). Automatic feeders can also support individualized feeding plans, which promote better nutrition and health. By addressing specific dietary needs based on horse activity levels, age, and health status, these systems can help reduce veterinary costs associated with improper feeding (Council, 1989). Also, automating feeding reduces the need for full-time staff to manage feeding times, streamlining daily operations and cutting down on labour costs (Gallardo & Sauer, 2018) (Grift, Zhang, Kondo, & Ting, 2008).

Horses in stables typically receive two types of food: concentrated, high-energy feed known as “grains” and hay which is dried grass mainly used to provide fibre and keep the digestive system functioning properly.

#### *2.1.1.1. Feeding system for grains*

A horse requires between 0.5 kg and 1 kg of feed per 100 kg of body weight per day. For a horse weighing 500 kg, the minimum daily intake is 2.5 kg and the maximum daily intake is 5 kg. Assuming a feed density of 0.65 kg/L (typical for pelleted or grain feed), this corresponds to a minimum volume of 3.85 litters per day and a maximum of 7.7 litters per day (EquiLannoo, Condition Cube, n.d.). Therefore, a 500 kg horse needs approximately 4 to 8 litters of feed daily, depending on its nutritional requirements. To optimize labour for refilling the dispensers while keeping the size manageable, it is ideal to store one week's worth of feed, equivalent to 56 litters, plus an additional day as a safety margin, resulting in a total storage volume of approximately 64 litters.

In an ideal feeding regimen, horses should receive forage at intervals no longer than six hours to closely mimic their natural grazing behaviour. This approach helps reduce the risk of gastric ulcers, colic, and stress-related behaviours. While many barns feed horses two to three times daily, increasing the frequency to three or four feedings per day is recommended for optimal digestive health (Horse, n.d.). Those requirements are met by several devices currently available on the market.

**AgriExpo - Equimatic copel automatic feeder**
Automatic feeder for horses that doses the fodder. It can be programmed to supply the amount of fodder that you consider appropriate, one, two, or three times a day, at the time indicated. Made of galvanized plate. It has a security battery. Approximate unit weight: 33 kg, capacity: 75 L. (AgriExpo, n.d.)

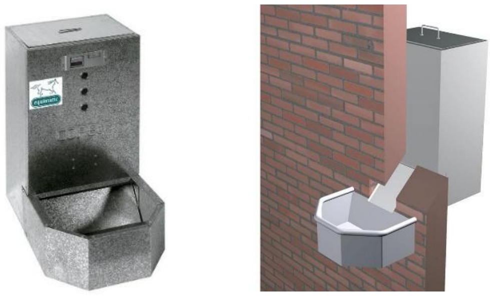

*Figure 1 Copel Equimatic Automatic Feeder*

**iFEED - Automatous distributors**

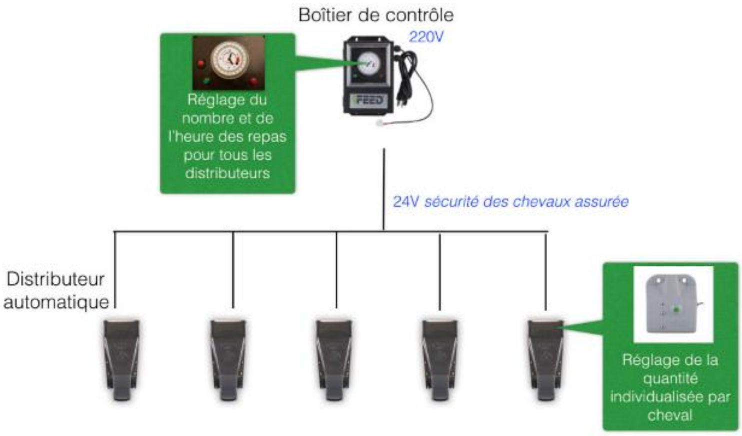


Figure 2. Diagram of the solution iFEED

iFEED mimics natural grazing by delivering up to 28 small feedings per day with adapted amount for each horse independently. It helps preventing ulcers, colic, and stress. It holds up to 5 kg of feed and fits most stalls with easy installation. The system saves up to 30% on feed and offers full control over feeding schedules. (iFEED, n.d.)

**Distributo - Doseur électrique**
Distributo is an automatic feeder system for dry feed such as pellets, grains, or flakes. Designed to mimic the horse's natural feeding rhythm, it can divide the daily ration into up to 80 portions over 24 hours, day and night. The 16L and 45L kits come "ready to install," while the eco kit allows for easy DIY assembly. Kits include a 12V power adapter but can also run on battery, and additional feeders can be added as long as all animals follow the same feeding plan. (Distributo, n.d.)

Figure 3. Distributo tank and controller

**HippoVision - HippoMeal**
The HippoMeal is an automated precision feeder designed to deliver small, frequent portions of feed and supplements to horses, promoting better digestion and reducing stress. It features an 80-liter stainless steel tank and can dispense both solid and liquid supplements with high accuracy. (HippoVision)

*Figure 4. Picture of the HippoMeal dispenser on site.*

This overview shows there are different appropriate options for grains distributer and the price with installation would be ±1000€/horse. The information is summarized in Table 1.

*Table 1. Summary of the main brands and models of automatic feeders for grains*

| Brand | Model | Capacity | # portions / day | price |
|---|---|---|---|---|
| AgriExpo | Equimatic copel | 75 L | 3 | 748.99 € |
| iFEED | iFEED | 10 L | 48 | 578€ |
| Distributo | Distributo | flexible | 80 | 255€ + container |
| HippoVision | HippoMeal | 80L | 6 | nc |

### *2.1.1.2. Feeding system for hay*

Horses at a healthy weight are ideally fed a minimum of 1.5 percent of their body weight in dry matter (DM) per day (Magazine, s.d.). So a 500kg horse eats approximately 7.5kg of hay per day. Hay volume depends on its type and density (loose, baled, chopped). On average 1 kg of grass hay is 10-12 litters in loose form, so 7.5kg correspond to 75-90 litters. To optimize labour for refilling the dispensers while keeping the size manageable, it is ideal to store one week's worth of feed, equivalent to 600 litters, plus an additional day as a safety margin, resulting in a total storage volume of approximately **680 litters** per horse. Recently, the market proposes some solution for controlled hay distribution.

The mobile solid corner hayrack is a piece of equipment designed to optimize feeding in barns, especially in the corners of an enclosure. With its compact dimensions (75 cm high x 74 cm wide x 75 cm deep) and a useful volume of 208.125 litters, it enables efficient hay distribution while minimizing waste. Its mobility makes cleaning and repositioning easy according to the needs of the livestock operation. (Environnement, s.d.)

The Coulisse à Foin pilotable CAF from HIT is an automated hay distribution system designed to enhance horse feeding practices in stables. This system allows for remote control via a computer or smartphone, enabling up to 15 scheduled feedings per day. The volume depends on the store behind the door. (HIT, s.d.)

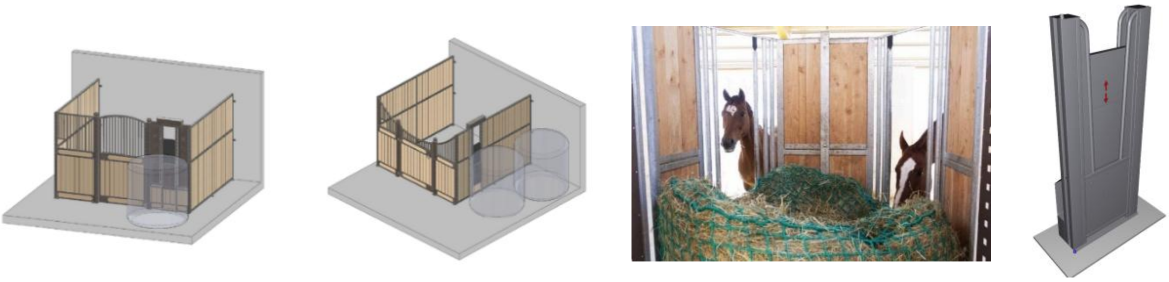

*Figure 5. Picture and schemes of the hay distributer from HIT*

The sliding door from HIT is more adapted to our needs and provides enough space for stocking hay. The price for this kind of doors is about €1300 per door.

### 2.1.2. Cleaning automation

Stall cleaning remains one of the most labour-intensive tasks in stable management. However, technological advancements in automated cleaning systems such as robotic manure scrapers or conveyor belt systems offer significant cost-saving potential. Automated waste lowers the need for full-time stable hands and enhances the overall efficiency of the facility (Bockisch, et al., 2007). Automation ensures consistent and timely cleaning, which can help maintain a high level of hygiene in the stables, reducing the risk of disease outbreaks and improving the health of the horses (Jamshidi, Ghiasi, Mehrandezh, Wang, & Paranjape, 2024). With consistent and efficient cleaning, bedding costs can be obviously optimized, as bedding materials will be used more effectively, reducing waste and the frequency of replacement (Bockisch, et al., 2007).

#### *2.1.2.1. Stalls cleaning*

##### Box cleaning by conveyor belt

NBTR Conveyor offers a silent and secure automatic system for the removal of manure and droppings, significantly easing your daily workload. The waste is carried away on a belt conveyor system installed in an underground pipeline. This conveyor belt runs beneath the horse stalls, and manure is deposited through a hatch by the stable hand. The system can also be programmed to allow use of the hatch throughout the day, serving as a replacement for traditional droppings bins (especially in stalls with wood shavings). The manure and droppings are then transported outside the stables to the end of the conveyor line, where they are collected in either a manure pit or a designated container.

*Figure 6. Photos of the manure conveyor from NBTR*

### Box cleaning by suction

The turbo system, powered by a 22 to 37 kW motor, delivers strong and consistent suction, capable of reaching speeds of up to 30 meters per second depending on the moisture level and density of the manure (Habitat, n.d.).

*Figure 7. Photos of the cleaning solution from Suction*

Both the conveyor belt and suction systems aim to reduce manual labour, but they differ greatly in performance, maintenance needs, and suitability for real stable conditions. Table 2 shows a compact comparison of the 2 solutions of manure extraction presented here above.

*Table 2. Summary of the manure extraction solution for equestrian centres*

| Aspect | Conveyor belt | Suction system |
|---|---|---|
| Energy Use | Very low | Very high (22–37 kW motor) |
| Bedding Compatibility | Works with straw, shavings, any manure | Not suitable for straw – clogs easily |
| Multiple Stalls | Yes – works across stalls and stables | No – one stall at a time |
| Maintenance | Minimal | High |
| Ease of Repair | Easy – accessible with removable planks | Difficult – pipes can block |
| Durability | Very high – concrete & anti-acid plastic | Lower – sensitive components |
| Noise | Quiet | Noisy |
| Cost | Moderate upfront, low long-term cost | High install & energy cost |
| Reliability | Very reliable | Less reliable, sensitive to conditions |

#### *2.1.2.2. Adding clean bedding: Straw distributer*

After removing the manure and dirty bedding, it should be replaced with clean straw for bedding. It exists the tractor extensions designed for this purpose: the straw bale is inserted into the machine, which automatically distributes and fluffs the straw evenly into the stalls. This method is not only much faster and less physically demanding for the worker, but it also ensures an even, soft bedding for the horse.

##### *2.1.2.3. Hallways and yard cleaning*

Manure robot from Lely

This robot was originally designed for dairy farms but appears adaptable for horse stable. It collects the bedding and food that are in the common areas. The basic cost is €25,000.


Barn-E from Joz

The Barn-E is an autonomous cleaning robot suitable for almost all types of solid floors in barns. It uses sensors to navigate independently and can be programmed to clean at specific intervals, thus ensuring consistent hygiene. The cost varies depending on the option going up to 40,000 €.

All these types of robots and other similar models are more or less the same and because they were designed for big farms with lot of manure, all of them can correspond to our needs. The only drawback is the expensive price 20,000 to 40,000€

### 2.1.3. Horse walker systems

Horse walkers are automated systems designed to provide consistent exercise for horses, reducing the dependency on human-led training or exercise sessions. By automating daily exercise routines, horse walkers ensure that horses receive regular physical activity, even when staff resources are limited. This helps maintain the horses' fitness and reduces the need for additional labour for exercise management. Regular use of horse walkers helps also preventing injuries caused by lack of exercise or over-exertion. Horses that are exercised regularly are less likely to develop musculoskeletal problems or other related injuries, reducing long-term veterinary costs. Additionally, with horse walkers, stable staff are freed up from performing daily exercise routines, allowing them to focus on more specialized tasks or engage in other forms of horse training or care.

### 2.1.4. Smart lighting and ventilation

The costs of maintaining an optimal climate in horse stables can be significant, especially in large facilities. The integration of smart lighting, ventilation, and heating systems offers both energy savings and improved horse welfare. Smart systems adjust lighting, temperature, and ventilation based on time of day or environmental conditions, ensuring energy consumption is minimized. This reduces utility costs, particularly for large barns or stables (Jamshidi, Ghiasi, Mehrandezh, Wang, & Paranjape, 2024). These systems help maintain a consistent and comfortable environment for horses by regulating temperature, humidity, and air quality. Proper ventilation can reduce the risk of respiratory problems, while controlled heating ensures horses are not exposed to harmful cold conditions. The adoption of energy-efficient technologies, such as solar panels and wind farms, further reduces operational costs and contributes to the facility's sustainability, while also enhancing its ecological footprint (Jamshidi, Ghiasi, Mehrandezh, Wang, & Paranjape, 2024).

#### 2.1.5. Barn management software

Barn management software offers a centralized platform for managing daily operations, significantly reducing the administrative burden and increasing operational transparency. Barn management software can automate the scheduling of feeding, vaccinations, farrier visits, and other essential tasks, reducing human error and ensuring tasks are completed on time. The software tracks feed, medications, and supplies, alerting staff when supplies are running low and helping prevent over-ordering or shortages. This optimizes resource allocation and reduces waste. The software also gathers and analyses data on horse health, performance, and facility operations. This data-driven approach improves decision-making, supporting more efficient resource allocation and long-term planning.

### 2.2. Horse health and wellbeing

The health and wellbeing of horses are crucial elements that need to be prioritized in modern equestrian facilities. Several equine illnesses, including colic, tendonitis, respiratory issues such as bronchitis, and dermatological conditions like rain rot (dermatophilosis), pose significant challenges to horse owners and caretakers. By aligning technological advancements and modern practices with the needs of both the horses and the market, we can design stable systems that proactively address these conditions. Table 3 outlines the causes and preventative measures for the most common equine health issues.

Modern technology provides a powerful toolkit that enables stable managers and caretakers to monitor and address health issues. By integrating sensors and automatic systems into stable environments, equestrian facilities can shift from reactive care to proactive prevention. These technologies enable continuous tracking of vital indicators such as diet, hydration, temperature, air quality, movement patterns, and even behavioural changes. The stable manager receives early warnings about emerging health concerns, and tailor care to each horse's specific needs. The table section outlines the key technological solutions that can be implemented to enhance equine health monitoring and management.

Aligning the needs of the equestrian industry with technological advancements offers a promising path toward creating sustainable, efficient, and healthier horse stables. By incorporating modern technologies, we can significantly improve the health and wellbeing of horses, as well as streamline management processes in stables. The adoption of a motoring mobile app to monitor key health parameters and AI-based alarm systems ensures that horse caretakers can proactively address potential health issues, leading to improved outcomes for both horses and their owners. To enhance the care and management of horses in a modern stable, we propose the following technological solutions.

*Table 3. Summary of the main diseases of the horses.*

| Disease | Cause | Technology Solution | Importance |
|---|---|---|---|
| Colic | Digestive issues (poor diet, dehydration, stress, irregular feeding) | Real-time feeding and hydration monitoring systems | High |
| Tendonitis | Overexertion, repetitive movement, improper training surfaces | Motion sensors for gait analysis, arena condition monitoring | Medium |
| Respiratory Issues (Bronchitis) | Dust, mould, poor air quality, lack of ventilation | Ventilation systems, air quality sensors, dust-free bedding | High |
| Rain Rot (Dermatophilosis) | Wet, muddy conditions, poor drainage and grooming | Drainage systems, stable humidity control, grooming alerts | Medium |
| Laminitis | Poor diet, excessive weight, stress | Weight and diet tracking apps, smart feeders | High |
| Dehydration | Inadequate water intake, hot conditions | Water intake sensors, hydration alerts, electrolyte management | High |
| Overheating/Heat Stress | High ambient temperature and humidity, poor ventilation | Environmental sensors (temp/humidity/VOC), activity monitors | High |
| Gastric Ulcers | Stress, inconsistent feeding, poor diet | Feeding schedule monitoring, stress behaviour tracking | Medium |

### 2.2.1. Technologies to improve horse health

#### *2.2.1.1. Health metrics*

Ensuring that horses receive a balanced and appropriate diet involves tracking feeding schedules and providing tailored recommendations based on each horse’s weight, breed, and activity level. This can be achieved through the integration of automated feeding systems that distribute small portions of food throughout the day. These systems can also incorporate grain and hay balancing mechanisms and weighing platforms to monitor the horse’s weight regularly. All collected data can be transmitted to a centralized database, enabling continuous monitoring and optimization of each horse’s nutritional health. Monitoring over time is essential to prevent both obesity and malnutrition, as either condition can lead to serious health issues.

Proper hydration is essential to prevent issues such as colic or kidney problems. By integrating water consumption sensors, we can monitor each horse's intake in real time. When combined with ambient temperature data, the system can generate alerts in cases of extreme heat or abnormal drinking patterns, enabling early intervention and improved health outcomes.

Tracking the horse's movement and detecting early signs of lameness or musculoskeletal injuries is essential, as these issues can lead to more severe conditions if left unaddressed. This can be achieved through the use of mobility sensors and specialized applications that monitor gait patterns, activity levels, and behavioural changes in real time, allowing for early intervention and improved overall health management.

Monitoring environmental factors like dust, VOC levels, temperature and humidity in the stable, which can significantly impact respiratory health and prevent conditions such as bronchitis or asthma.

A dedicated mobile application serves as a central hub to collect and analyse real-time data from all the above technologies: nutrition, water intake, weight, mobility, and air quality. By consolidating this information into a single, user-friendly interface, stable managers and caretakers can monitor each horse’s condition more effectively. The app can generate alerts for abnormal trends, support data-driven decision-making, and facilitate early intervention, ultimately enhancing the preventive care and health outcomes for every horse in the stables

#### *2.2.1.2. AI-Based Alarm Systems with Cameras*

The AI-based alarm systems equipped with cameras offer an intelligent way to monitor horse behaviour and movement, ensuring quick responses to any signs of distress or injury. The AI algorithms can analyse the movement of horses within their stalls to detect any signs of discomfort or injury, such as limping or unusual positioning, and alert caretakers immediately. Cameras can identify sudden falls or trauma, enabling caretakers to respond quickly in case of an accident, potentially preventing severe injuries or complications. Furthermore, AI cameras can track horses’ interactions with each other and their environment, identifying stress, aggression, or anxiety. Behavioural alerts can help reduce stress-related health issues by allowing for immediate environmental adjustments or attention.

### 2.2.2. Paradise paddocks with varied terrain

To further enhance the wellbeing of horses, the concept of paradise paddocks offers an innovative solution by mimicking the horses' natural habitat. These paddocks are designed with varied terrain, including sand, grass, hay distributors, and ponds, to encourage natural behaviours and improve physical and mental health. The inclusion of different types of surfaces, such as sand and grass, promotes natural movement patterns, offering horses the opportunity to exercise on diverse footing, which strengthens muscles, improves balance, and reduces the risk of injury.

Hay distributors placed within the paddocks ensure that horses can graze in a way that closely resembles their natural foraging habits, encouraging slower, more natural feeding patterns that contribute to better digestion and overall health. Additionally, ponds or small water features offer horses a source of natural hydration while encouraging behaviours such as wading or play, which contribute to their mental stimulation and happiness. By creating a more natural environment within the paddock, horses can engage in activities that align with their instincts, promoting better physical fitness, reducing stress, and enhancing overall wellbeing. These varied terrains provide not only physical benefits but also foster mental enrichment, making the paddocks an integral part of a sustainable and healthy equestrian facility.

Regarding the horse health and wellbeing, this holistic approach to horse care, combining technological advancements with a focus on comfort, encourages a deeper sense of contentment for the horses, aligning with the future of sustainable equestrian facilities where technology and welfare work in harmony to create a better quality of life for both horses and their caretakers.

## 2.3. Sustainability

### 2.3.1. Circular sustainability in horse stables

The implementation of circular practices in a horse stable should first focus on waste management. One of the largest waste streams in stables is manure and soiled bedding. Rather than disposing of it, these materials can be composted on-site and transformed into nutrient-rich fertilizer for pasturelands or gardens. This not only reduces the environmental burden of disposal but also creates a valuable product that supports vegetation and soil health. Bedding materials can also be part of the circular model. Opting for biodegradable bedding like straw or wood shavings that can be composted or recycled into other agricultural uses keeps waste within a regenerative cycle. Some innovative operations have even begun exploring the use of hemp bedding, which is highly absorbent and decomposes rapidly, further supporting soil enrichment when composted.

The prioritization of recyclable or sustainable materials for construction, bedding, and arena footing reduce the carbon impact of the equestrian centre. Promote recycling practices across the facility to limit landfill waste. The aspect opens often debate about the cost – impact ratio which requires serious analysis and knowledge about the numerous possibilities currently offered by the market.

Water conservation is another crucial aspect. Stables can install systems to capture and reuse rainwater for non-potable purposes like cleaning stalls or irrigating paddocks. Additionally, implementing slow-feed systems and durable feed containers can reduce feed waste, while sourcing local hay and feed minimizes transportation emissions.

Following the resilient wave promoted in Europe, the energy-saving via LED lighting, timers, and motion sensors must be used to minimize electricity use. The equivalent concern push toward a better air quality management. The design of the stables are though to maximize natural airflow, using prevailing wind patterns to reduce the need for mechanical ventilation. Choose low-dust bedding and lightly water dry areas to reduce airborne particles, improving both equine and human health.

Sustainability is nowadays a vast domain that should be more explored. However, the current restriction and the cost of energy, water and polluting emission force industry to consider the solutions. In this work, it has been considered that only manure treatment and sustainable materials are relevant for a differentiation of the equestrian centres. Indeed, the other mentioned sustainable features are supposed to be implemented by default. The following paragraphs detail the ways and relevance of the manure valorisation, and the discussion about the different type of recycled and sustainable materials for equestrian centres.

### 2.3.2. Manure recycling

The manure recycling involves collecting, treating, and reusing animal waste, mainly from livestock, as a valuable resource. Rich in nutrients like nitrogen and phosphorus, treated manure can become organic fertilizer, soil conditioner, or biogas, supporting sustainable farming (Animal Manure Recycling: Treatment and Management, Zhenya Zhang (Wiley-Blackwell, 2012).). Recycling manure through proper technologies protects water quality, improves soil health, reduces greenhouse gas emissions, and minimizes the spread of disease (East, n.d.) (Concerns, n.d.) (Organization, 2006). Depending on the manure production and the equipment, some recycling methods are more appropriate. The main methods are described here after:

#### *2.3.2.1. Composting*

Several methods have been developed to recycle manure effectively, each with its own advantages and limitations. One of the most common approaches is composting, where manure is biologically decomposed under controlled aerobic conditions. By regularly turning manure piles and maintaining the right moisture and temperature, microorganisms break down the waste into stable, pathogen-free compost within a few weeks to a few months. Composting not only reduces odours and volume but also creates a valuable soil amendment. (Agency, Composting, n.d.)

#### *2.3.2.2. Produce biogas*

Another important method is anaerobic digestion, where manure is processed in oxygen-free digesters. In these digesters, bacteria break down the organic matter and produce biogas, mainly composed of methane, which can be used as a renewable energy source. The remaining slurry, called digestate, is rich in nutrients and can be applied to fields as fertilizer. Anaerobic digestion helps in energy production while also managing waste safely. (Agency, How Does Anaerobic Digestion Work?, 2024)

#### *2.3.2.3. Drying and pelletizing*

Pelleting is a mechanical process that compacts or aggregates manure solids into uniform-sized pellets or granules. This transformation enhances the material's handling, storage, and transportability, making it more convenient for various applications. Pelleted manure serves multiple purposes, including use as fertilizer and as a renewable energy source (Hu, 2021) (Liu & Wang, 2020).

#### *2.3.2.4. Mushroom cultivation*

A less conventional but increasingly popular method involves using manure in mushroom cultivation. Mushroom farming efficiently transforms animal manure into valuable food products. Composted manure, especially from horses and poultry, is mixed with straw and other residues to create a nutrient-rich substrate. After composting and pasteurization, the material supports the growth of mushrooms like *Agaricus bisporus*. This method not only produces food but also recycles agricultural waste, promoting sustainable and circular farming practices. (Oei, 2003)

#### *2.3.2.5. Biochar production*

Manure can be pyrolyzed (heated in low-oxygen conditions) to produce biochar (a stable form of carbon that improves soil structure, enhances water retention, and sequesters carbon for long periods). Biochar made from manure is gaining attention for its potential role in climate change mitigation. (Lehmann & Joseph, 2024)

#### *2.3.2.6. Comparison of the manure valorization methods*

Each method offers different benefits depending on the specific needs, scale and goals of the farming operation. For industrial application, the manure amount and the timeframe of a cycle are significant criteria for their potential implementation. Table 4 gives on overview of the requirement for each method and the minimum manure amount for operability.

*Table 4. List of the main methods for manure recycling with minimum manure amount for operability.*

| Method | Min. manure requirement | Timeframe | Notes |
|---|---|---|---|
| Composting | ~1–5 tons | per batch (over several weeks) | Needed to build a pile large enough to sustain microbial heat generation. |
| Biogas Production | ~10–20 tons | per day | Continuous-feed anaerobic digesters typically require daily input for steady biogas production. |
| Drying and Pelletizing | ~5–10 tons | per batch (can be daily or weekly) | Batch-based processing; production schedules vary. |

| | | | |
|---|---|---|---|
| Mushroom Cultivation | ~1–2 tons | per batch (per growing cycle, ~1–2 months) | For small farm substrate preparation; depends on mushroom species and production cycles. |
| Biochar Production | ~2–5 tons | per batch | A typical pyrolysis run uses a few tons of feedstock at a time; frequency depends on facility setup. |

Based on Table 4, the manure requirement defines its implementation on small equestrian centres. An average horse produces around 22.7 kg of manure per day (including both faeces and urine) (Center, Horses and Manure, n.d.). Bedding (straw, wood shavings, etc.) adds about 25% to 50% more weight, depending on how much is used (Center, Horse Manure Management: Bedding Use, n.d.). Figure 8 shows the linear evolution of the manure production depending on the number of horses.

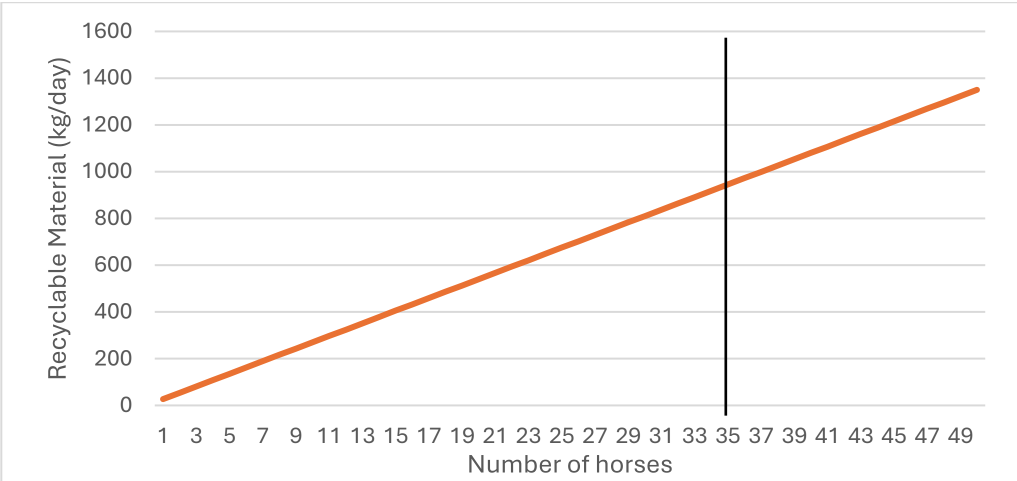


*Figure 8. Graph of the manure production in function of the number of horses.*

According to the produced amount of manure and the minimum amount required for each method. By keeping the example of 35 horses, the waste with bedding is ~1112 kg/day, or ~33.4 tons in a month, or ~406 tons of manure par year. Then, it seems that the best choices are composting and mushroom cultivation. However the profitability of each method should be discussed.

#### *2.3.2.7. Cost for mushroom cultivation*

The cost estimate assumes a semi-automated mushroom cultivation facility processing 1 ton of manure per day (approximately 30 tons per month), using it as substrate for button or oyster mushrooms. The setup includes composting and pasteurization units, spawn incubation, growing areas with shelving or bags, and basic environmental controls (humidity, temperature, and ventilation). Infrastructure like water systems and handling tools are included, while ongoing operational costs (labour, electricity, spawn) are excluded. The estimate shown in Table 5 reflects typical construction and material costs in an average-cost region.

*Table 5. Costs for first installation for mushroom cultivation.*

| Requirements | Min cost (€) | Max cost (€) |
|---|---|---|
| Infrastructure (shed, incubation room) | 4,700 | 11,100 |
| Processing Equipment (pasteurization, water system, handling tools) | 6,500 | 14,300 |
| Growing System (shelving, spawn setup) | 2,800 | 5,600 |
| Environmental Control (ventilation, lighting, climate systems) | 5,100 | 12,200 |
| Contingency (10–15%) | 2,000 | 4,000 |
| **TOTAL** | **21,000** | **47,000** |

The first installation cost is between €21,000 to €47,000. As the next step, the monthly cost for the exploitation is given in Table 6.

*Table 6. Monthly costs of mushroom cultivation.*

| Cost category | Details (based on Belgium rates 2025) | Monthly cost (€) |
|---|---|---|
| Human resource | 2 full-time workers, €14/hr + employer overhead (1.4x) | €6,500 – €7,000 |
| Energy | Fans, lighting, humidifiers, pasteurization, air exchange (high cost region) | €600 – €1,200 |
| Packaging | Plastic/wood crates, eco labels, food-grade materials, local market prep | €400 – €900 |

The total monthly operational costs is between €7,500 and €9,100 per month. For Production scale of ~1 ton of manure/day the mushroom yield would be ~25 kg mushrooms/m² per cycle × ~40 m² growing area so the monthly yield would be 3,000–4,000 kg (conservative and efficient setup). The wholesale price would be €3.00–€4.00/kg (e.g., supermarkets, distributors) that results the selling income of €12,250 per month. So the estimated profit is **€3,150 – €4,750 per month.**

#### *2.3.2.8. Cost for composting*

The installation costs for a composting facility processing 1 ton of manure per day can vary significantly based on the chosen composting method, infrastructure, and equipment. A fork of the most adapted values for our case is given in Table 7.

*Table 7. Total installation cost for composting system in a medium equestrian centre.*

| Requirement | Included Components | Estimated Cost (€) |
|---|---|---|

| | | |
|---|---|---|
| Infrastructure Setup | Composting pad, shelter, leachate system | €6,000 – €12,500 |
| Processing Equipment | Aeration, watering, turning tools/equipment | €2,500 – €7,000 |
| Contingency & Misc. | Buffer for unforeseen site and regulatory expenses | €1,000 – €2,000 |
| **TOTAL** | | **€9,500 – €21,500** |

The total installation cost for an equestrian centre with a medium size is estimated between €9,500 and €21,500. The management and exploitation of the composting in detailed in Table 8.

*Table 8. Monthly costs of composting installation.*

| **Cost Category** | **Details** | **Cost (€)** |
|---|---|---|
| Labor | 1 part-time worker (≈20 hrs/week + tax) | €1,200 – €1,800 |
| Energy | Low (aeration, water, turning) | €100 – €300 |
| Equipment upkeep | Occasional maintenance, tools | €100 – €200 |
| Admin | Basic permits, insurance | €100 – €200 |
| **TOTAL** | | **€1,500-€2,500** |

With a daily input of 1 ton of manure, the composting operation would yield approximately 15 to 20 tons of finished compost per month, due to moisture loss and organic reduction during the process. In a wholesale-only model with no packaging, delivery, or branding, this compost can be sold in bulk at typical market prices ranging from €60 to €80 per ton. This translates to monthly revenue between €900 (15 tons at €60/ton) and €1,600 (20 tons at €80/ton). However, even with minimal operating costs, primarily part-time labour, basic energy, and equipment maintenance; the total monthly expenses range from €1,500 to €2,500. As a result shown in Figure 9, the business would operate at a loss of approximately €600 to €900 per month at this scale, indicating that profitability would require scaling up or integrating compost into a larger value-added operation.

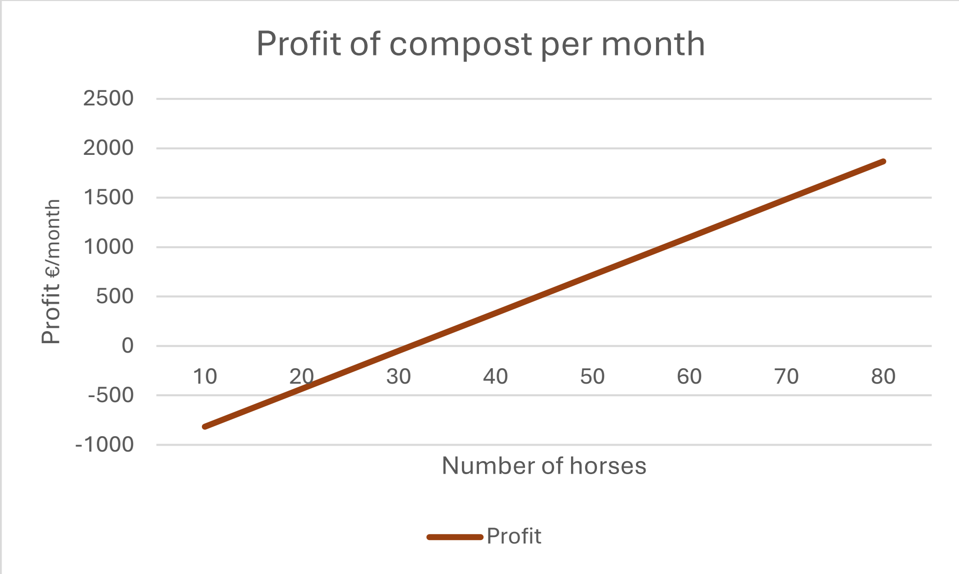


*Figure 9. Graph of the profit of composting per month in function of the number of horses*

### 2.3.3. Green construction materials

Choosing environmentally friendly materials for constructing horse stables plays a key role in reducing the ecological footprint of equine operations. By opting for sustainable options such as recycled lumber, bamboo, reclaimed metal, low-VOC paints, and permeable flooring, stable owners can minimize waste, lower emissions, and improve water management. These green building practices not only promote better health for horses and humans through improved air quality and safer materials, but they also support long-term environmental goals like reducing deforestation, conserving energy, and protecting local ecosystems. As an example, for stall construction we have a lot of choices of the materials listed in Table 9. Table 9, and it is the choice of constructor to concentrate on low-cost, appearance or sustainability of the materials.

*Table 9. Summary of the advantages and drawbacks of the green construction materials suited for stalls.*

| Material | Advantages | Disadvantages | Indicative Price | Impact |
|---|---|---|---|---|
| **Treated Pine Wood** | Affordable, Easy to work with, Natural appearance | Prone to chewing, Requires regular maintenance | €20 to €30/m² | Medium |
| **Oak Wood** | Very strong and durable, Aesthetic, Less prone to chewing | High cost, Harder to work with | €50 to €70/m² | Medium |
| **Bricks/Concrete blocks** | Very solid and durable, high thermal insulation, moisture-resistant | Cold to the touch, May require coating to prevent injuries | €15 to €25/m² (excluding HR) | High |
| **PVC** | Moisture and chemical resistant, Easy to clean | Less impact-resistant, May wear over time | €30 to €50/m² | High |
| **Galvanized metal** | Very strong, Easy to clean, Corrosion-resistant | Noisy, Cold feeling, Industrial look | €40 to €60/m² | High |
| **Rubber** | Shock and injury protection, Non-slip, Durable | High cost, Technical installation | €60 to €80/m² | Medium |
| **Composite** | Mimics wood without downsides, Moisture and impact resistant | Higher cost, Less traditional appearance | €40 to €70/m² | Medium |
| **Bamboo** | Eco-friendly and renewable, Natural look, Moisture and chew resistant | Can be expensive, Susceptible to humidity if untreated | €50 to €80/m² | Low |
| **Fiber cement** | Impact and weather resistant, Good thermal/acoustic insulation | Heavy material, Needs technical installation | €20 to €40/m² | Medium |
| **OSB Panels** | Affordable, Easy to install, Good mechanical strength | Poor moisture resistance if untreated, Less aesthetic | €15 to €30/m² | Medium |
| **Concrete coating** | Strong and durable, Moisture and shock resistant | Cold look, May need surface treatment to avoid injuries | €10 to €20/m² | High |
| **Corrugated sheet metal** | Strong, durable, lightweight, Easy to clean | Less aesthetic, Poor thermal and sound insulation | €15 to €25/m² | High |
| **Laminated panels** | Smooth surface, Easy to clean, Moisture and stain resistant | Less robust than wood/metal, Sensitive to impact | €30 to €60/m² | Medium |

### 2.3.4. Sustainability development goals

The implementation of circular sustainability in horse stables directly supports several United Nations Sustainable Development Goals (SDGs). It contributes to SDG 6 (Clean Water and Sanitation) by promoting water conservation and preventing water pollution through proper manure management. SDG 7 (Affordable and Clean Energy) is addressed via the production of renewable energy such as solar panels. These practices also support SDG 9 (Industry, Innovation, and Infrastructure) by introducing modern, efficient, and resilient waste treatment and stable designs. The circular approach aligns with SDG 12 (Responsible Consumption and Production) by reducing waste, reusing resources, and utilizing sustainable materials. Finally, SDG 15 (Life on Land) benefits from enhanced soil quality, reduced chemical runoff, and improved biodiversity through sustainable waste and land management. Altogether, these efforts create a regenerative equine facility model that integrates environmental responsibility with operational efficiency.


*Figure 10 The sustainability goals achieved in this model*

# 3. Financial planning

In this section, the cost of constructing a traditional horse stable will first be calculated to establish a baseline for comparison. However the profitability of the traditional model is not the thesis subject and its only to make sure that the base model was developed correctly. This baseline will serve as a reference point for evaluating a range of alternative and innovative stable models, including automated systems, horse wellbeing-focused designs, eco-friendly constructions. The potential profitability and long-term benefits of each model will then be examined and compared against the baseline to assess their viability from both a financial and operational perspective.

## 3.1. Traditional horse stables model

### 3.1.1. Cost evaluation

The cost for constructing a traditional horse stable can be defined into different categories. This section is dedicated to the cost evaluation of those categories.

1. Stables

The stable includes 35 Individual horse stalls, tack room, feed room, shower, utility connections (water, electricity, drainage), light and ventilation. Table 10 lists the cost of each part of the stable.

*Table 10. Cost evaluation for the building with 35 stalls and other required rooms and equipment*

| Equipment | Quantity / Area | Unit Cost (exVAT) | Total Cost (exVAT) |
|---|---|---|---|
| Individual stalls (3x4m) (abris-chevaux.be, n.d.) | 35 | 3,500 € | 122,500 € |
| Building structure m² (Abris-cheveaux.be, s.d.) | 1000 | 150 € | 150,000 € |
| Doors and access (Stop, Horse Stop, n.d.) | 4 | 2,500 € | 10,000 € |
| Roof m² (Stop, Horse Stop, n.d.) | 1000 | 50 € | 50,000 € |
| Foundations and concrete slab m² (Stop, Horse Stop, n.d.) | 1000 | 60 € | 60,000 € |
| Tack room m² | 15 | 3,000 € | 45,000 € |
| Feed room m² | 15 | 2,500 € | 37,500 € |
| Horse shower (Kestryan, n.d.) | 3 | 3,000 € | 9,000 € |
| Water connection (Thermiques, n.d.) | 4 | 800 € | 3,200 € |
| Electricity connection (RESA, 2024) | 4 | 972 € | 3,888 € |
| Drainage | 4 | 2,000 € | 8,000 € |
| Lighting (AgroDieren, n.d.) | 35 | 35 € | 1,225 € |
| Ventilation (AgroDieren, n.d.) | 35 | 65 € | 2,275 € |
| | | | |

| | | | |
|---|---|---|---|
| **Total exVAT** | | | **502,588 €** |

2. Indoor Arena

The indoor arena includes the foundation and ground preparation, riding surface (e.g., sand, fibre, rubber), steel or timber frame building, roofing and cladding, door and windows, lighting and ventilation, watering system viewing gallery or seating (optional), mirrors (optional). Table 11 lists the cost of each part of the indoor arena.

*Table 11. Cost evaluation for construction of a 20m X 60m indoor arena*

| Equipment | Quantity / Area | Unit Cost (exVAT) | Total Cost (exVAT) |
|---|---:|---:|---:|
| Foundations and ground preparation m² (Ecurie, n.d.) | 1,200 | € 45 | € 54,000 |
| Working surface (fibered sand) m² (Stop, Horse Stop, n.d.) | 1,200 | € 55 | € 66,000 |
| Structure (wood or steel frame) m² | 1,200 | € 150 | € 180,000 |
| Roof | 1,200 | € 60 | € 72,000 |
| Doors and windows | 2 doors, 10 windows | € 5,000 | € 5,000 |
| LED lighting (300 lux) m² (Sport, n.d.) | 1,200 | € 15 | € 18,000 |
| Ventilation m² (AgroDieren, n.d.) | 1,200 | € 5 | € 6,000 |
| Automatic irrigation system (Systems, s.d.) | 1 | € 5,000 | € 5,000 |
| Spectator gallery (optional) m² | 100 | € 200 | € 20,000 |
| Mirrors (optional) m² | 60 | € 150 | € 9,000 |
| | | | |
| **Total exVAT** | | | **€ 435,000** |

3. Outdoor Arena

Then the outdoor arena includes the ground preparation and drainage, the riding surface and the base layers, the perimeter fencing, gate, lighting (optional) and the mirrors (optional). Table 12 lists the cost of each part of the outdoor arena.

*Table 12. Cost evaluation for construction of a 20m X 60m outdoor arena*

| Equipment | Quantity / Area | Unit Cost (exVAT) | Total Cost (exVAT) |
|---|---|---:|---|
| Ground preparation & drainage (Ecurie, n.d.) | 1,200 m² | €45/m² | €54,000 |
| Riding surface (sand) (Stop, Horse Stop, n.d.) | 1,200 m² | €8/m² | €9,600 |
| Perimeter fencing (Solvari, n.d.) | 160 m | €50/m | €8,000 |

| | | | |
|---|---|---|---|
| Gate | 2 | €550 | €1100 |
| Lighting (Sport, n.d.) | 6 | 500€ | €3,000 |
| Mirrors (optional) m² | 60 | € 150 | € 9,000 |
| | | | |
| **TOTAL exVAT** | | | **€84,700** |

4. Paddocks and pasture

The paddocks with the pasture naturally includes the fencing (post-and-rail, electric, etc.), the gates and the access tracks. Additionally, water troughs or automatic waterers are considered as well as shelter (field shelters or run-ins) and grass management (seeding, harrowing). Table 13 shows the budget calculated for 10 horse paddocks of 600 m² each.

*Table 13. Cost evaluation for construction of paddocks*

| Item | Material Cost exVAT | Labour Cost | Total Cost exVAT |
|---|---|---|---|
| Fencing (3-rail wooden) (Leboutte, tout pour le faire!, n.d.) | 26700 | 3400 | 30000 |
| Gates (3m wide) (AgriShop, n.d.) | 1700 | 900 | 2500 |
| Automatic waterers | 2000 | 500 | 2500 |
| Field shelters (3x4 m) (Abris-cheveaux.be, n.d.) | 14500 | 2500 | 17000 |
| **TOTAL** | **43700** | **7500** | **52000** |

5. Accommodation and office

The stable must have an accommodation space including the grooms' quarters or staff accommodation, office space, a kitchen, rest areas and potentially bathrooms or changing facilities. Table 14 gives the cost of the different rooms for the accommodation.

*Table 14. Cost evaluation for construction of accommodations*

| Item | Estimated Cost (ExVAT) |
|---|---|
| Staff Accommodation (15 m²) | €20,000 |
| Office and Administrative Space (10 m²) | €18,000 |
| Kitchenette and Break Area | €20,000 |
| Sanitary Facilities and Changing Rooms | €9,000 |
| **Total Estimated Cost** | **€67,000** |

6. Driveways and access

The cost for access of the site considers the site entrance with the gates, the driveways for horseboxes and cars, the parking area and a turning circle. For the study, some assumptions have been performed:

- Driveways for horseboxes and cars: 500 m² (approximately 14 meters wide and 35 meters long to cover the main access and driveways).
- Parking areas: 300 m² (approximately 10 parking spaces for horseboxes and cars).
- Turning circles: 1 turning circle with a diameter of 15 meters for manoeuvring vehicles.
- Site entrance and gates: a motorized entrance with a width suitable for vans and vehicles.

*Table 15. Cost evaluation for driveways and acess*

| **Item** | **Average Price (Excl. VAT)** | **Total Price (Excl. VAT)** |
|---|---|---|
| Site Entrance and Gates | €4,500 | €4,500 |
| Driveways for Horseboxes and Cars (Ecurie, n.d.) | €35 per m² | €17,500 (500 m² × €35) |
| Parking Areas (Floor4horses, n.d.) | €20 per m² | €6,000 (300 m² × €20) |
| Turning Circles (Stop, Tout savoir pour bien concevoir le parking de son écurie, n.d.) | €7,500 | €7,500 |
| | | |
| **Total** | | **€35,500** |

7. Manure Management

Each horse produces 23 kg of manure per day, resulting in a total of 48,300 kg (48.3 m³) of manure over 2 months for 35 horses. A 50 m² concrete pad with a 15 cm thickness will be required for proper drainage and handling. A linear or sub-slab drainage system will be installed beneath the slab to ensure effective water management. Table 16 shows the cost for manure bays or bins, concrete pads and drainage.

*Table 16. Cost evaluation for construction of manure stocking platform*

| **Item** | **Total Price (Excl. VAT)** |
|---|---|
| Concrete (15 cm thickness) | €2,000 – €2,500 |
| Drainage (linear or sub-slab system) | €500 – €1,000 |
| **Total Estimated Cost** | **€2,500 – €3,500 (Excl. VAT)** |

8. Storage buildings

For the storage buildings, a 100 m² hay barn is assumed for winter hay storage for 35 horses, a 150 m² machinery shed for equipment, and a 50 m² general storage for tools and tack. The buildings will have a steel frame with metal cladding and concrete slab foundations. The cost estimates are based on average prices in Wallonia, Belgium. Table 17 sums up the cost of the hay barns, machinery sheds, general storage for tools and equipment.

*Table 17. Cost evaluation for construction of storage building*

| Building Type | Area (m²) | Estimated Cost (Excl. VAT) |
|---|---|---|
| Hay Barn | 100 | €12,000 – €15,000 |
| Machinery Shed | 150 | €18,000 – €22,500 |
| General Storage | 50 | €6,000 – €7,500 |
| **Total Estimated Cost (Frisomat, n.d.)** | **300** | **€36,000 – €45,000** |

9. Machinery and equipment

The remaining equipment is the wheelbarrows or muck carts, stable sweeper or slower, tractor, mowers (for pasture management), water pumps and jumping fences.

*Table 18. Cost evaluation for buying machinery and equipment*

| Item | Quantity | Unit Price (€) | Total (€) |
|---|---|---|---|
| Wheelbarrow | 3 | €150 | €450 |
| Stable Sweeper/Blower | 2 | €300 | €600 |
| Tractor | 1 | €25,000 | €25,000 |
| Mower | 1 | €2,000 | €2,000 |
| Water Pump | 3 | €250 | €750 |
| Jumping Fences | 7 set | €500 | €3500 |
| Other | | | 10000 |
| | | | |
| **Total** | | | **€43,300** |

10. Human resource

The human resources are quite short since it requires a stable manager, workers for cleaning stalls and feeding, and maintenance staff.

*Table 19. Monthly cost of human resources*

| Position | Number | Net salary (€) | Gross salary (€) | Employer Cost (gross + social charges) |
|---|---|---|---|---|
| Stable manager | 0.5 | 2,400 | 3,560 | 2,652 |

| | | | | |
|---|---|---|---|---|
| Stable workers (7day/week) | 2 | 2,380 | 2,380 | 6,949 |
| Maintenance Staff | 0.5 | 2,300 | 3,366 | 2,457 |
| **Total** | — | — | | **12,058** |

11. Energy and feeding cost

The energy for centre activity and the food for horses is summarized in Table 20.

*Table 20. Monthly energy and feeding cost per horse*

| **Item** | **Average Daily Consumption** | **Average Monthly Consumption** | **Average Unit Cost** | **Estimated Monthly Cost** |
|---|---|---|---|---|
| Hay (Belge, s.d.) | 12.5 kg/day | 375 kg | €0.1275/kg | €48.00 |
| Grains (EquiLannoo, s.d.) | 3 kg/day | 90 kg | €0.45/kg | €40.50 |
| Bedding (straw) | 20 kg/day | 600 kg | €0.1225/kg | €73.50 |
| Water | 40 L/day | 1.2 $m^3$ | €5.80/$m^3$ | €6.96 |
| Electricity (CallMePower, s.d.) | 3.3 kWh/day | 100 kWh | €0.17/kWh | €17.00 |
| **Total** | | | | **€185.96** |

12. Other costs

Finaly all the uncategorized costs are set in Table 21.

*Table 21. Other monthly costs*

| **Category** | **Monthly Cost (€)** |
|---|---|
| Insurance (liability, property) | €417 |
| Accounting & Legal Fees | €500 |
| Utilities, Phone, Internet | €100 |
| Software/Management Tools | €50 |
| Fuel | €180 |
| Electricity | €300 |
| Water | €60 |
| **Total** | **€1607** |

Based on the detailed breakdown provided across all components, i.e., ranging from stables, arenas, paddocks, infrastructure, accommodation, machinery, to monthly operational costs, the total estimated investment to establish a functional horse facility for 35 horses in Belgium is approximately €1.28 million (excluding VAT). This estimate includes construction, equipment, labour, and energy/feeding costs. To host such a facility, a minimum of 3 hectares of land is essential, with an estimated purchase cost of €200,000 (Notaire.be, 2022). By adding a 15% contingency margin to cover unforeseen expenses, the final projected budget rises to around €1.68 million, offering a realistic and financially secure foundation for a professional equestrian operation.

13. Total monthly fixed cost

Independently of the activity of the centre, fixed costs are mandatory every month. This basically includes HR, feeding & energy and insurance & administration costs (described here above). If an independent instructor is added, it represents an additional employer cost of €20€ per hour.

*Table 22. Total fixed monthly cost*

| Category | Description | Monthly Cost (€) |
|---|---|---|
| HR | Stable manager (0.5 FTE), 2 workers, maintenance (0.5 FTE) | €12,058 |
| Feeding & Energy | Hay, grains, straw, water, electricity for 35 horses | €6,508.60 |
| Insurance & Admin | Insurance, accounting, legal, phone, internet, software | €1607 |
| **Total Fixed Costs** | | **€20,170** |

The total base monthly cost of operating the horse stable is **€20,170**. This includes human resource costs for the stable manager (part-time), two stable workers, and a part-time maintenance staff (€12,058), feeding and energy expenses for 35 horses (€6,508.60), and insurance plus administrative overheads (€1607).

### 3.1.2. Profit evaluation

A horse stable can generate income through a diverse range of activities, making it a potentially profitable enterprise when managed strategically. Beyond traditional horse boarding, which often serves as the primary revenue stream, stables can expand into riding lessons, horse training, sales, leasing, and hosting equestrian events. Additional income can be earned through facility rentals, breeding programs, equine holiday camps, and even agricultural by-products like hay or manure. By diversifying services and tailoring them to local demand, a stable can build multiple income streams and improve long-term financial sustainability.

**General Assumptions**

- Total number of horses: 35

- All stalls are full with monthly fixed costs (rent, fixed salaries, electricity, water, etc.): €20,170

**Boarding (Livery)**

- Boarding price: €500/month per horse
- All horses are boarded (none used for lessons)
- No variable cost included related to boarding (feed, hay, staff)
- Revenue increases linearly with the number of boarded horses

**Riding School (Lessons)**

- Price per session (30 min): €25
- Instructor payment: €10 per 30-min session
- Each horse can do 3 sessions of 30 min per day = 1.5h/day
- Activity: 7 days/week
- Unlimited number of instructors available
- No other cost (infrastructure, horse wear & tear) is considered
- All horses are used at full capacity

By keeping the maximum of 35 horses in the stable, each horse is either in livery or in lesson. As shown in Figure 11, a profitable situation requires a few horses in riding school, and the profit linearly increases with the number of horses in lesson.

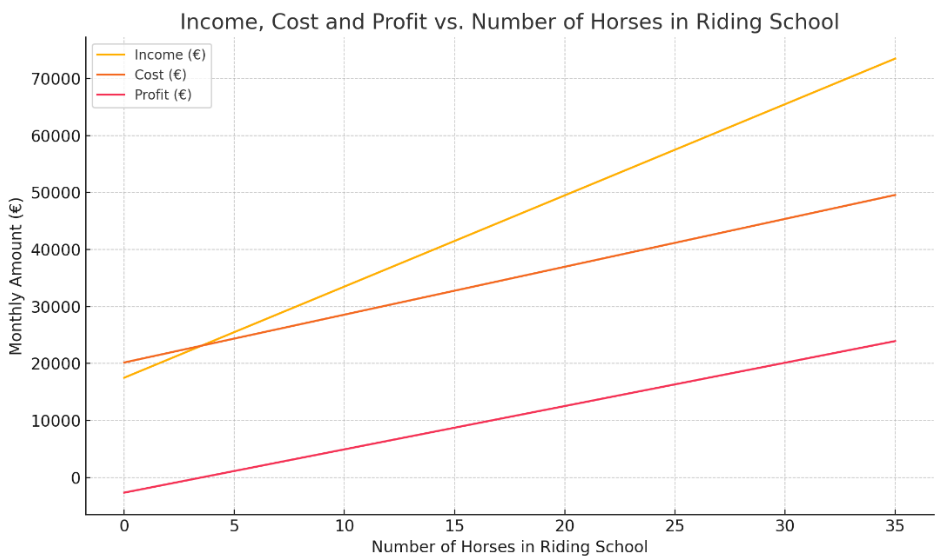


*Figure 11. Monthly income, cost and profit of the stables, from all horses in livery (left side) to all the horses working at school (right side)*

**Boarding by Day (per total number of days)**

- Boarding price: €85/month for each day of presence per week (e.g., a horse boarded 3 days/week = 3 × €85 = €255/month)
- Calculation based on the total number of boarding days per month, up to 245 days (35 horses × 7 days/week)
- No variable costs added (labour, hay, etc.)

- Revenue = €85 × total number of days

Figure 12 shows the cost and profit for renting a horse from the stable (without teacher). The horse is rented one day per week to the renter along a monthly contract. Because of the high monthly costs of the stables this method is not very profitable and all the horses should almost be rented all the week round to be able to cover the costs.


*Figure 12. Monthly income, cost and profit of the stables per boarding days per month*

**Workshop**

- 16 stage weeks per year
- €180 per kid per week
- Instructor works 4 hours/day, 5 days/week → 20 hours/week
- Instructor paid €17/hour → €340/week (fixed cost)
- Monthly stage weeks: 16 ÷ 12 = 1.33 weeks/month

The organisation of workshops is quickly profitable but the values remain low. As shown in Figure 13, the cost is low which allows profit with a poor amount of participant. The fixed cost, time for organisation and the periodicity of this kind of event make them less attractive in terms of incomes, but more acting as a vitrine of the stable.

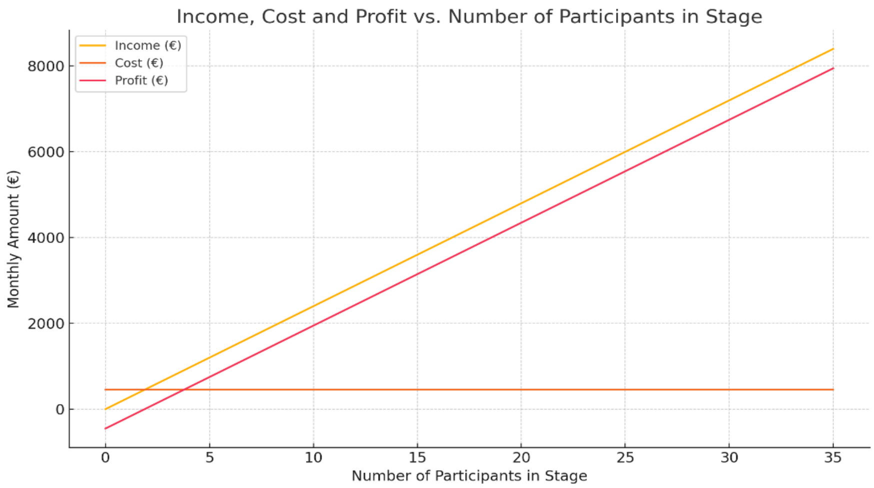


*Figure 13. Monthly income, cost and profit of the stables per month based on the number of participants in the workshop*

**Hosting events**

A horse-riding show hosted at your stables with 20 riders and 20 additional visitors generates revenue from both entry fees and food sales. Each rider pays an entry fee of €30, total of €600, while all 40 attendees (riders + visitors) are estimated to spend €10 each on food, bringing in €400. This results in a total revenue of €1,000. On the cost side, expenses include a judge (€150), prizes (€100), event setup (€50), one-day staff help (€100), insurance/admin (€50), and food stock (€100), summing up to €550 in total costs. Therefore, the net profit for the event is €45

*Table 23. Cost and profit evaluation of a small sized horse show event*

| **Profit** | | | **Costs** | |
|---|---|---|---|---|
| Revenue | | | Judge/Officials | 150 |
| Entry Fees (20 × €30) | 600 | | Prizes/Ribbons | 100 |
| Food Sales (40 × €10) | 400 | | Setup/Decoration | 50 |
| Total Revenue | 1,000 | | Staff Help (1 day) | 100 |
| | | | Insurance/Admin | 50 |
| | | | Food Stock & Supplies | 100 |
| | | | Total Costs | 550 |
| **Net Profit** | | | | **€450** |

### 3.1.3. Conclusion

The profit potential of a horse stable is highly dependent on how its services are structured and diversified. A boarding-only model is financially fragile if not paired with other high-yield activities. However, by integrating riding lessons, stages, flexible boarding options, and event hosting, a horse stable can transform from a cost-heavy operation into a profitable, resilient, and multi-stream business. The purpose of this section was to evaluate whether the base economic model of the horse stable is inherently profitable and whether it provides a realistic and solid foundation for further development.

## 3.2. Automated model

Switching from a traditional horse stable to an automated model offers several advantages, but also some drawbacks. On the positive side, automation significantly reduces the time required for daily tasks such as feeding, watering, and cleaning, while ensuring consistency and precision in horse care. Labor costs decrease over time as fewer workers are needed, and smart systems improve resource management by minimizing waste and optimizing feed and water usage. Automation also allows for better monitoring of environmental conditions and horse health, and facilitates scalability for larger operations. However, the transition involves a high initial investment in equipment and installation, and technical failures can pose serious risks if not detected quickly.

### 3.2.1. Additional costs

This method will reduce the cleaning time for each stall to less than half so only one worker would be needed. But more electricity and fuel would be needed. In the other hand the initial investment should be increased. The updated monthly and initial investment is shown in the following tables. First, Table 24 sums up the additional initial cost related to automated model. Then Table 25 and Table 26 respectively list the additional monthly cost and the total fixed monthly cost for the automated model.

*Table 24. Additional initial cost for automated model*

| **Additional Initial costs** | |
|---|---|
| Grains distributer | 35,000€ |
| Hay distributer | 45,500€ |
| Manure cleaning with conveyor belt system | 420,000€ |
| Straw distributer | 4,000€ |
| Robot cleaner | 25,000€ |
| Horse walker | 20,000€ |
| | |
| **Total** | **549,500€** |

*Table 25. Additional monthly cost for automated model*

| **Category** | **Monthly Cost (€)** |
|---|---|
| Insurance (liability, property) | €417 |
| Accounting & Legal Fees | €500 |
| Utilities, Phone, Internet | €100 |
| Software/Management Tools + barn management software | ~~€50~~ → 150€ |
| Fuel | ~~€180~~ → 80€ |
| Electricity | ~~€300~~ → 400€ |
| Water | €60 |
| | |
| **Total** | **~~€1607~~ → 1907€** |

*Table 26. Additional total monthly cost for automated model*

| **Category** | **Description** | **Monthly Cost (€)** |
|---|---|---|
| Human resource | Stable manager (0.5 FTE), 1 worker, maintenance (0.5 FTE) | €8,583€ |
| Feeding & Energy | Hay, grains, straw, water, electricity for 35 horses | €6,508.60 |
| Insurance & Admin | Insurance, accounting, legal, phone, internet, software | ~~€1607~~ → 10907€ |

| Total Fixed Costs | | ~~€20,170~~ → 16,998€ |
|---|---|---|

So, for integrating this model 549,500€ initial investment is needed, the monthly other costs including fuel, electricity and it costs will increase from €1607 to €10,907, however by removing one stable worker the total fixed costs will decrease from €20,170 to 16,998€

### 3.2.2. Additional profit and return on investment

By integrating this method in additional to the mentioned benefits for the horses and the workers, the costs are decreased by €3,172 per month and the livery costs can be increased to €650 per month (€150 increased). So, the total benefit can be considered as €3,322 per month.

The Net Present Value (NPV) calculates the present value of all future cash flows (profits), discounted back to today's value, and subtracts the initial investment.

$$\text{NPV} = \sum_{t=1}^{n} \frac{\text{Cash flow}_t}{(1+r)^t} - \text{Initial investement}$$

- Initial Investment = €549,500
- Monthly Net Profit (Cash Flow) = €3,322
- Period = 30 years × 12 months = 360 months
- Annual Discount Rate = 5%
- Monthly Discount Rate= $r_{monthly} = (1+0.5)^{\frac{1}{12}} - 1 \cong 0.407\%$

NPV = €77,227 → the project creates €77k of value over 30 years

The interest rate of return (IRR) is the NPV of all cash flows (positive and negative) equals zero. It's the break-even rate of return for the investment.

- Monthly IRR = 0.51%
- Convert to annual IRR: $(1+0.0051)^{12} - 1 \cong 6.25\%$

*Table 27. Investment details for automated model*

| Parameter | Value |
|---|---|
| Initial Investment | €549,500 |
| Monthly Profit | €3,322 |
| Duration | 30 years (360 months) |
| Discount Rate (Annual) | 5% |
| Discount Rate (Monthly) | ~0.407% |
| NPV | €77,227 |
| IRR (Annual) | 6.25% |

The project is financially sound. With a solid annual return of 6.25% and a positive NPV, this stable construction is economically justified, assuming the monthly benefits stay stable over 30 years. However, it can be much more profitable if the scale is bigger.

The sensitivity analysis in Table 28 show changes in the monthly profit affect the overall financial viability of your horse stable investment.

*Table 28. Sensitivity test for investment in automated model*

| Monthly Profit | NPV | IRR (Annual %) |
|---|---|---|
| 2500 | -77851.01 | 3.67 |
| 3000 | 16478.79 | 5.27 |
| 3322 | 77227.18 | 6.25 |
| 3500 | 110808.59 | 6.78 |
| 4000 | 205138.39 | 8.21 |

## 3.3. Ecologic model

Transitioning to an ecological horse stable with solar panels, manure recycling, rainwater harvesting, and other green systems, offers clear long-term advantages. Energy, water, and waste management become more efficient, reducing dependency on external utilities and lowering operating costs over time. These systems also improve the stable's environmental footprint and market appeal, especially among clients who prioritize sustainability. However, this shift requires significant upfront costs for equipment and infrastructure. It also demands ongoing technical oversight: solar systems need monitoring, water systems need filtration and maintenance, and manure recycling must be managed properly to avoid hygiene or odour issues. In short, it's a smart move for long-term, sustainable operation—but only if you're prepared for the investment and the management it entails.

**Solar panels**

We currently pay around €350 per month for electricity. To generate this amount of energy with solar panels in Belgium, we would need an installed solar capacity of about 16 kWp when accounting for real-world efficiency losses such as inverter inefficiencies, shading, and system performance. This roughly translates to installing around 53 solar panels of 300 W each. The total cost for such a system, including panels and installation, would be approximately **€20,000** before VAT. This setup would cover 60- 70% of our monthly electricity needs and reduce our electricity bills by €250 per month. (Electricity prices in Belgium, s.d.) (Save, 2025) (Solar, s.d.) (CallMePower, Solar panels in Belgium: prices, subsidies and injection, s.d.)

**Water gathering and refining system**

To cover the water needs for horses—including drinking, cleaning, sanitation, and other uses, approximately 53 m³ of water per month is required. Given the large roof surfaces available (1,200 m² for the indoor arena and 1,000 m² for the stalls), collecting this volume of rainwater is entirely practical. For such an application, the system must include a sufficiently sized storage tank, professional installation and infrastructure, and a robust refining (filtration and treatment) system to ensure water quality suitable for animal use (Efthalia Karkou). Hopefully integration of such system will cover all the water costs.

*Table 29. Estimated cost for collecting and filtering rainwater*

| Component | Estimated Cost (€) |
|---|---|
| Storage Tank (100 m³) (maciterneecolo, s.d.) | 10,000€ |
| Filtration & Treatment (rainyfilters, s.d.) | 20,000€ |
| Installation & Infrastructure | 10,000€ |
| Water pump | 5,000€ |
| **Total Estimated Investment** | **45,000€** |

**Manure recycling**

As calculated in section 2.3.2. the suitable method for manure recycling is mushroom cultivation that has an initial cost of 21,000 to €47,000 (average 34,000€) and the profit is €3,150 – €4,750 (average 3,950€) per month.

**Eco-friendly materials**

Incorporating sustainable and eco-friendly materials into the stable project can increase construction costs by approximately 10% to 30%, depending on the specific materials and systems chosen. This premium covers elements such as responsibly sourced timber, energy-efficient insulation, renewable materials, design to maximize natural and ventilation etc. By considering 20% increase because of sustainable materials the initial cost of construction will be €1,776 million instead of €1,48 million.

### 3.3.1. Additional costs

The additional cost related to the ecological model are summarized here after. Table 30 lists first the additional initial cost of this model. Then Table 31 and Table 32 give the monthly costs due to the energy, the feeding costs and the other costs.

*Table 30. Additional initial cost for ecological model*

| Additional initial cost | |
|---|---|
| Solar panel | 20,000€ |
| Using rain water | 45,000€ |
| Manure recycling | 34,000€ |
| Eco friendly materials | 296,000€ |
| **Total** | **395,000€** |

*Table 31. Monthly cost of energy and feeding for ecological model*

| Item | Average Daily Consumption | Average Monthly Consumption | Average Unit Cost | Estimated Monthly Cost |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Hay | 12.5 kg/day | 375 kg | €0.1275/kg | €48.00 |
| Grains | 3 kg/day | 90 kg | €0.45/kg | €40.50 |
| Bedding (straw) | 20 kg/day | 600 kg | €0.1225/kg | €73.50 |
| Water | 40 L/day | 1.2 m³ | €5.80/m³ | ~~€6.96~~ |
| Electricity | 3.3 kWh/day | 100 kWh | €0.17/kWh | ~~€17.00~~ |
| **Total** | | | | **~~€185.96~~ → 162€** |

*Table 32. Monthly other costs*

| **Category** | **Monthly Cost (€)** |
|---|---|
| Insurance (liability, property) | €417 |
| Accounting & Legal Fees | €500 |
| Utilities, Phone, Internet | €100 |
| Software/Management Tools | €50 |
| Fuel | €180 |
| Electricity | ~~€300~~ → €100 |
| Water | ~~€60~~ |
| **Total** | **~~€1607~~ → €1347** |

The summary of the monthly costs for the ecological model is written in Table 33. This transformation needs 395,000€ of initial investment and it can reduce the costs by €1,095 per month.

*Table 33. Total monthly costs*

| **Category** | **Description** | **Monthly Cost (€)** |
|---|---|---|
| Human resource | Stable manager (0.5 FTE), 2 workers, maintenance (0.5 FTE) | €12,058 |
| Feeding & energy | Hay, grains, straw, water, electricity for 35 horses | ~~€6,508.60~~ → €5,670 |
| Insurance & admin | Insurance, accounting, legal, phone, internet, software | ~~€1607~~ → €1347 |
| **Total Fixed Costs** | | **€20,170 → €19,075** |

### 3.3.2. Additional profit and return on investment

As mentioned in the previous section the costs would be reduced by €1,095 per month and an additional profit of €3,950 would be added by mushroom cultivation for manure recycling. So, a total of 5,051€ would be the profit of this model per month. This project shows strong financial potential with a positive NPV of €557,354 and an impressive annual IRR of 16.27%.

The initial investment of €395,000 is well justified by the consistent monthly benefits, making it a solid and profitable long-term investment assuming stable cash flows over 30 years.

*Table 34. Investment details for the ecological model*

| Metric | Value |
|---|---|
| Initial Investment (€) | 395,000 |
| Monthly Benefit (€) | 5,051 |
| Project Duration | 30 years (360 months) |
| Discount Rate (Annual) | 5% |
| Net Present Value (NPV) (€) | 557, 919 |
| Monthly Internal Rate of Return (IRR) | 1.26% |
| Annual Internal Rate of Return (IRR) | 16.28% |

The sensitivity analysis shows that this project remains financially strong even with lower monthly benefits. Even at €4,000 per month, the NPV stays positive (€359,638) and the annual IRR is a healthy 12.45%. This means that this investment is quite resilient to fluctuations in income and has a solid margin of safety.

*Table 35. Sensitivity test for investment in ecological model*

| Monthly Benefit (€) | NPV (€) | IRR (Annual %) |
|---|---|---|
| 4000 | 359638.39 | 12.45 |
| 4500 | 453968.19 | 14.28 |
| 5048 | 557353.65 | 16.27 |
| 5500 | 642627.78 | 17.91 |
| 6000 | 736957.58 | 19.73 |

## 3.4. Horse well-being model

Shifting the focus of a stable toward horse well-being places animal welfare at the core of stable design and management. This model includes technologies such as wearable activity trackers, weight monitoring platforms, water flow sensors, and air quality detectors. Enhancing well-being not only benefits the horses but also leads to fewer injuries, improved performance, and reduced veterinary costs over time. Furthermore, a well-being-oriented facility often gains stronger public trust and a better reputation among clients. However, this model can require changes in infrastructure, staff training, and daily routines, and may initially increase operational complexity and costs.

### 3.4.1. Additional costs

The model oriented to the horse well-being involved also additional costs compared to traditional model. The additional initial costs are listed in Table 36. The monthly costs related to energy and feeding costs are given in Table 37. Because of the nature of the sensor equipment 5% of the total price should be considered as the price of maintenance and replacing the broken electronics per year.

*Table 36 Additional initial cost for horse well-being model*

| **Component** | **Approx. Price (€)** |
|---|---|
| Weighting Platform (1 unit) | 1,500 |
| Wireless Data Transmission Modules (35 units) | 1,750 |
| Water Flow Sensors (35 units) | 2,500 |
| Wearable Horse Activity Trackers (35 units) | 10,500 |
| Dust Sensors (5-10 units) | 300 |
| VOC Sensors (5-units) | 400 |
| Temperature and Humidity Sensors (5-10 units) | 300 |
| Central Server or Cloud Platform | 360 |
| Mobile Monitoring Application | 15,000 |
| Power Supply Systems | 5000 |
| Camera with AI | 20,000 |
| Grains distributer | 40,000€ |
| Hay distributer | 50,000€ |
| Paradise paddocks | 100,000€ |
| **Total** | **231,060€** |

*Table 37. Monthly cost of energy and feeding for Horse well-being model*

| **Item** | **Average daily consumption** | **Average monthly consumption** | **Average unit cost** | **Estimated monthly cost** |
|---|---|---|---|---|
| Hay | 12.5 kg/day | 375 kg | €0.1275/kg | €48.00 |
| Grains | 3 kg/day | 90 kg | €0.45/kg | €40.50 |
| Bedding (straw) | 20 kg/day | 600 kg | €0.1225/kg | €73.50 |
| Water | 40 L/day | 1.2 m³ | €5.80/m³ | €6.96 |
| Electricity | 3.3 kWh/day | 110 kWh | €0.17/kWh | ~~€17.00~~ → 18.7 |
| **Total** | | | | **~~€185.96~~ → 187.66€** |

*Table 38. Monthly other costs for horse well-being model*

| Category | Monthly Cost (€) |
|---|---|
| Insurance (liability, property) | €417 |
| Accounting & Legal Fees | €500 |
| Utilities, Phone, Internet | €100 |
| Software/Management Tools | ~~€50~~ → €2000 |
| Fuel | €180 |
| Electricity | €300 |
| Water | €60 |
| Equipment maintenance | €962.5 |

| Total | ~~€1,607~~ → €4,519.5 |
|---|---|

In this model, there are automatic feeders that reduce the need for manual worker but there would be more work to maintain the paradise paddocks so the labour cost stays unchanged. The electricity usage would be increased slightly to power all the sensors. There would be much more software cost to cover the abonnement, cloud database and other software needs. In summary an initial investment of €231,060 and the monthly fixed costs would increase from €20,170 to €23,145.6.

*Table 39. Total monthly cost for horse well-being model*

| Category | Description | Monthly Cost (€) |
|---|---|---|
| Human resource | Stable manager (0.5 FTE), 2 workers, maintenance (0.5 FTE) | €12,058 |
| Feeding & Energy | Hay, grains, straw, water, electricity for 35 horses | ~~€6,508.60~~ → 6,568.1 |
| Insurance & Admin | Insurance, accounting, legal, phone, internet, software | ~~€1607~~ → €4,519.5 |
| **Total Fixed Costs** | | **~~€20,170~~ → €23,145.6** |

### 3.4.2. Additional profit and return on investment

Thanks to new attention on horse well-being and the lack of such places with high concentration on horses health this model can attract many clients with high concern of their horse health and can be in partnership with horse clinics and the horses with special needs. The horse livery can be increased to €850 from €500 per month that means €12,250 of increase in profit. With the increase in costs of €2,975.6 the net profit of this model is €9,274.4. This is an exceptionally strong investment. A positive NPV over €1.5 million and an IRR far exceeding 5% suggest that the project will generate substantial value well beyond its cost, assuming the cash flows remain stable.

*Table 40. Investment details for horse well-being model*

| Parameter | Value |
|---|---|
| Initial Investment | €231,060 |
| Monthly Profit | €9,274.40 |
| Investment Duration | 30 years |
| Annual Discount Rate | 5% |
| Net Present Value (NPV) | €1,518,644.57 |
| Internal Rate of Return (IRR) | 60.36% |

The sensitivity analysis shows that the investment remains highly profitable across all tested monthly profit levels. Even at €7,000 per month, the IRR is well above the 5% discount rate, indicating strong financial viability.

*Table 41 Sensitivity test for Investment in horse well-being model*

| Monthly Profit (€) | NPV (€) | IRR (%) |
|---|---|---|
| 7000 | 1089557.18 | 43.07 |
| 7500 | 1183886.98 | 46.71 |
| 8000 | 1278216.78 | 50.45 |
| 8500 | 1372546.57 | 54.27 |
| 9000 | 1466876.37 | 58.18 |

### 3.4.3. Model comparison and discussion

An interesting and somewhat counterintuitive trend emerges from this comparison: the models requiring higher initial investments actually yield lower profits. This is particularly evident in the automated model, where despite its cost (€549,500), the profit remains modest. This can be explained by two main factors:

- The scale of the operation is relatively small, so automation doesn't significantly reduce labour or operational costs.
- The core business offering remains unchanged, which means we cannot justify a price increase for services like horse boarding, resulting in limited profit gains.

In contrast, the ecological model not only reduces operational costs through sustainability measures but also generates additional income from mushroom cultivation. It thus provides both cost savings and new revenue streams, making it financially more viable.

The horse well-being model stands out as the most profitable. Despite its lower initial investment, it leverages growing public concern for equine health. Given the lack of highly specialized facilities in this domain, it can attract high-value clients, including those with horses requiring medical care. This allows for premium pricing and potential partnerships with veterinary clinics, resulting in significantly higher returns.

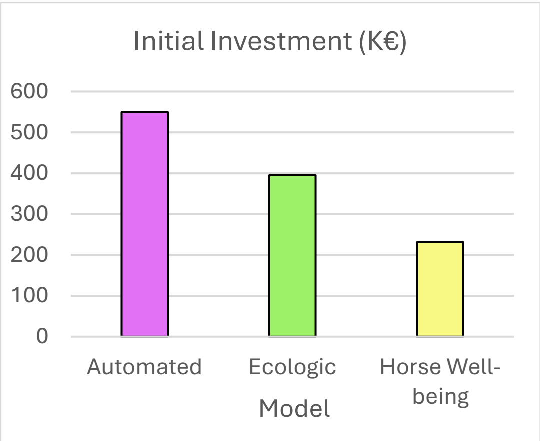


*Figure 14. Initial investments for different models*

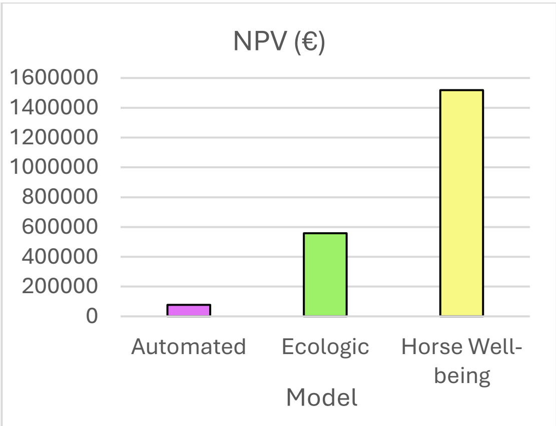


*Figure 15. NPV for different investment models*

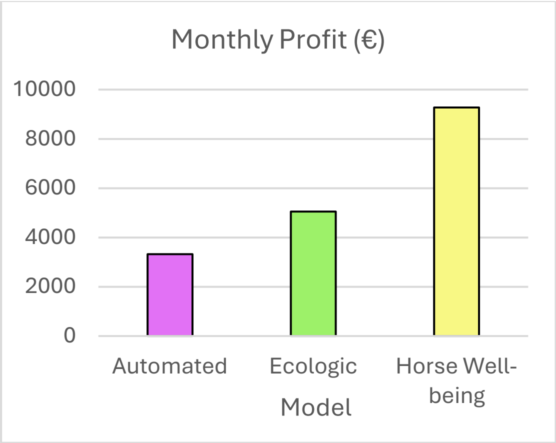


*Figure 16. Monthly profit for different models*

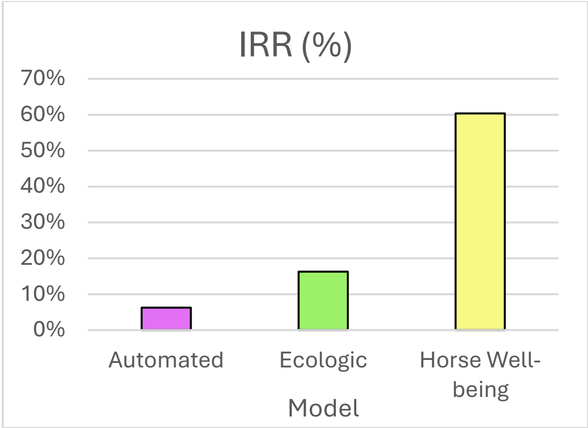


*Figure 17. IRR for different investment models*

# 4. Conclusion & prospects

The equestrian industry in Belgium, although deeply embedded in cultural tradition, faces considerable challenges, including high operational costs, insufficient infrastructure comfort, concerns about horse health and welfare, and ecological sustainability. To address these challenges, this work proposed new models of horse stables, integrating advanced technologies and sustainable practices with a focus on horses' wellbeing.

In the financial planning section, significant findings indicated the advantages of shifting from traditional model to other models. The analysis demonstrated that although all the models require higher initial investments (€549,500 for automation, €395,000 for ecological and €231,060 for horse well-being model), these investments yield substantial operational savings and profitability over time. The automated stable model reduces monthly operational costs by approximately €3,172 monthly, achieving a positive Net Present Value (NPV) of €77,227 and an Internal Rate of Return (IRR) of 6.25% over 30 years. The ecological model, generating additional profit of 5,051 monthly (increase the profit around €3,950 monthly through mushroom cultivation and reduce the costs by €1,095 per month), achieving a positive Net Present Value (NPV) of €557, 919 and an Internal Rate of Return (IRR) of 16.28% thus making ecological practices financially advantageous as well. Finally, the model with concentration on horse well-being increases the profit significantly by €9,274.40 per month leading to a NPV of €1,518,644.57 and IRR of 60.36% that shows a very advantageous investment also. Overall, the integration of automation, sustainability practices, and advanced horse wellbeing technologies presents a robust and promising strategy for elevating Belgium's equestrian industry, positioning it for long-term success and sustainability.

Despite these promising results, future improvements can further optimize both financial and operational efficiency. Additional research should explore integration scalability, robustness of technological systems against failures, detailed lifecycle cost analysis of sustainable materials, and enhanced monitoring systems using AI to further improve horse welfare and operational management. Ultimately, these advancements could establish a new benchmark in equestrian facility management, benefiting horses, stakeholders, and the environment alike.

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