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**Please note:** This document contains the main findings and conclusions from our impact team's due diligence on the company. The top section contains a summary of all material conclusions relevant to Norselab's impact requirements, as well as considerations relevant for SFDR Article 9. The main content is research on the impact thesis of the company, and some of the supporting data. This is only a partial representation of the complete impact due diligence Norselab deploys in the investment process, but still provides an overview of aspects that are material to the company's impact potential, including potential negative impacts. See list of additional aspects addressed in the DD at the bottom of the document.

| | |
|---|---|
| Company name | Beefutures Holding AS |
| Products | Light therapy equipment for bees, Beehive monitoring equipment, Beehive heaters for Varroa mite prevention, Apicultural monitoring and analysis software, Biodiversity impact assessment services |
| Industry | Apiculture |
| Impact theme | Sustainable food systems |
| Norselab partner | Maria Grimstad de Perlinghi |
| Memo lead | Initial lead: Kenza Akallal<br>Reassessment lead: Inès van Tol |
| Date (version) | 25.03.2024 (v. 2.0) |

## Impact due diligence summary

| | |
|---|---|
| Approved by PGC | Yes |
| Impact score | Impact-generating (5/5) - unchanged since last assessment. |
| Input to investment agreement | • Collaborate with Norselab's impact team to explore alignment with the EU Taxonomy Biodiversity objective, to set up the appropriate policies and |

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| | mechanisms to formally address SFDR good governance criteria and due diligence processes, and improve sustainability management by the end of 2023. |
| Ownership strategy recommendation | • Prioritize the development and deployment of Onibi Watch and Onibi Insights to strengthen the biodiversity impact thesis. |
| Impact assessment summary | • Beefuture's technology enables the use of honeybees as biosensors of the environment, providing insights into how human activities and climate change are impacting pollinators and local biodiversity. A broad range of stakeholders may hence better understand ecosystem health and take appropriate action to avoid negative impacts.<br>• Beefutures has developed a thermal, chemical-free treatment to combat the varroa mite, an invasive species, reducing the risk of collapse of honeybee colonies and promoting immunity in honeybees.<br>• Beefutures has developed a red light therapy treatment for domesticated honeybees to support mitochondria in cells, thereby increasing energy and immunity. |
| SDGs | **15.5 (Life on land)** Introduces solutions to increase the resiliency and immunity of domesticated honeybee populations that complement the wild bees' pollination.<br>**15.8 (Life on land):** Introduces a chemical-free treatment to contain bees' contamination by the varroa mite, eventually benefiting wild bees.<br>**15.9 (Life on land):** Monitors and measures the biodiversity gains from more responsible agricultural and urban rehabilitation practices by analyzing bee foraging activity through AI-powered insights.<br>**2.4 (Zero hunger):** Supports the optimal management of bees to increase apiculture and agricultural productivity. |
| Net impact[1] | **+ 74%** |
| EU Taxonomy | Potential eligibility for enablement of conservation, including restoration, of habitats, ecosystems and species |
| SFDR | • **Sustainable investment:** Substantial contribution to at least one SDG.<br>• **DNSH:** Limited information, but no negative SDG contribution uncovered. |

[1] Applying Norselab SDG-mapped value set to the Upright model.

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| | Additionally, the phase and size of the company indicated that any potential negative impact would be very limited.<br>• **Good governance:** Limited information. No indication of non-compliance with good governance criteria.<br>• **PAI:** Estimated PAI indicators have been reviewed. No indication of significant harm. No peer company data available for benchmarking. |
| Areas to monitor | • **Harmful product risk:** Apiculture could threaten the balance of honey bees vs. wild bees. This is to keep in mind when communicating about risks.<br>• **Drop-off risk:** Varroa mites could become resistant to heat treatment. No indication that this has manifested until today.<br>• **External risk:** Access will depend on the level of digital skills and the availability and affordability of adequate digital infrastructure.<br>• **Evidence risk:** Beefutures may not always have access to the data and insights generated. |

## About Honeybees and Apiculture

Honeybees can be managed or wild. However, honeybees refer predominantly to managed honey bees that are kept in hives and are grown, sold, and traded as a commodity[2]. Apiculture is the practice of beekeeping, which involves the management of honey bees to produce honey and other honeybee products such as beeswax and royal jelly[3]. But the greatest importance of honeybees to agriculture is not the products of the hive but rather their work as crop pollinators[4]. Apiculture can provide livelihoods or a source of income for many rural areas and small farms. Modern apiculture is shifting towards a farming system that is more sustainable and respectful of wild bees. But sustainable apiculture requires good knowledge of the proper management of bees to optimize the natural systems and resources that beekeepers rely on. State-of-the-art technologies and innovations may also strongly enhance beekeeping activities[5].

## About Beefutures

Beefutures combines biotechnology, data science and 30 years of beekeeping know-how to craft game-changer beekeeping solutions. Their approach is to improve bee health and safety first and further optimize beekeeping operations and economics with digital tools. Beefutures applies a breakthrough biotechnology to boost the bees' immunity and metabolism. The company is also reinventing thermal treatment to eradicate the number 1 bee

[2] The Economist, Sept 2015
[3] Food and Agriculture Organization of the United Nations, 2021
[4] FDA, July 2018
[5] Food and Agriculture Organization of the United Nations, 2021

enemy without chemicals, and combines healing and defense solutions with robotics, automation and AI powered digital monitoring. Beefutures has developed an innovative technology that turns honey bees into biosensors of the environment, supporting agriculture and urban landscapes rehabilitation and promoting pollinator-friendly agriculture practices and cities.

# 1. Impact thesis

## 1.1 The big picture

### 1.1.1 Challenge

**Key takeaway:** Bee populations have been threatened by habitat loss, intensive farming practices, changes in weather patterns, excessive use of agrochemicals and invasive species, in particular the varroa mite for honeybees. Both domesticated honeybees and wild bees play important and complementary roles in pollination, and a diverse and balanced mix of pollinators can be beneficial for sustainable food systems and ecosystem health.

#### Decrease in pollinators threatens ecosystems and food production

Succeeding World Economic Forum global risk reports suggest that biodiversity loss and ecosystem collapse is one of the fastest-deteriorating global risks over the next decade, and the 2nd most severe risk in 10 years[6][7]. The extinction of pollinators has been at the heart of the biodiversity debate, associated with potential annual agricultural losses ranging from USD 210[8] up to 570 billion[9]. Pollinators such as bees sustain populations of wild plants that underpin ecosystem services, allow us to produce crops and ensure food security. Ecosystem services are the multitude of benefits that nature provides to society and make human life possible[10]. Pollinators play an instrumental role for a third of the world's food production[11]. Bees are by far the biggest pollinators, with wild bees pollination services on par with that provided by honeybees[12]. Bee populations have been declining globally over recent decades due to habitat loss, intensive farming practices, changes in weather patterns, invasive species and excessive use of agrochemicals such as pesticides[13].

[6] World Economic Forum, Jan 2023
[7] World Economic Forum, 2024
[8] Paulson Institute, 2020
[9] World Economic Forum, Nov 2020
[10] Food and Agriculture Organization of the United Nations
[11] Food and Agriculture Organization of the United Nations
[12] Nature, June 2015
[13] IPBES, 2019

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## Invasive species causing colony collapse disorders

While the number of honey bees has been increasing globally[14,15], there have been widespread reports of vast die-offs or sudden abandonments of honeybee hives, called colony collapse disorders[16]. In particular, an invasive species, the varroa mite, is the primary cause of colony collapse disorder[17,18]. Varroa mites weaken the honey bee by attaching themselves to the body and sucking hemolymph, the fluid similar to blood in mammals, from their host, causing parasitic diseases and transmitting viral diseases[19]. If left untreated, the mites can kill entire colonies of honeybees. The mites can spread from bee to bee and through beekeeping equipment[20]. There is also evidence that the viruses carried by the mites could spill over into wild bees[21,22,23]. The mites have spread from Japan through Europe and in the US, with drastic preventive measures implemented in regions that have only recently been affected, like Australia[24]. The conventional chemical treatment methods are insufficient and can only be applied after the honey harvesting season. To add to the challenge, the varroa mites have strong adaptability to chemical treatments and require ongoing monitoring of infestation and resistance to treatment[25].

## Balance of managed domesticated honeybees and wild honeybees

There is a common misconception that bees make one uniform group. There are about 20,000 bee species, and only a few are honeybees. Domesticated honeybees are an important pollinator for commercial crops, particularly for large-scale monoculture crops including apples, melons, cranberries and almonds[26]. The timing and intensity of pollination can be managed more easily with domesticated honeybees but this varies by crop and region. Domesticated honeybees, despite being pollinators, can also destabilize natural ecosystems by competing with wild bees[27,28,29,30], some of which are species at risk[31]. Domesticated honeybees can reduce pollen and nectar

[14] IPBES, 2019
[15] Scientific Reports, Dec 2022
[16] The Economist, Sept 2015
[17] US Environmental Protection Agency, Oct 2022
[18] The Economist, Dec 2021
[19] Financial Times, Sept 2015
[20] New York Times, June 2022
[21] Santamaria et al., Jan 2018
[22] Graystock et al., April 2016
[23] Manley et al., June 2019
[24] New York Times, June 2022
[25] Food and Agriculture Organization of the United Nations, 2015
[26] US Food & Drug Administration, July 2018
[27] Valido et al., March 2019
[28] Goulson, Nov 2003
[29] Goulson, Sept 2004
[30] Geslin et al., June 2018
[31] Scientific American, Nov 2020

availability[32,33,34] and displace wild pollinators from floral resources[35,36,37,38,39]. The presence of domesticated honey bees can reduce the size of wild bees and impact their reproduction[40,41,42]. However, in a study of over 40 pollination systems from around the world, managed honeybee colonies were found to supplement rather than substitute wild pollinators. When the natural pollinator declines, beekeeping can also contribute to pollination[43]. Ultimately, both domesticated honeybees and wild bees play important roles in pollination, and a diverse and balanced mix of pollinators can be beneficial for crop production and ecosystem health.

### 1.1.2 Theory of change

**Key takeaway:** Beefutures has developed an innovative technology that turns honey bees into biosensors of the environment, supporting agriculture and urban landscapes rehabilitation and promoting pollinator-friendly agriculture practices and cities. Beefutures' one stop solution also enables bees' treatment agains destructive invasive species, and promotes bees' immunity.

#### Using honey bees as biosensors

Honey bees can provide insights into how pollinators respond to human activities. Knowing where and how honey bees move and die outside the hive in a variety of landscapes provides critical information in evaluating the impact of habitat loss, intensive farming practices, changes in weather patterns, presence of invasive species and excessive use of agrochemicals, and has been out of reach so far. Traditional honey bee monitoring is inefficient and could only be performed in controlled experimental conditions[44]. Beefutures has developed an innovative technology (Onibi Watch) that turns honey bees into biosensors of the environment and enables biodiversity assessments evaluating at local level how the environment is resilient or susceptible to climate incidents and human activities and how pollinators are impacted. AI-powered visual and audio monitoring data is turned into actionable insights (Onibi Insights). A broad range of insights can be derived from in-hive sensors real-time data including nectar and pollen availability, floral diversity, presence of intruders in the local environment and bees' response to climate conditions and human activities. By offering data and insights to beekeepers but also farmers, property owners, municipal and national planners and land managers, Beefutures can enable a broad range of stakeholders to assess the ecosystem health and make timely decisions to support pollinator-friendly

[32] Dupont et al., July 2004
[33] Torné-Noguera et al., May 2016
[34] Cane et al., 2017
[35] Dupont et al., July 2004
[36] Shavit et al., 2009
[37] Artz et al., Oct 2011
[38] Lindström et al., Nov 2016
[39] Ropars et al., Sept 2019
[40] Thomson, Feb 2004
[41] Goulson et al., Feb 2008
[42] Torné-Noguera et al., May 2016
[43] Devkota et al., May 2016
[44] World Economic Forum, Dec 2015

agriculture and urban landscapes rehabilitation. With the same technology, Beefutures helps its users to also monitor the success of the rehabilitation projects.

### Chemical-free treatment for varroa mites

Beefutures has reinvented thermal treatment to eradicate varroa mite infestations. Varroa mites die fairly rapidly above 41°C while bees can tolerate 48°C. This is the window that Beefutures uses to treat bee hives under controlled conditions. The chemical-free solution allows for regular treatments, including during the honey harvesting season. Regular treatments break the reproductive cycle of the Varroa mites, further preventing the infestation in the hive.

### Red light therapy to increase immunity to external stress

Beefutures has developed a biotech solution using deep red light to improve respiration, increase energy, reduce cell inflammation and generally increase domesticated honeybees' immunity. This solution enable domesticated honeybees to be more resilient in the face of external stressors, such as pesticides or low food availability, and therefore to continue their mission to thermoregulate their nest.[45]

## 1.2 Company contribution

### 1.2.1 SDGs contribution

These are the SDGs where Beefutures can have the greatest contribution in order of significance. It's not considered an exhaustive list of all the SDGs Beefutures contributes to.

| SDG | SDG target | Company contribution | Metric |
|---|---|---|---|
| 15 - Life on land | 15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species | Introduces a chemical-free treatment to contain bees' contamination by the varroa mite, eventually benefitting wild bees. | # honeybees treated with the varroa mites treatment (Onibi base) |
| | 15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species | Introduces solutions to increase the resiliency and immunity of domesticated honeybee populations that complement the wild bees' pollination. | # honeybees treated with Onibi Light (Onibi base with Onibi Light) |
| | 15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development | Monitors and measures the biodiversity gains from more responsible agricultural | # km2 area where biodiversity |

[45] Stabentheiner et al., 2021

| | | | |
|---|---|---|---|
| | processes, poverty reduction strategies and accounts | and urban rehabilitation practices by analyzing bee foraging activity through AI-powered insights. | monitored |
| 2 - Zero hunger | 2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality | Supports optimal management of bees to increase apiculture and agriculture productivity | # beehives deployed near agricultural lands |

Beefutures SDG contributions also map to COP15 Global Biodiversity Framework targets[46]:

- Target 6: Eliminate, minimize, reduce and or mitigate the impacts of invasive alien species on biodiversity and ecosystem services by identifying and managing pathways of the introduction of alien species, preventing the introduction and establishment of priority invasive alien species, reducing the rates of introduction and establishment of other known or potential invasive alien species by at least 50 percent, by 2030, eradicating or controlling invasive alien species especially in priority sites, such as islands .
- Target 11: Restore, maintain and enhance nature's contributions to people, including ecosystem functions and services, such as regulation of air, water, and climate, soil health, pollination and reduction of disease risk, as well as protection from natural hazards and disasters, through nature-based solutions and ecosystem-based approaches for the benefit of all people and nature.

### 1.2.2 Further company contribution

#### Keeping a complex biodiversity assessment easy and simple

For relevant stakeholders beyond beekeepers, Beefutures also provides the installation of beehives alongside their technology. The interface is also by design easy and clear, making complex data and insights accessible.

#### Where do we see more impact potential?

Beefutures plans to expand to urban beekeepers in the near-term, and can further expand their positive contribution to SDG target 15.9 working more broadly with municipalities. Their technology can provide insights towards planning for cities with more green spaces, with a clear contribution to SDG target 11.7, potentially towards climate adaptation, with a potential contribution to SDG targets 13.1 and 11.b.

[46] Convention on Biological Diversity, Dec 2022

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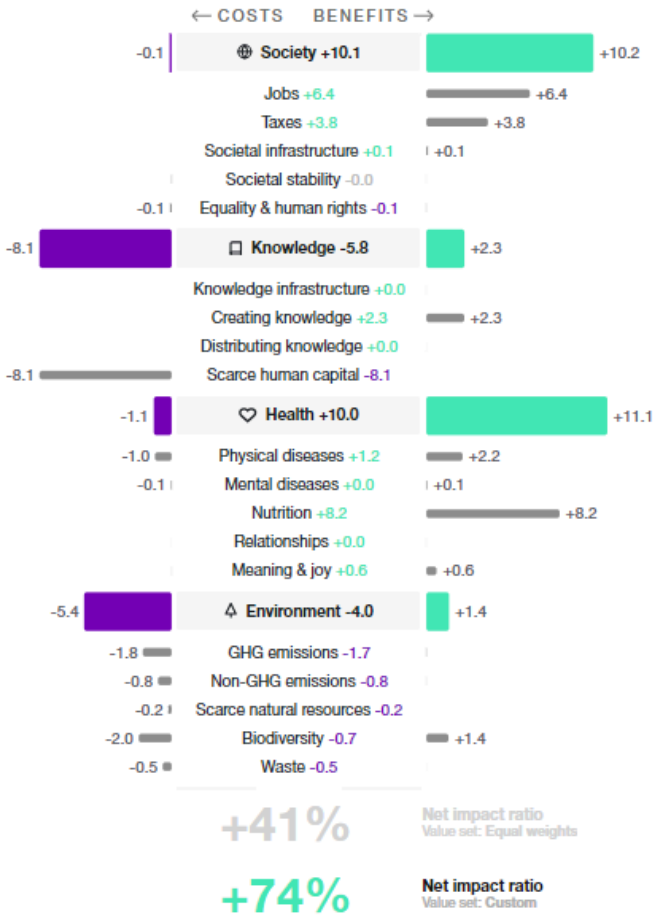
## 1.3 Net impact assessment

### 1.3.1 Company net impact assessment

The company's net impact modeling[47] as of March 8th, 2023 is illustrated below.




[47] Applying Norselab SDG-mapped value set

Key highlights from Upright's assessment include:

- Beefutures is a net positive company with major positive impacts in the health and society dimensions:
    - The technical systems and software enhance the living conditions and prevent diseases of honey bees, which increases the effectiveness of honey production. This can be seen as a positive impact on the nutrition and physical diseases categories.
    - Additionally, the software developed by Beefutures drives a positive impact on creating knowledge as it is used to monitor and analyze the behavior of the bees and their living conditions. Also, the biodiversity impact assessments carried out by the company contribute to the creation of knowledge positively.
    - What's more, Beefutures' products contribute positively to biodiversity by e.g. increasing the number of pollinators and bees, which affects the pollination of plants positively
- On the negative side, the largest resource used is scarce human capital:
    - Manufacturing and developing technical systems and software for apiaries require highly skilled and educated employees.
    - Negative environmental impacts are relatively minor, and stem from e.g. the emissions produced and waste created in the life-cycle of the products. In addition, some minor negative impact on biodiversity stems from problems related to beekeeping and its effect on the original pollinator populations.

### 1.3.2 Industry peers assessment

No peer companies modeled on Upright.

## 1.4 EU Taxonomy assessment

Beefutures might be eligible for the restoration of biodiversity and ecosystem environmental objective through the activity: conservation, including restoration, of habitats, ecosystems and species. Beefutures has the potential to enable eligibility for this activity by addressing one of the minimum requirements (6.2. The introduction of invasive alien species is prevented or their spread is managed in accordance with Regulation (EU) No 1143/2014.).

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## 1.5 Risks assessment

- **Harmful product risk: Apiculture could threaten the balance of honey bees vs. wild bees.** By enabling and enhancing apiculture, Beefutures might contribute to managed honey bees' potential negative impacts on wild pollinators and their ecosystems. The research on the topic is widely discussed from opposite angles, suggesting it is a risk but is also context-specific.

- **Drop-off risk: Varroa mites could evolve and become resistant to heat treatment.** Beefutures is currently monitoring potential resistance of Varroa mites to heat treatments with the veterinary body. There has been no evidence suggesting that this risk has materialized.

- **External risk: Access will depend on the level of digital skills and the availability and affordability of adequate digital infrastructure.** Beefutures technology relies on connectivity and data transmission through wifi between hives, and transmitted to Beefutures Cloud via 3G or 4G. In Europe, only 50% of households in rural regions have access to next generation broadband[48]. The good news is that connectivity coverage is increasing almost everywhere. By 2030, advanced connectivity infrastructure of some type is estimated to cover roughly 80 per cent of the world's rural areas. The notable exception is Africa, where only a quarter of the area will be covered[49].

- **Evidence risk: Beefutures may not always have access to the data and insights generated.** Customers can choose to carry out hand-off projects with Beefutures where Beefutures is not allowed to access the data and insights generated using their technology. These cases may not provide sufficient data to demonstrate concrete impact.

[48] European Commission, July 2019
[49] McKinsey, Oct 2020

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## 1.6 Impact potential assessment

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| Impact-generating | Beefutures has developed a one-stop solution. Product features increase bee resiliency by treating against a destructive invasive species, and increasing immunity to external stresses such as weather or pesticides. Its innovative technology domesticated also turns honey bees into biosensors to evaluate at local level how resilient their environment are in the face of climate incidents and human activities, and to evaluate how pollinators are impacted. By offering data and insights to beekeepers but also farmers, property owners, municipal and national planners and land managers, Beefutures can enable a broad range of stakeholders to assess the ecosystem health and make timely decisions to support pollinator-friendly agriculture and urban landscapes rehabilitation. | 5 |

| | | |
|---|---|---|
| Deal breaker | Substantial controversy and/or ties to controversial industries, substantial negative impact with limited opportunity to mitigate. | 1 |
| Not satisfactory | Impact thesis present alongside substantial and/or unmitigated negative impacts. | 2 |
| Neutral | Impact thesis absent or weak for the company’s products or services. Limited negative impacts and/or risk. | 3 |
| Impact-aligned | Contributing to positive change without sparking big, catalytic shifts. Setting the standard for positive SDG contribution in new or established industries or product categories. Not necessarily a novel product or solution, but at minimum best-in-class improvements to existing products and solutions. | 4 |
| Impact-generating | Potential for large-scale system impact in industries that are central to major sustainability challenges. Novel product, solution, or business model that may replace existing offerings, or that can lay the foundation for a new product category or industry. Substantial and/or differentiating contribution to the SDGs. | 5 |

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|---|---|---|
| Unknown / Not relevant | Not applicable or lack of information. | - |

**Summary of additional topics reviewed in detail as part of the impact due diligence:**

- SFDR DNSH, Good governance and Principal Adverse Impacts
- Impact outcomes reach and scale, additionality potential
- Impact risk assessment connected to the product, regulatory compliance, and operations of the company.
- Operational excellence factors

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