

Initial Research

2023-03-16

Bioextrax: Advancing the green transition

- Solutions enabling production of bio-based and biodegradable plastics
- Licencing revenue model enabling fast scalability and operating leverage
- We initiate coverage with a fair value of SEK 10.5 per share

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Stock ticker: BIOEX
Industry: Biotech
Listed on: Nasdaq First North
Latest share price (SEK): 3.72
Market cap (MSEK): 94.8
Enterprise Value (MSEK): 67.3
Total number of shares (M): 25.46
- of which free float (M): 14.64

VHCF fair value per share
DCF model SEK 10.5

Bioextrax AB

Address: Skiffervägen 76
224 78 Lund
Webpage: bioextrax.com
CEO: Edvard Hall

Main owners (13 January 2023) Capital (%)

Nordnet Pensionsförsäkring	9.3
Henrik Nilsson	8.4
Mohammad H.A. Ibrahim	7.6
Rajni Hatti Kaul	6.9
Avanza Pension	6.9

Share price history (SEK)



	-1m	-3m	-12m
Change (%)	-20.4	4.7	-85.2
52 w k range (Low/Hi) - SEK	2.19 / 33.62		

Source: Västra Hamnen Corporate Finance

Bioextrax has developed a unique process solution that enables production of the biodegradable plastic PHA. In addition, the company is offering a technology that could utilize poultry waste in a more efficient way. The licence-based revenue model in combination with attractive market opportunities constitute an exciting upside potential for investors.

Bioextrax bio-based production methods enable several application areas. One of the key benefits of Bioextrax technology is its ability to replace unsustainable plastic solutions in industries such as cosmetics and packaging. The plastic market is expected to grow significantly in the coming years with estimates indicating that it could triple between 2019 and 2060, growing from 460 to 1,321 million tons. At the same time there is a growing movement toward finding more sustainable solutions and reducing the negative consequences from plastics in our nature – increasing demand for biodegradable and carbon neutral alternatives.

We have developed a set of economic projections for the company's future earnings. In our economic scenario, we forecast revenues from Bioextrax two segments, PHA and protein from feathers. Regarding the microfiber, we include this as an optional future business segment. We have estimated licence agreements to be entered in 2024 which will lead to a significant acceleration of revenues starting in 2025 and result in positive cash flows in 2027.

Our DCF model indicates a fair value for the Bioextrax share of SEK 10.5 given our current assessment of the risks. The company needs to showcase that their technology is applicable for production in larger scales before reaching future value inflection points. The company estimates that the recently acquired facility will be able to produce a larger amount of PHA for market introduction and sample volumes. If this phase is successful, the company will have greater opportunities to accelerate the steps toward licence agreements and therefore we see potential of revising our valuation at a later stage.

Table 1: Financial Overview

MSEK	2020	2021	2022	2023e	2024e
Total revenues	0.2	1.0	2.2	2.5	3.7
Growth (%)	0.0%	351.3%	115.4%	13.3%	46.5%
EBITDA	-5.4	-10.2	-18.3	-19.7	-23.2
EBITDA margin (%)	neg	neg	neg	neg	neg
EBT	-5.6	-10.5	-18.7	-20.4	-24.0
Cash holdings	2.1	9.0	27.5	24.7	27.9
Total assets	3.0	12.6	37.9	36.2	42.9
Total equity	1.7	7.5	31.8	27.2	35.7
Solidity (%)	54.5%	59.3%	83.8%	75.1%	83.2%
P/E	neg	neg	neg	neg	neg
ROE	neg	neg	neg	neg	neg
EV/EBIT (x)	neg	neg	neg	neg	neg
EV/Sales (x)	293.1	64.9	30.2	26.6	18.2

Source: Västra Hamnen Corporate Finance

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What does Bioextrax do?

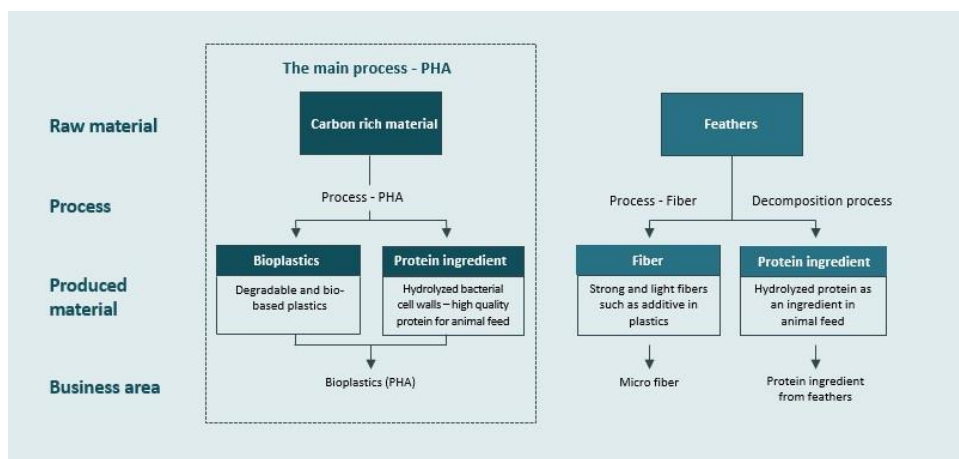
With its origin from research conducted at the Department of Biotechnology at Lund University, the industrial biotech company Bioextrax was founded in 2014. The original concept concerns a technology for production of a type of bio-based and biodegradable plastics (polyhydroxyalkanoates – "PHA"). Since then, the company has discovered additional application areas for their fermentation-based process technologies.

Process technology key to production of PHA

Bioextrax main process technology enables production of the bioplastic PHA in an environmentally friendly and cost-effective way. The company has received several development grants owing to the technology’s potential to contribute to a sustainable world. Bioextrax became listed on the Spotlight Stock Market in April 2020. On November 29, 2022, the company underwent a change of trading venue to Nasdaq First North Growth Market.

Bioextrax technologies include various types of fermentation processes, where the main production process for PHA can use carbon rich raw materials, such as sugar, organic household waste and used cooking oil, as input to produce bioplastic PHA. A unique feature of Bioextrax extraction method is that it creates a by-product in the form of hydrolyzed bacterial cell walls. This product is highly digestible, nutritious, and rich in amino acids. Thus, it can be utilized as a high-quality protein for animal feed. In addition, the company also has two other business areas: Protein from feathers and Microfibers. The various usage of Bioextrax technologies is described in the sections below.

Figure 1 – Business areas



Source: Bioextrax

PHA – The main business area

Bioplastics (PHA)

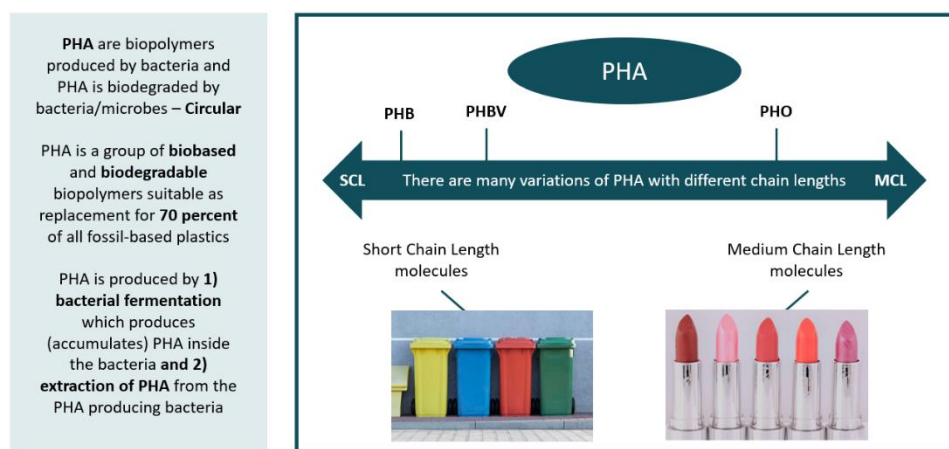
PHA (Polyhydroxyalkanoates) are a family of bioplastics produced by certain microorganisms using carbon sources. They are bio-based and biodegradable, i.e., compostable, and have physical properties similar to conventional plastics. Bioextrax main business area consists of production technologies for production of PHA by using basically any carbon rich raw material. A range of different waste/by-product streams can be used to produce PHA. Materials such as organic household waste or molasses from the sugar industry are examples of possible inputs. The process of producing PHA takes place in nature as a way for the bacteria to build carbon and energy reserves. When used in consumer applications, PHA behaves and feels like conventional plastic such as, e.g., PE, PP, and PET.

Variations of PHA depends on chain lengths

Different types of PHA

There are many different variations of PHA with different material properties. The material properties vary with the chain lengths of the PHA molecule. In general, decreasing the chain length of PHA molecules tends to make the plastic stronger, stiffer, and more durable. In general, increasing the chain length of PHA molecules tends to make them flexible and elastic. By controlling the chain length of PHA molecules during production, it is possible to tailor the material properties of PHA plastics to meet specific application requirements. Two variations of PHAs are Polyhydroxybutyrate (PHB) and polyhydroxyoctanoate (PHO). Poly(3-Hydroxybutyrate-co-3-Hydroxyvalerate), commonly known as PHBV, is a co-polymer of PHB with more elastic properties and with a lower melting point. PHB and PHBV are short chain length (SCL) molecules, while PHO is a medium chain length (MCL) molecule. Being types of PHA, both PHB and PHO are bio-based, biodegradable and biocompatible alternatives to traditional petroleum-based plastics. However, they differ in their chemical structure and properties.

Figure 2 – PHA



Source: Bioextrax

PHB – The most common type of PHA, has properties similar to the fossil-based plastic polypropylene (PP) or Polyethylene terephthalate (PET). PHB is known for its high strength and toughness, making it suitable for use in applications where harder properties are required, such as packaging material. However, these qualities can also constrain its use in other application areas where other characteristics are needed. Currently there are other PHA producers with their own methods to produce PHB and its co-polymers. However, according to Bioextrax there are no other PHB production methods resulting in the high quality and low cost that the company believe they can offer with their technology.

PHO – PHOs have a lower melting temperature compared to PHB, making it easier to process. This makes the material more flexible and allows for a wide range of properties and applications such as ingredient in cosmetics like lipsticks and skincare products. There are existing technologies for the PHO accumulation process but no methods for the extraction process on the market. Bioextrax, with its proprietary extraction technique that also

allows for extraction of PHO, thus has an opportunity to take a unique position within the bioplastic market.

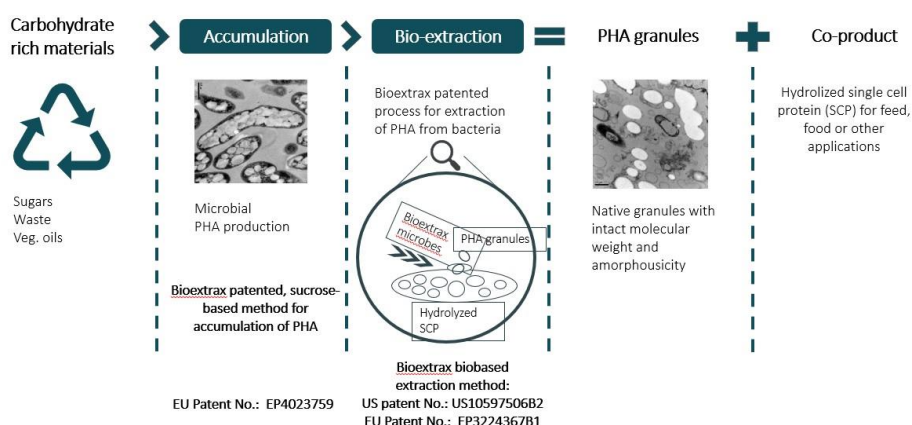
A cost-efficient process technology

How is PHA produced?

PHA is produced by bacteria through a process known as microbial fermentation. It is created intracellularly by bacteria and therefore the PHA needs to be extracted from the cells. The extraction step currently represents up to 50 percent of the total production cost of PHA and the process either requires the use of large amounts of chemicals or a combination of pressure and heat.

Bioextrax patented extraction process does not require chemicals or pressure or significant amount of energy. Instead, it uses a bacterium that, in contact with the PHA-producing bacterium, releases enzymes that break down the cell walls of the PHA-producing bacteria and thereby releases the PHA. The company's process of extracting the accumulated PHA forms the basis of the patented technology which, according to Bioextrax, enables a cost-efficient process technology with great commercialization opportunities.

Figure 3 – PHA production process



Source: Bioextrax

Patent application of sucrose-based method for accumulation of PHA

In the first stage: Accumulation, a bioreactor is filled up with a carbon rich raw material like sugar, organic household waste or used oil. The nutrient-rich environment in the bioreactor is creating conditions that promote growth of bacteria. By controlling this process and cutting off the supply of nitrogen, the bacteria eventually stop reproducing. This results in the bacteria taking the carbon atoms and begin synthesizing and polymerizing them within the cells to produce PHA. As the bacteria grow and multiply, they produce PHA granules within their cells. This stage is often referred to as the "fermentation stage." There are various technologies available for accumulation. For this process step Bioextrax has its own unique patented approach, utilizing sucrose derived from sugar beets. The differences between Bioextrax method mainly lie in the amount of sugar required per kilogram of produced PHA.

A unique method for the extraction process

In the second stage: Extraction, the PHA-containing cells are harvested, and the PHA granules are extracted from the cells. In addition to Bioextrax process, there are currently three main techniques used to extract the PHA-granules form the bacteria. (1) The cell walls are disrupted through either chemical or thermomechanical processes (or a combination thereof), (2) A solvent is used which penetrates and dissolves the granules within the cells or (3) Enzymes are using to disrupt the cells walls. The most common method today is to extract the PHA by disrupting the cell walls with a combination of chemicals, heat and pressure. Instead of this costly process, Bioextrax has a unique method which involves transferring the PHA-filled cells into another reactor and adding their own bacteria producing an enzyme that breaks down the cell wall and extracts the PHA. The extracted PHA is then purified, dried, and processed into the desired form, such as pellets or fibers which can be

used for different applications. Similar bio-based methods like Bioextrax patented technology are not currently commercially available making it a potentially game-changing solution.

Cost saving solution

The required extraction process is the main reason why PHA, with existing production methods, are two to three times more expensive than conventional fossil-based plastics. Using Bioextrax technology, PHA can be extracted in a natural, bio-based manner, resulting in a PHA granulate believed to have higher quality since the material has not been exposed to any chemicals or high heat. Bioextrax believes their own patented extraction process is significantly less expensive than other PHA extraction methods, which could give the company a clear advantage in commercializing its process technologies and provide a potential cost saving solution in the production of PHA.

In addition to PHA granules, Bioextrax process also creates hydrolyzed single cell protein (SCP) as a co-product corresponding to around 30 percent of the output. Using other methods than Bioextrax extraction method, the cell walls must be purified before use – which is not the case with Bioextrax method. Instead, this product could easily be separated from the PHA and sold. Creating a co-product that is highly digestible, nutritious and rich in amino acids. The SCP could therefore potentially serve as food or feed supplement in animal feed – an alternative to conventional protein sources.

Tons of feathers wasted every year

Protein from feathers

Existing operations to produce protein ingredients (feather meal “HFM”) from poultry feathers use large amount of chemicals and energy, therefore having a negative environmental impact. The product made from current techniques is smelly, has a low conversion rate of amino acids from feathers, and low digestibility. The lack of better process techniques results in millions of tons of feathers being wasted every year.

Bioextrax solution to this issue is a completely bio-based production method. By adding a bacterium that utilizes the feathers as an energy source, Bioextrax is able extract the protein from the feathers in less than 24 hours. The source of protein produced has shown in laboratory analyses, conducted by both Bioextrax and external parties, to have a high degree of digestibility (more than 99 percent) and a high nutritional value combined with a good appearance and smell.

HFM has previously been forbidden in most applications within the EU as feathers needed to be completely broken down to be used as animal feed. However, as of 2021, a legislation was passed which allowed poultry feathers to be used as animal feed. Thus, the market interest in utilization of feed ingredients from poultry feathers has increased significantly. By breaking down the feathers into a hydrolysed form, the product can be used as a source of protein in animal feed. Bioextrax bio-based method thus provides the market with a more environmentally friendly alternative to the current HFM products on the market.

A patent-pending method for converting feathers into microfibers

Fiber from feathers

The current commercial utilization of feathers from the poultry industry is insignificant for material applications. Current methods that companies and research institutes are testing to improve recycling of feathers are often problematic since they tend to destroy the naturally persistent fiber structures that feathers have. These methods have a significant negative environmental impact because of the high energy requirement in the manufacturing process.

Bioextrax has developed a patent-pending method for converting feathers into microfibers. Microfibers have strong keratin structures and a great potential for a variety of applications that can be applied to improve different material properties. It can for example be applied to furniture, textiles, and transportation etc. Bioextrax microbially produced microfibers are the naturally existing fibers found in feathers. These fibers are released by breaking

down the fiber-bindings using the company's bacteria. The technology was developed during 2017 and 2018, and the functionality of the microfibers is in the process of being validated for various applications.

The microfibers have properties that make them interesting for several applications. They are small, strong and have a low density while being fully biodegradable, meaning no pollutants are released onto nature. Bioextrax, together with co-working partners, has mixed the fibers with various bioplastics, which has proven to be successful. The results indicate that the elasticity of the plastic is enhanced, the tensile strength increases, and the density decreases when the microfibers are applied.

Licensing opportunities

Business model

Bioextrax strategy is to conduct research, develop, and secure intellectual property rights for manufacturing techniques of bioplastics, feather protein and microfibers. The company is offering licensing opportunities in these segments based on their technologies.

The vision of becoming a leading player in bioplastics is expected to be done through constant development of process technologies and through strategic customer agreements that ensure a long-term and commercially sustainable production of bioplastics. The company also has the ambition to enable technologies to produce hydrolysed protein from feathers. The strategy is to cooperate with leading market players to produce animal feed based on feathers from poultry. As for the microfiber segment, the goal is to offer the market an environmentally friendly alternative to the current existing fiber with noticeable properties that create materials with better properties than the ones currently available.

Bioextrax customer strategy is targeted toward material producing companies that may license Bioextrax technology. Customers may already produce similar materials and find cost and efficiency improvement by changing to, or implementing Bioextrax technology in their current operations. Customers could also be companies with own operations that have products such as waste materials like feathers or raw material supply like sugar, which can be utilized better to produce more value added products using Bioextrax technology. The producer, who is the customer of Bioextrax, owns the production facility and is responsible for its operation. Bioextrax provides intellectual property rights, advice, expertise, production of tests and evaluation of materials for the customer. Thus, the producer needs a licence agreement with Bioextrax for production and sale of materials to be able to use Bioextrax technology.

The company's revenue basis consists of a license model in which the company offers licenses for the use of the company's process technology for a certain process in a specific business area. Through a license agreement, the customer gets access to the bacteria necessary for the process. The license then includes a royalty-based remuneration that could be linked to produced volume, turnover or profit from sold materials. The company also expects to earn a minimum royalty per year or quarter, with the possibility to generate additional revenues through support, competence, and process implementation for customers. However, the terms of the agreements could be dependant on the project and Bioextrax ability to negotiate with the customers.

Customer processing depends on situation

Sales and marketing strategy

Bioextrax choice of strategy derives from the fact that the company, with small resources, can be active in several industries where each industry can involve large volumes. Customer processing from initial contact to full commercialization varies depending on customer and situation, however the process can in general be described in three steps:

(1) The first step begins with being visible to potential customers. Bioextrax is doing this by being present at public industry gatherings such as conferences and trade fairs, as well as participation in events arranged by various trade associations. The first customer contact then usually comes from inbound inquiries from companies interested in utilizing Bioextrax

technology to start production of PHA. Historically, a challenge for the company has been to select the most promising customers to make agreements with.

(2) If the chosen companies decide to move forward, an evaluation agreement extending over 6–18 months is initiated. This process begins with small-scale tests where Bioextrax produces and deliver test material for the customer, which is evaluated and analysed. Bioextrax usually gets compensated for test samples sent to customers. Bioextrax may also apply its technology to the customers' own raw material to further evaluate the material properties. Bioextrax currently has several customers that performs initial tests with the company.

(3) The third step consists of a commercialization agreement/license which is based on a royalty model, as well as the scope of the agreement. At this stage, Bioextrax seeks an advance payment that covers the initial costs such as site visits, installation, and early-stage support. A commercialization agreement ranges between 10–25 years and the time required from a signed license agreement to full industrial production capacity is expected to be 12–18 months.

Focus on projects with high commercial potential

Ongoing projects – As of 15th February 2023

Business area	Customer	Last pm	Status
PHA	Global top-3 cosmetics company	12 Aug 2022	Agreement on customer-financed development project entered. The project includes 3 phases and Bioextrax has delivered on phase 1. The project should be completed the summer 2023.
PHA	One of the world's largest candy producers	26 Jan 2023	In January 2023, the customer ordered additional and larger volumes of material after promising tests of materials that Bioextrax delivered in November 2022.
PHA	One of the world's leading sugar producers	24 Mars 2022	Cooperation agreements with six possible PHA customers entered. The first phase of the project - production of the first batch of PHA for small-scale tests is completed. Phase two, where larger volumes are to be produced for delivery to potential PHA customers, is expected to begin in September.
Protein hydrolysate from feathers	Leading European waste management company	24 Dec 2021	Bioextrax has delivered a product which is evaluated by the customer and the customer's customer, in parallel Bioextrax and customer are jointly making process cost calculations.
PHA	Leading European bioplastics producer	7 Dec 2021	Bioextrax has delivered material to the customer and visited them during the autumn when Bioextrax carried out extraction from their biomass. After positive results, Bioextrax and the customer are now planning a joint scale-up of a combined process.
PHA	Large PHA-producing sugar producer	22 Nov 2021	Bioextrax has received the PHA from the customer to be treated with the company's technology for depolymerization of PHA. Bioextrax has produced PHA which was delivered to the customer. The analysis of the PHA and the feedback from the customer has been positive.
PHA	Full Cycle Bioplastics Inc	23 Aug 2021	Commercial license agreement entered. Implementation delayed.
PHA	Konkan Specialty Polyproducts	19 Jan 2023	Memorandum of understanding is entered and negotiation regarding license agreement is ongoing.
PHA	Global top-3 chemical company	11 Feb 2021	Bioextrax has delivered sample material that has been evaluated by the customer and negotiation regarding license agreement is ongoing
PHA	Global technology company	3 Nov 2020	After a longer break, the evaluation project has resumed. Initial tests show promising results, and the partners are now doing more in-depth tests.

Source: Bioextrax year-end report 2022

Vision, ESG and UN's Global Goals

The company's vision and technology harmonize with UN's Agenda 2030 and its underlying global goals, which aim, among other things, to promote sustainable development.

- **Goal 9: Sustainable industry, innovation, and infrastructure** - Bioextrax bio-based production methods contribute to the goal by developing processes that enable more efficient use of resources and a more sustainable industrial process.
- **Goal 12: Responsible consumption and production** - Bioextrax enables sustainable technologies where the product contributes to more environmentally conscious alternatives for consumers.

Promoting agenda 2030

- **Goal 14: Oceans and marine resources** –Through Bioextrax technology enabling production of biodegradable bioplastics (PHA), another sustainable solution is offered that protects our oceans and marine species from contamination.

An experienced and strong team

Company and key personnel

At the end of the fiscal year 2022 the company had 11 full time employees and several working consultants resulting in a total of 15 co-workers. All co-workers are based at the company's office in Lund. In addition to permanent employees, the company hires a small number of consultants on a part-time basis. The five key people who are considered most important for the development of the company in the future are described in more detail below.

Edvard Hall was appointed CEO of Bioextrax in January 2023, a position he also held during the years 2017–2022. During the interim period he has been Director of Business Development. During his career, he has co-founded companies in narrative analysis, medical technology, and strategy consulting. He holds a law degree and a bachelor's degree in economics from Lund University as well as a master's degree in International Development and Humanitarian Emergencies from the London School of Economics and Political Science.

Per-Erik Velin was appointed CCO of Bioextrax in March 2022. He joined the company in early 2022 and has been the Chief Commercial Officer since the beginning of March 2022 (Velin has also held the position as acting CEO for a short period). He has over 25 years of experience in the chemical industry. Prior to his position at Bioextrax, Velin held several executive positions in companies such as Perstorp, Diab and Saint-Gobain. He holds a master's degree in chemical engineering from Lund University and an Executive MBA from EFL/School of Economics and Management at Lund University.

Klas Ingstorp was appointed COO at Bioextrax in June 2022. He has more than 25 years of experience from the process chemistry company Perstorp where he worked as factory manager for special polyol manufacturing, site manager for the entire feed additive production, head of global Perstorp Engineering groups, and responsible for EHS-Q within Global Technology. Ingstorp holds a master's degree in chemical engineering from Lund University.

Mohammad H.A. Ibrahim is the CTO and founder of Bioextrax. He has more than 20 years of experience in research of microbial production of polymers, enzymes and chemicals. Ibrahim has held several postdoctoral positions at Lund University, the University of Hawaii and Rensselaer Polytechnic Institute. Ibrahim holds a PhD in microbiology and biotechnology from the University of Münster.

Mats Persson was appointed Chairman of the board in 2022. Persson is actively working within the company and has previous experience with the industry including deputy CEO of Perstorp Group. Prior to Bioextrax, Persson worked as COO at the composite manufacturer Diab with responsibility for manufacturing and logistics. Persson holds a Master of Science in Chemical Engineering from Lund University.

Owners and financing

Spread ownership

The ownership structure in Bioextrax is spread with no single owner of more than 10 percent of the company. The formally largest owner with 9.34 percent ownership is Nordnet Pensionsförsäkring, which can be assumed to represent a large number of underlying customer accounts. Henrik Nilsson is the largest individual owner with 8.39 percent which was acquired in connection with the rights issue in October 2022 and through the acquisition of 200,000 shares from the CTO and co-founder of Bioextrax, Mohammad H.A. Ibrahim in January 2023. Mohammad H.A. Ibrahim is the second largest individual owner with 7.62 percent of shares, followed by the other co-founder Rajni Hatti Kaul with 6.88 percent of the shares. The remainder of ownership is spread among approximately 4,000 shareholders.

The company has carried out a series of issues in recent years in the form of directed issues, right issues and warrant redemptions, in total ca SEK 70 million. The most recent one was the unit issue of shares and warrants in October 2022. The unit issue was subscribed to 70 percent, of which approximately 40 percent were allocated to guarantors. In total, Bioextrax obtained approximately SEK 28 million before issue costs.

Subscription of shares from the warrants takes place in September 2023. If all warrants of series TO 2022 are fully exercised for the subscription of new shares in the company at the lowest subscription price, Bioextrax will obtain approximately SEK 15.7 million, but the amount can be significantly higher depending on the share price during the read-out period.

Despite the estimated capital injection from TO 2022, our assessment is that further injection of capital is needed before the company is expected to be cash flow positive. However, the size, timing and type of any future financing are uncertain.

Founded in 2014 by CTO Mohammad H.A. Ibrahim

History

- 2014:** Bioextrax is founded in Lund based on research by CTO Mohammad H.A. Ibrahim from Lund University. A patent application regarding extraction of PHA technology is submitted.
- 2015:** Lund University Holding invests in Bioextrax.
- 2016:** Receives funding from the Nordic Innovation Fund of 1.8 MNOK over three years for the development of the technology to convert chicken feathers into animal feed.
- 2017:** Founder Mohammad H.A. Ibrahim becomes full-time CTO in the company. Receives grants from the Sten K Johnson Foundation for the conversion of turkey feathers into animal feed.
- 2018:** Filing a patent application for the process where feathers are converted into microfibers. Receives a grant from Vinnova within the framework of the program "Innovative Start-ups." Edvard Hall is employed as CEO after working as a consultant since 2017.
- 2019:** New management team and board are assembled in preparation for trading on the stock exchange. Membership in GO! PHA. Important milestone that enables Bioextrax to accelerate its vision of contributing to a more sustainable economy. Receives a grant from Vinnova to develop bio-based textile alternatives from feathers and bioplastics.
- 2020:** Patents are granted in the EU and the USA for the bio-based method of extracting PHA from PHA-producing bacteria. Bioextrax is listed on the Spotlight Stock Market.
- 2021:** Submitting the patent application regarding a cost-effective production process for PHA with sucrose as raw material. An advisory board is established to strengthen the organization.
- 2022:** Granted patent PHA with sucrose. Change of listing venue to Nasdaq First North Growth Market.

Interesting market potential

What is the market potential?

Bioextrax bio-based production methods has several applications, which contributes to the company addressing different markets. The technology has the potential to replace parts of the currently unsustainable solutions used in markets such as cosmetics and packaging. Furthermore, this underlying growth, driven by changes in legislation and consumer behaviour, is also expected to contribute to a strong market potential in the long run.

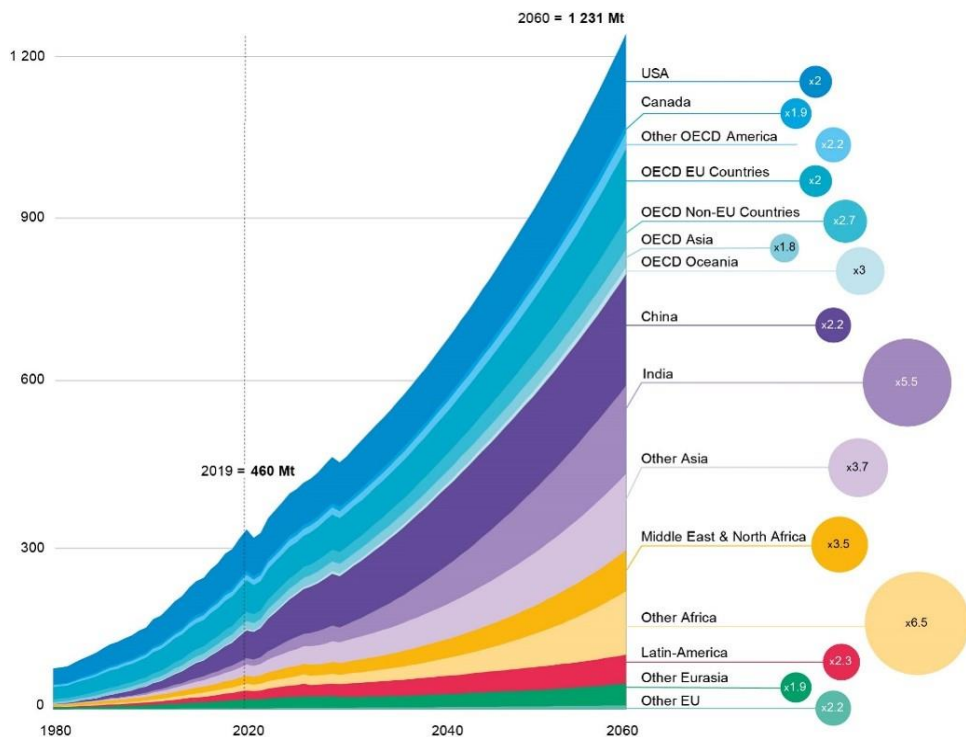
Notable is that the shift toward more sustainable materials is greatly desired and in high demand by the market. A current example can be seen in India where certain plastic straws have been banned creating further incentives for transformation. At the same time, companies are looking to replace conventional materials with biodegradable alternatives, making PHA highly sought after. This is for instance illustrated in the cosmetic industry where Unilever has committed to reduce plastics by 50 percent and L'Oréal have pledged to make bio-based packaging by 2030. This creates a demand-driven market, causing potential customers to be insensitive to the price of materials like PHA.

PHA as the biggest segment

PHA – Market Potential

The world's production and consumption of plastic is a well-known problem. Conventional plastics are not degradable, which contributes to negative consequences for the environment. In addition, the production process results in extensive CO2 emissions. While plastic is usable in many ways, we have become addicted to single-use plastic products, leading to severe environmental effects. The plastic market is growing, expected to triple between 2019 and 2060 and grow from 460 to 1,321 million tones, driven mainly by the overall growth in the world and the increased consumption of plastic in developing economies as they experience greater prosperity. For example, plastic use in India is expected to more than five-fold during the period.

Figure 4 – Growth of plastic use globally, 2019 - 2060



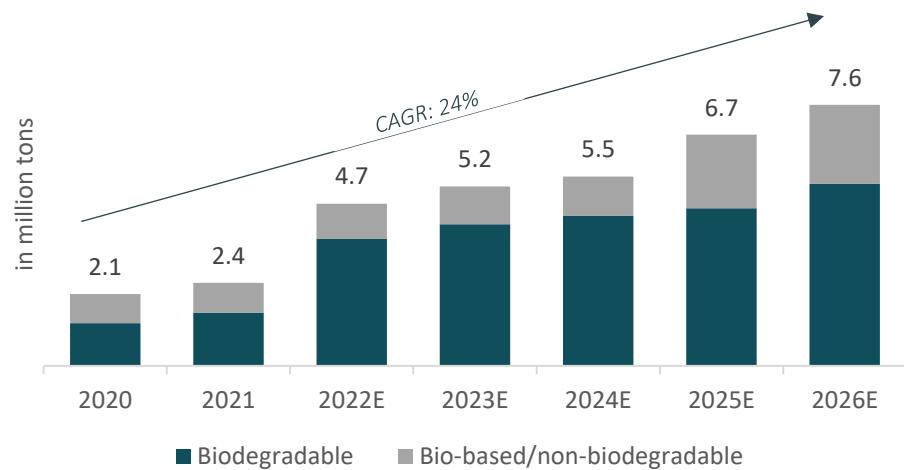
Source: Global Plastics Outlook: Policy Scenarios to 2060, OECD 2022

Biodegradable bioplastics, such as PHA, offer a potential solution to replace conventional plastics, thus creating an extensive market potential. PHAs are a very versatile group of polymers, and their properties can be tailored to numerous target applications. As mentioned earlier, the polymer type PHO has more elastic, rubber-like properties that can be compared to chewing gum. At the same time, the polymer type PHB is harder and is more comparable to traditional hard plastics such as food packaging and plastic toys. Furthermore, there are several possible application areas, where the material could be used in everything from biomedicine to ingredients in cosmetic products. According to the company itself, PHA will be able to replace other plastic types such as polypropylene (PP), polyurethane (PU), polyethylene (PE), PVC and PET – which together represent a market valued at approximately USD 330 billion per year.

Market estimated to 480,000 tons by 2026

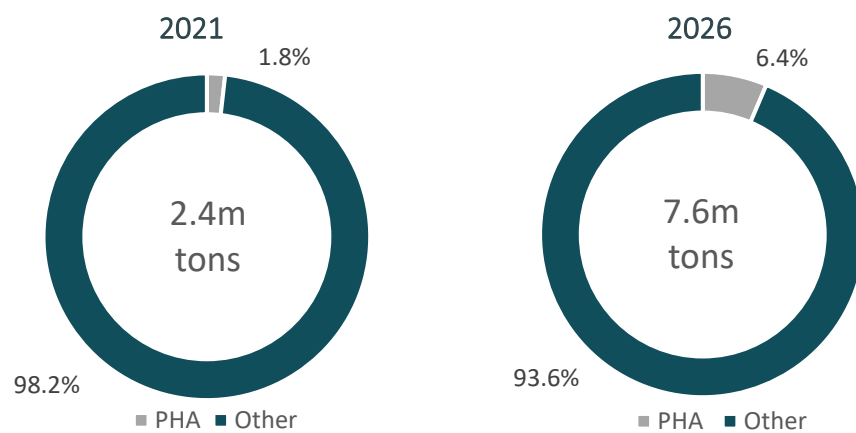
The company operates based on a technology licence-based model and has already initiated projects with international players. Considering Bioextrax potential uniqueness, within its offering and the simplicity in working with a licence-based model the global PHA market is assumed to be addressable. PHA currently represents approximately 1.8 percent of total bioplastic production, which corresponds to a market of SEK 1,100 million and a global production capacity estimated at 45,000 tons of PHA by 2021. This market is expected to grow tenfold to 480,000 tons by 2026, estimated to correspond to 6.4 percent of the total bioplastics market in 2026. Despite the predicted growth of future PHA production capacity, the demand for PHA is expected to exceed supply for long time due to the environmental transition.

Figure 5 - Global production capacities bioplastics, 2020 - 2026



Source: European Bioplastics, novo-institute (2021)

Figure 6 - Global production capacities bioplastics



Source: European Bioplastics, novo-institute (2021)

Growth trajectory of plastics is monumental

The underlying growth of the PHA market is driven by a number of megatrends. The most important among these is the move towards decarbonization of the plastic industry. It is expected that by 2050, without any major mitigation efforts, conventional plastics’ portion of fossil fuel usage would amount to >20% and represent 15% of the total amount of carbon emitted into the atmosphere. As governments are taking action to cut carbon emissions, the cost of carbon emissions is increasingly rapidly, through instruments such as energy and carbon taxation or cap and trade schemes (carbon pricing). An example is the EU’s carbon market where the price of permits went above 100 euro/ton carbon for the first time ever in February 2023. The implications of the rising cost of carbon are increasingly being felt by companies across the world, who are moving carbon reduction strategies into the core of their operations.

The only two ways a buyer or producer of plastics can decarbonize is to either source recycled plastics or turn to biobased alternatives. Recycling is facing challenges in the collection and sorting of materials. And, more importantly, plastics degrade and lose its properties after one or two uses and using recycled plastics doesn’t solve the problem of plastic pollution in the environment. This leaves biobased polymers and within this group PHAs is the only alternative that is fully biobased while also being biodegradable.

5 million tons of feathers globally

Market potential - Hydrolyzed protein from feathers

At present, approximately five million tons of feathers are produced globally, of which three million originate from industrial production. A large part of these feathers is currently thrown or transported away at a cost and then burned. In fact, feathers consist of approximately 90 percent of the protein keratin. This protein source could be utilized in a more efficient way and through extraction be used for animal feed.

In this area, there are mainly three different application areas: fish feed, feed for pets and feed for livestock such as pigs, chickens and turkeys who account for the largest potential market. According to the company, pig feed is a potential market for both the feather protein and the hydrolysed single-cell protein from the PHA production.

The market is in general driven by a growing population, where more food production is required and hence also more food for agricultural production. A report from Global Market Insights (GMI) states that the global market for animal feed is estimated to reach more than USD 280 billion by 2027 creating a big market potential.

Market potential - Microfiber

Microfiber from feathers is a non-fossil-based material that can be used as an additive to biopolymers to improve physical properties. This means that a variety of applications such as composites, insulation, packaging, and textiles, etc. can be potential markets. An ever-increasing demand for sustainable materials contributes to the expected market growth. However, which application area the company chooses to focus on is still unclear.

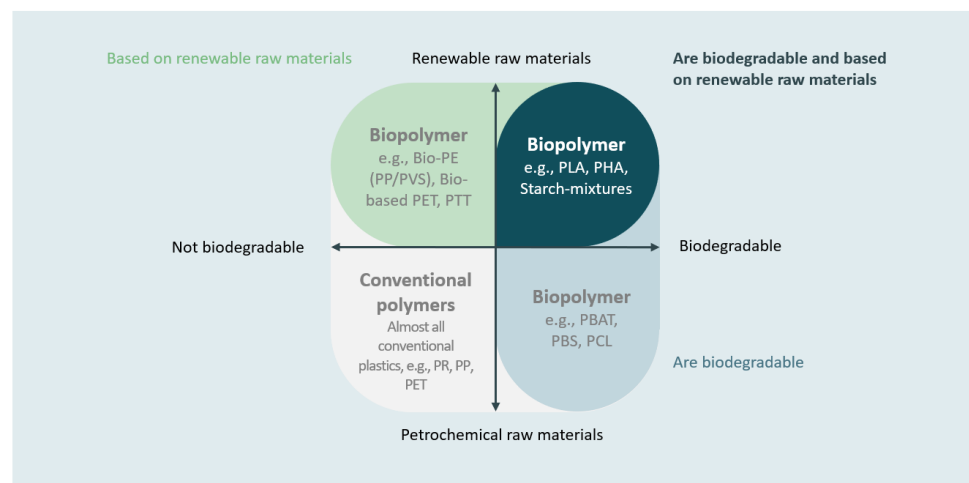
What is the competitive situation?

PHA

Within PHA, Bioextrax competes with other similar bio-based and biodegradable materials as well as other PHA extraction technologies. Other bio-based and degradable materials include, for example, PLA (Polylactide). Players in this segment are, among others, the American company Natureworks and the Dutch Total Corbion. PHA's competitive advantage is described primarily as being related to its high biodegradability. The advantage with PHA is the fact that it is biodegradable and do not release toxins when it breaks down, making it versatile. Thanks to being produced of bio-based raw materials and the ability to degrade in the natural environment, PHA is one of the most promising bioplastics. PHA can replace the following plastics: PP (polypropylene), PU (polyurethane), PET (polyethylene) and PE (polyethylene).

Competing against other materials

Figure 7 – PHA vs other plastics



Source: Bioextrax, Västra Hamnen Corporate Finance

According to the company, no other bio-based extraction techniques that are commercially available or in the development phase are known of – creating a potential competitive advantage in this area for Bioextrax.

Competing against chemically HFM**Hydrolyzed protein from feathers**

In the feather protein market, the main competing solutions are chemically HFM which is also used as a protein asset in animal feed. HFM is currently produced by several other companies such as Sonac, K-Pro, and EM-PRO EUROPE N.V. In comparison with the product HFM, the company itself emphasizes a competitive advantage when it comes to digestibility, aroma and taste. Production processes that can be mimicked in Bioextrax method for converting feathers into animal feed are, among other things, the company BRF ingredient that uses enzymatic hydrolysis, a method that, however, does not seem to be available on the market yet.

Microfiber

The many potential application areas of microfiber from feathers contribute to the company competing in microfiber directly with other mineral-based and biodegradable fiber materials such as carbon and fiberglass as well as other applications of fossil-based polymers such as polyethylene or polypropylene. Competitors in the same application area include British start-up company Aeropowder, which sells an insulating packaging material for temperature maintenance of food or pharmaceutical deliveries. However, Bioextrax has made the assessment that Aeropowder's products do not have properties like Bioextrax microfibers.

Only bio-based method for extraction of PHA**What are Bioextrax competitive advantages?**

Bioextrax business model include several unique features that are important to its competitiveness. In assessing the strength and robustness of its value proposition from an investor's point of view, we consider the following to be Bioextrax foremost competitive advantages.

Unique method. Bioextrax process is believed to be the only bio-based method available for the extraction of PHA from PHA-producing bacteria. Enzyme-based methods can be considered bio-based, but its high cost and energy consumption have contributed to the absence of commercial methods. Today, PHA producers instead use chemical or thermo-mechanical methods, which are expensive methods that have a great negative environmental impact. Bioextrax also has a more efficient accumulation technology, the advantage of which is a better conversion rate from sugar to PHA.

Unique offering. Despite existing other PHA producers, as far as Bioextrax is concerned, there are no other companies offering PHA technologies for licencing in the market today. This makes Bioextrax the only possible partner for companies who want to establish PHA production.

Unique product. As mentioned earlier, PHO and PHB are different types of PHA where PHO have more elastic material properties than PHB. The materials are produced in a similar manner but have two distinct properties. PHO have softer, more elastic properties that can be used in cosmetic products, for example. Unlike PHB, PHO is not currently available on the commercial market. Bioextrax method of extracting PHO is therefore considered unique in potentially being able to produce PHO. Initiated partnerships with companies seeking PHO also gives the company a unique position and an opportunity to have a first mover advantage in this market space.

Environmentally sustainable solution. Bioextrax process is more environmentally friendly because no chemicals or solvents are used. The process is also faster and contributes to lower energy consumption and higher efficiency, which reduces production costs. At present, there is a great need for environmentally friendly solutions where Bioextrax can have a major impact on both the plastic and food industries. These two industries have a great need for innovation as the respective environmental impact is given significantly greater attention in the public consciousness and among legislators today.

Can be used for multiple applications. Bioextrax process is universal and can work with all PHA-producing bacteria and with all PHA types. The producing PHA also has a higher molecular weight than its competitors, which contributes to the plastics being used for more applications. The process also creates a co-product in the form of hydrolysed single-celled protein that can be used as a protein ingredient for animal feed. On top of this, the PHA product is also non-toxic and can therefore be used in applications that involve direct contact with humans, for example cosmetics.

High digestibility from feather protein. The company's bio-based method can be used to convert poultry feathers into feed with a digestibility of approximately 99.7 percent according to analyses made by one of the company's customers. Digestibility is a measure of how well the body can absorb nutrients and protein from food. In general, the average with today's methods for chemical analysis is about 75 percent, which means that Bioextrax process has about 33 percent higher digestibility than current technologies on the market.

Several patents protect the processes

Intellectual property and patents

Bioextrax technologies rely on fermentation processes that utilize specific bacteria. The intellectual property (IP) associated with these processes are protected through various patents. The patents do not cover the bacteria itself; instead, they protect the usage of the bacteria in different processes.

Within PHA, the company currently hold a patent for the extraction process of bioplastic and monomers from the bioplastic using a group of bacteria. This patent cover Europe, USA and is valid until 2035.

In Q4 2022 the company announced a received final approval for the patent covering production of PHA using sucrose as raw material. According to Bioextrax, this patented process implies a significantly lower production cost. This patent was granted in November 2022 and is now in the National phase where Bioextrax is selecting the countries where it is important to have protection.

The company also has a patent-pending application for the production process of protein hydrolysates and microfibers.

New facility in place

Facility for scaling

In the spring of 2022, Bioextrax evaluated various possibilities for gaining access to increased production. Bioextrax labs already had fermenters with a capacity of 7 and 60 litres. Extra capacity would free these up for other projects as smaller fermenters are needed to multiply the bacteria before they are added to a larger volume.

In the end of November 2022, Bioextrax acquired a facility that significantly can scale up the inhouse production of different PHA-samples, feather protein and microfibers. With the new facility, the company gets fermenters with a capacity of 50, 60, 500 and 2 times 1,000 litres. Fermentation is a time-consuming process, and the facility for scaling enables optimization of the processes and delivery of volumes that are thought to be demanded due to increased interest from customers. This is a strategy for Bioextrax to increase its credibility and demonstrate the capabilities of its technology. This will help to build trust and confidence in the company's technology and give potential customers greater assurance that the technology they are considering licensing will be reliable and effective.

Up and running first half of 2023

Through its previous facility, the company was only able to produce a few kilograms that took several weeks to complete. With the new facility in place, Bioextrax will be able to produce a few tons of PHA per year of customer samples. The facility is expected to be up and running during the first half of 2023.

Market growth to grow steadily

What is the earnings outlook?

To estimate a fair value for the company and its share, we have developed a set of economic projections for the company's future earnings. In our economic scenario, we forecast revenues from Bioextrax two segments: PHA, and protein from feathers. Regarding the microfiber segment, the company is in an early stage in its dialogue with potential customers. This, in combination with an uncertainty in the target market for microfibers, results in a decision to include microfiber as an optional future business segment within our model without adding any value at this stage.

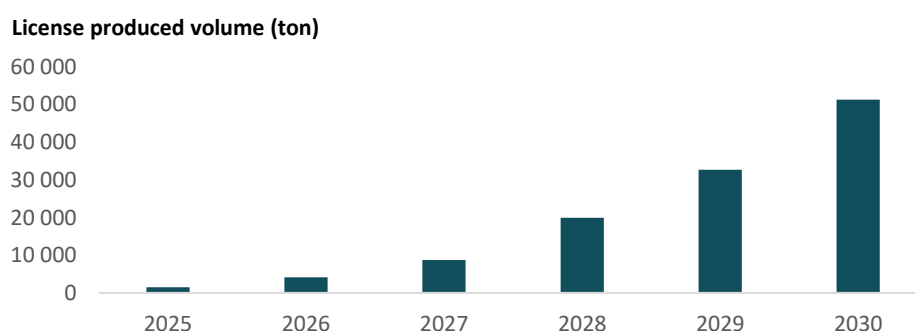
For the core operations, the PHA segment of the business, we have assumed that the market experiences a steep growth during the coming years. Starting with the global addressable market of 40,000-tons PHA by the end of 2021, which is expected to grow to approximately 500,000 tons until 2026. As we expect that at least some of the current initiated projects will result in licence agreements, we assume Bioextrax will start earning revenue from licence agreements and start to capture market share in Q2 2024. This market share is then expected to grow steadily as production increase and more agreements are initiated.

52,000 tons in license produced volume 2030

Our scenario assumes that Bioextrax process is unique in the market and that the company is successful in initiating new agreements, leading to successive increased revenue and market share. By 2030, we estimate a market share of approximately 5 percent of the target market which implies approximately 52,000 tons in license produced volume.

Owing to Bioextrax expected uniqueness in the extraction process of PHO, we believe this segment will account for a share of the revenue streams within PHA-revenues. As mentioned earlier PHO is not currently produced in commercial scale. Therefore, it is assumed to be a completely new market space where we expect higher prices of the material. Furthermore, we expect the price of PHO to be higher than that of PHB. In our model, we have based the revenue streams on an estimated weighted average licence revenue per ton for the PHA segment, which constitutes of revenues from both PHO and PHB. In the beginning of the projection period, we expect PHB (believed to have a lower price than PHO) to account for a larger share of the licence revenues. In the future, as production of PHO scales up, we expect the licence revenue per ton to increase as the weighted average price is expected to increase in relation with the volume of PHO produced.

Figure 8 – Estimated license produced volume for Bioextrax



Source: Västra Hamnen Corporate Finance

Royalties and milestones will accelerate

We have forecasted a produced volume stemming from Bioextrax license agreements. This forms the basis of the royalty revenue. As more licence agreements are established, we expect the licence produced volume to increase both by an increase in the number of licence agreements and in production volume per licence. The terms in the royalty agreement will most certainly differ depending on factors such as client, volume, and length of agreement. The revenue is then calculated by our expected weighted average market price for PHA and an estimated average royalty of ten percent of the revenue. These revenue streams from licence produced volume are also expected to be supported by milestone payments from customers to Bioextrax as conditions to scale up production are created.

0.5 percent of target market 2030 within feathers protein

Within the second segment, protein from feathers, Bioextrax is currently in contact with fewer potential partners. This, in combination with a smaller addressable market and lower potential growth in the market outlook, is resulting in this segment accounting for less revenue than PHA. We estimate that the initial total addressable market within the feather segment will be the sum of the dry weight of all collectible feathers in Europe and the US. In Q4 2022 this number amounted to 4.5 million tons. Within feather protein we anticipate the first licence agreement to start producing revenues for Bioextrax in Q3 2024. By 2030, we estimate a market share of 0.5 percent of the target market which implies approximately 20,000 tons in license produced volume. A precise percentage for the royalty is uncertain at this stage and we therefore estimate an average of ten percent of the revenue from the produced licence volume.

Table 2: Summary income statement

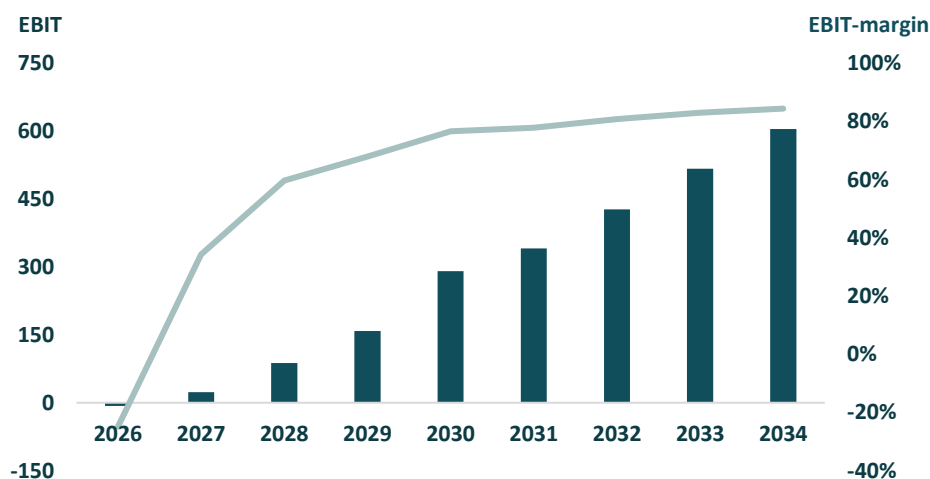
MSEK	2020	2021	2022	2023e	2024e	2025e	2026e	2027e
Net revenues	0.0	0.3	0.4	1.0	2.1	10.1	27.2	66.8
Total revenues	0.2	1.0	2.2	2.5	3.7	11.7	28.9	68.6
COGS	-0.8	-1.0	-1.3	-3.5	-4.4	-4.5	-4.7	-5.3
Operating expenses	-4.9	-10.2	-19.1	-18.7	-22.5	-26.7	-30.0	-37.9
EBITDA	-5.4	-10.2	-18.3	-19.7	-23.2	-19.5	-5.8	25.4
Amortisation & Depreciation	-0.2	-0.3	-0.5	-0.8	-0.8	-1.0	-1.4	-1.9
EBIT	-5.6	-10.5	-18.7	-20.4	-24.0	-20.5	-7.2	23.5
Net financials	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0
EBT	-5.6	-10.5	-18.7	-20.4	-24.0	-20.5	-7.2	23.5
Taxes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net profit	-5.6	-10.5	-18.7	-20.4	-24.0	-20.5	-7.2	23.5

Source: Västra Hamnen Corporate Finance

EBIT positive by Q1 2027

Considering Bioextrax business model is based on licence agreements, we expect the Cost Of Goods Sold (COGS) to represent inhouse production of test materials to evaluate product qualities and the distribution of samples to customers. Once licence agreements are initiated, these costs are not expected to grow in par with revenues. Similarly, we expect the operating expenses to remain relatively fixed whilst scaling revenue. We therefore anticipate operating leverage and successively increasing margins. The company is expected to be EBIT positive by Q1 2027 and then reach an EBIT margin of 77 percent by Q1 2030.

Figure 9 – Annual EBIT and EBIT-margins



Source: Västra Hamnen Corporate Finance

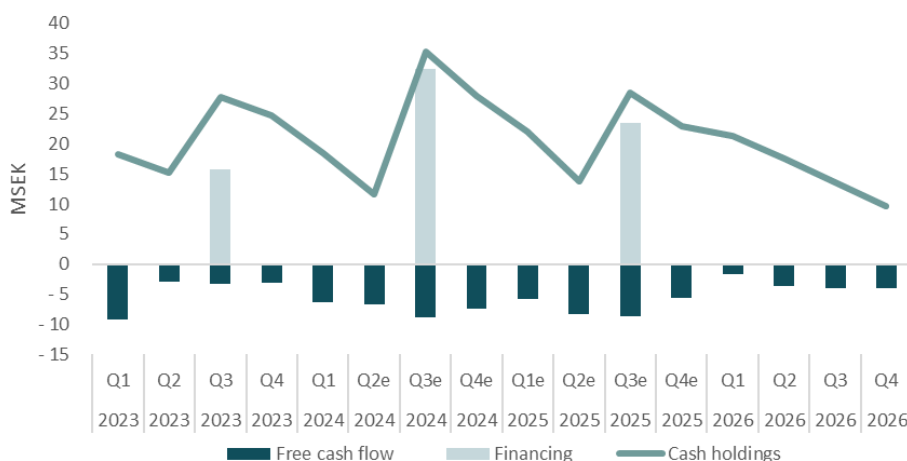
SEK 27.5 million in cash balance

What is the cash situation?

At the end of Q4 2022, Bioextrax had a cash balance of SEK 27.5 million. In Q4, the company carried out a rights issue of SEK 28 million before deduction of issue costs. In connection with the rights issue in Q4 2022, the company also issued warrants. Subscription of shares from the warrants takes place between September 1 - September 14, 2023. The subscrip-

tion price of warrants series TO 2022 amounts to 70 percent of the volume-weighted average price of the company's share during the period from and including August 16 - August 29, 2023, but not less than SEK 2.80. If all warrants of series TO 2022 are fully exercised for the subscription of new shares in the company at the lowest subscription price, Bioextrax will receive approximately SEK 15.7 million, but the amount can be significantly higher depending on the share price during the read-out period.

Figure 10 – Cash flow and cash holdings



Source: Västra Hamnen Corporate Finance

Positive cash flow in 2027

We assume that the warrants will be exercised in Q3 2023 at the lowest subscription price, and according to our model, it will take until mid-2027 before the company can present its first quarter with positive cash flow. Until then, we estimate a capital requirement of SEK 35 million by the end of Q2 2024 and SEK 25 million by the end of Q2 2025. These are only our estimates of the timing and capital needed, and it should be noted that the size, timing, and type of financing are uncertain. Historically, the free cash flow of the company has tended to fluctuate between quarters due to various factors that impact revenues and expenses. However, based on our analysis, we anticipate that the company's free cash flow will gradually stabilize over time until it becomes cash flow positive.

A two-step DCF valuation

What is fair value for the share?

We apply two techniques to estimate a fair value for the company. The first is a discounted cash flow (DCF) model based on the economic scenario described above and the second is a peer valuation.

Our DCF calculation comprises two steps (see details in the appendix). In the first step, we estimate the fair enterprise value assuming our estimated projections. In the second, we multiply this enterprise value with a risk coefficient, reflecting the probability of it reaching our forecasted case. This method is recommended for young companies on the way to their first year of sustainable profits - making it applicable for Bioextrax. A large number of businesses find it difficult to get through the growth stage into a scenario where they make profit every year. Since our scenario does not expect Bioextrax to reach sustainable profitability within the near future, we multiply the company value by a factor that represents the probability of our future scenario. The factor can vary over time and the closer the company gets to stable positive profits, the higher we set this multiplier. Given Bioextrax position today, we assign a 30 percent probability that our case will occur. The 30 percent will therefore be **our risk coefficient**.

We apply a WACC of 14 percent

Since the risk coefficient adjust for the risk of non-survival, we can apply a lower discount rate than would otherwise be the case. We have chosen to discount future cash flows by a weighted average cost of capital (WACC) rate of 14 percent. Arguments in favour of a lower

WACC could be that the company has a technological edge over competitors, that it has little dependence on suppliers and that it has secured projects with bigger customers. On the other hand, we must consider that the company is still small and that it will take time until the company is financially self-sufficient. This means high dependence on key personnel and potentially a financing risk, which we in turn believe justifies a higher required rate of return. We think a WACC of 14 percent balances risks and strengths and leaves room for future valuation upgrades as the company demonstrates increasing robustness to the risk factors.

The net present value of cash flows during the model's explicit period sums up to SEK 878.7 million. To this we add a discounted terminal value of all cash flows from terminal year onward, assuming a growth rate of 2 percent in perpetuity. Together this sums up to a fair enterprise value of SEK 995.8 million before adjusting for risk. As mentioned, we regard 30 percent to be a reasonable probability for Bioextrax to reach our forecasted case of sustainable profits. After the risk adjustment of 30 percent, our estimated fair enterprise value becomes SEK 298.8 million.

DCF model indicates SEK 10.5 per share

To go from enterprise value to market capitalisation we add the company's cash holdings and subtract all interest-bearing debt. This leaves us with a fair market valuation of the equity at SEK 326.3. **This is equivalent to an estimated fair value per share of SEK 10.5.**

Table 3: DCF model assumptions

MSEK	2023e	2024e	2025e	2026e	2027e	2028e	2029e	2030e
Total revenues	2.5	3.7	11.7	28.9	68.6	146.6	232.9	379.9
EBIT	-20.4	-24.0	-20.5	-7.2	23.5	87.5	158.2	290.8
EBIT margin	Neg.	Neg.	Neg.	Neg.	34.3%	59.7%	67.9%	76.6%
Adj. Taxes	0.0	0.0	0.0	0.0	0.0	0.0	-29.9	-59.9
NOPLAT (= EBIT - tax)	-20.4	-24.0	-20.5	-7.2	23.5	87.5	128.2	230.9
Depreciation	0.8	0.8	1.0	1.4	1.9	2.5	3.3	4.0
Capex + Working cap	1.1	-6.1	-8.9	-7.5	-11.4	-14.0	-10.4	-29.0
Net cash flow	-18.6	-29.3	-28.5	-13.3	14.0	76.0	121.1	205.9

DCF (MSEK)	
WACC	14%
Enterprise value (EV)	995.8
Prob of profitability	30%
Risk adjusted EV	298.8
Warrants	0.0
Net cash (= cash - debt)	27.5
Fair value market cap	326.3
Diluted no of shares (M)	31.09
Fair value/share (SEK)	10.50

Sensitivity analysis (value per share, SEK)

		Prob of profitability			
		20%	30%	40%	50%
WACC	16%	6.00	8.50	11.10	13.60
	15%	6.60	9.40	12.30	15.10
	14%	7.30	10.50	13.70	16.90
	13%	8.10	11.80	15.40	19.00
	12%	9.10	13.30	17.40	21.50

Source: Västra Hamnen Corporate Finance

Peer valuation as a complement to DCF

In addition to our DCF-model, we have also conducted a peer valuation, meaning a valuation based on what values the market assigns to comparable companies. The comparison with the peer group serves as a complement to our DCF valuation. As we estimate that the company will achieve profitability in the future, we have compared Bioextrax with a peer group based on our estimated net profit and EBIT for Bioextrax 2027.

Even though the companies in our peer group operate in different industries, they have a similar business model as Bioextrax. This helps to ensure that the valuation is benchmarked against companies with similar business characteristics. The companies in our peer group have: recurring revenues, indicating a stable and predictable source of income; high EBIT margins, due to scalability; and an established and growing market position, attributable to a unique product or patent. These are all, each on their own, desirable characteristics of companies that entails higher earnings multiples in the stock market. Given these characteristics, we believe that the peer group below, despite being software companies, can give an indication of what multiples Bioextrax could trade at in 2028.

Table 4: Peer analysis		Net profit		Enterprise					
MSEK	Market cap	LTM 12M	P/E	value (EV)	LTM EBIT	LTM Sales	EV/EBIT	EBIT %	
Bioextrax	94.8	(18.7)	neg	67.3	(18.3)	0.4	neg	neg	
Fortnox	37 951.0	347.0	109.4x	37 879.0	464.0	1 276.0	83.8x	36.4%	
HMS Netw orks	18 203.0	508.0	35.8x	18 503.0	653.0	2 506.0	29.1x	26.1%	
Vitec Softw are	18 567.0	245.0	75.8x	19 483.0	356.0	1 978.0	55.7x	18.0%	
Formpipe Softw are	1 350.0	8.8	153.4x	1 389.0	15.7	485.0	88.0x	3.2%	
Upsales	1 145.0	22.5	50.9x	1 081.0	28.5	130.0	38.4x	22.0%	
Lime Technologies	3 334.0	67.8	49.2x	3 522.0	91.0	490.0	40.6x	18.6%	
Average			79.1x				55.9x		
Bioextrax 2027e		23.5			25.4	66.8		34.3%	
Fair value per share, SEK			9.80				7.70		

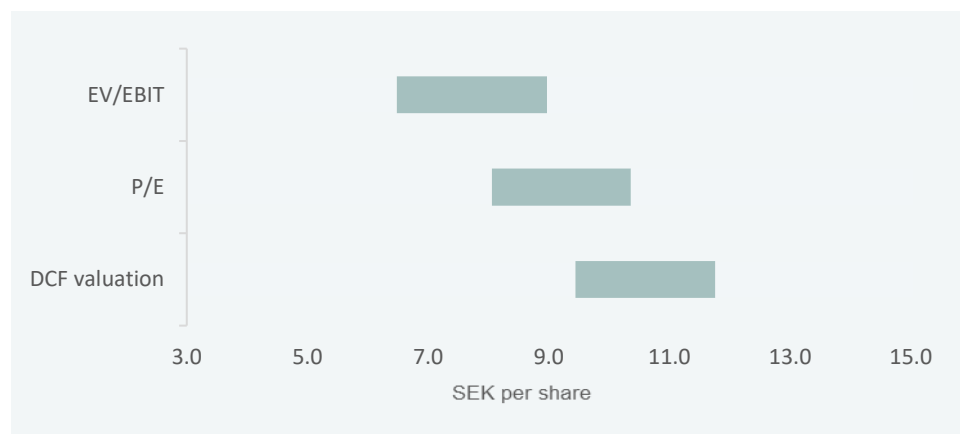
Source: Västra Hamnen Corporate Finance

Peer valuation points to SEK 9.8 and SEK 7.7 per share

We have investigated how companies with similar business models are valued in relation to their earnings and EBIT. We have taken the average P/E and EV/EBIT multiples of the peer group and applied them to Bioextrax estimated profits for 2027. The implied market value for Bioextrax is discounted back to present value. Finally, we have applied our chosen risk coefficient of 30 percent as in the DCF model to get the risk adjusted present value of the market cap/enterprise value. In summary, the peer analysis suggests a fair value of SEK 9.8 per share using the average P/E multiple of 79.1x, while the average EV/EBIT multiple of 55.9x implies a fair value of SEK 7.7 per share.

In figure 11 below, we present the various implied values per share using a wider range of assumptions in addition to our estimates. The DCF valuation range below is based on a WACC of 13–15 percent resulting in an implied value of SEK 9.4–11.8 per share. The P/E peer valuation range is based on P/E multiples of 70x–90x resulting in an implied value per share of SEK 8.1–10.4. The estimated range for EV/EBIT is based on EV/EBIT multiples of 50x–70x resulting in an implied value of SEK 6.5–9.0 per share.

Figure 11 – Football field DCF valuation, P/E and EV/EBIT



Source: Västra Hamnen Corporate Finance

What is behind the numbers?

Potential dilution

In our research we try to look beyond the reported numbers to see if the company uses accounting methods or reports items off the income statement or balance sheet, that could impact our interpretation of its official figures. The underlying economics of the company could be stronger or weaker than they look at first glance and this could be important for our valuation. In the case of Bioextrax, the reporting is straightforward and transparent, with few notable items off the published accounts that may affect valuation.

TO 2022 is in-the-money

An important factor to pay attention to is the potential dilution resulting from the outstanding warrants followed by the rights issue made in Q4 2022. If all warrants of series TO 2022 are fully exercised for subscription of new shares in the company, the number of shares will increase by an additional 5,623,516 to a total of 35,303,197 shares. This corresponds to a dilution effect from the warrants of an additional 15.9 percent. As the warrants

at the time of writing this analysis are in-the-money, we have chosen to assume that all warrants will be redeemed and thus our justified value per share is calculated based on the number of shares, which includes full dilution upon redemption of the warrants.

The company also has a latent off-balance sheet asset in the form of accumulated tax losses. This deficit can be used to offset future profits and thus reduce the tax cost. At the end of 2022, we estimate that the saved losses amount to approximately SEK 46 million and we have thus not modelled any tax costs until the company has used its latent tax asset in its entirety. We estimate that the company will not be subjected to pay any taxes until 2029.

What could go wrong?

We have identified a handful of risks that are crucial to the company success or failure. And it is our belief that they require special attention.

Successfully scaling up the production process

Scaling up production

The company's acquisition of a larger production facility is aimed at facilitating the demonstration of its production technologies on a larger scale. However, there is no assurance that the technology will function in the same way at a larger scale. This uncertainty raises concerns about whether the same material properties and production efficiency can be achieved. Successfully scaling up the production process is therefore critical to the company's business case and to its ability to pursue potential future customers.

Success is dependent on others

The company currently has primarily dialogue and a number of ongoing collaboration projects with various companies. Despite this, there are currently no established agreements that generates license revenue for the company. There is therefore a high degree of uncertainty as to whether the company's ongoing collaboration projects will result in license agreements and thus be able to generate greater revenue streams for the company.

Competitors ability to adapt better to the market

Market competition

The company's success depends partly on the development of competing products and technologies. Future competing technologies from major players such as DuPont, BP, Exxon Chemical and Resinex could be expected in the future. These competitors have a global presence and currently have large market shares in the plastic market. Even though Bioextrax has a patented technology, there is a risk that well-funded competitors have a better ability to adapt to the market and develop new products that can also meet the market's needs.

Patents and intellectual property

The company's operations are dependent on patents and technology areas protected by patents. There are no guarantees that current or future patents will receive sufficient commercial protection against competitors. It also cannot be guaranteed that patents will result in a competitive advantage or that competitors will not be able to circumvent Bioextrax patents. A large part of the value lies in the company's technological uniqueness, this also constitutes a large part of the company's future success.

Financial risk

There is a risk that Bioextrax may not achieve sufficient revenue or positive cash flow in the near future to finance its operations. A shortage of capital may limit the company's ability to expand and maintain its market position or competitiveness of its product offering. The company will likely need to seek additional external financing before reaching a positive cash flow. The financing method could come from third parties or existing shareholders through public or private financing options. We have taken this into consideration in our model, however, the timing, magnitude and type of financing is highly uncertain at this stage, and this is only our best estimate.

What should we look for?

Upcoming events

Looking forward, there are certain milestones that we would consider important for validating the company and its method. Firstly, the company needs to showcase that their technology is applicable for production in larger scales. The company estimates that the recently acquired facility will be able for demonstration, market introduction and sample volumes. If this step turns out to be successful, the company will have greater opportunities to accelerate the steps toward licence agreements.

Projects are moving toward a decision

Secondly, considering Bioextrax has several projects running today, some of which are in early phases, it is prudent to assume that some projects will not turn into a license agreement. However, several evaluation projects with major players are moving toward a decision. The company's belief is that some of these will show proof of concept and that they will start to generate revenue streams for Bioextrax.

Financial calendar

5 May 2023	Annual report 2022
12 May 2023	Q1 report 2023
25 May 2023	Annual general meeting
15 Aug 2023	Q2 report 2023
17 Nov 2023	Q3 report 2023

Appendix: Valuation method

Companies in an early stage usually report negative net profits and may have many years left until they turn a profit. Sometimes they even have years until their first significant sales revenues. The difficulty in valuing growth companies with limited historical records is that the valuation rests on uncertain estimates of future earnings, more uncertain than for companies with years of stable profits on record. There is little in terms of historical figures on which to base estimates of future revenues, future profit margins and other items.

To handle these challenges, we choose to follow a generally accepted method for valuing growth companies described by finance professor Aswath Damodaran¹⁾ among others. Instead of scaling the discount rate (WACC) to account for all the risks and uncertainties associated with a young company, we use a two-stage valuation approach:

- First, we estimate fair enterprise value under the explicit assumption that the company survives until its first year of sustainable profits. We use a WACC commensurate with the circumstances of the company once it reaches profitability.
- Second, we adjust the estimated enterprise value by multiplying with a probability factor reflecting the likelihood that the company survives.

With each passing period after the initial valuation, the probability factor may be adjusted based on the company's development and our updated assessment of its chances of survival.

1) **Damodaran, Aswath**, "Valuing Young, Start-up and Growth Companies: Estimation Issues and Valuation Challenges", Stern School of Business, New York University, May 2009.

Income Statement - Annual Data

kSEK	2020	2021	2022	2023e	2024e	2025e	2026e	2027e
Net revenues	22	276	394	1 020	2 134	10 063	27 180	66 793
Other revenues	208	760	1 837	1 509	1 571	1 634	1 701	1 770
Total revenues	230	1 036	2 232	2 529	3 705	11 698	28 880	68 563
Cost of goods sold	-757	-1 033	-1 344	-3 480	-4 362	-4 534	-4 679	-5 315
Personnel costs	-3 548	-6 792	-10 028	-11 802	-14 081	-16 382	-18 091	-22 621
Other external costs	-1 290	-3 395	-9 230	-6 538	-7 997	-9 533	-10 781	-13 801
Other operating expenses	-30	-3	115	-367	-442	-777	-1 155	-1 457
EBITDA	-5 396	-10 188	-18 255	-19 657	-23 177	-19 529	-5 826	25 370
Amortisation & depreciation	-172	-350	-476	-751	-800	-989	-1 353	-1 874
EBIT	-5 568	-10 537	-18 732	-20 408	-23 977	-20 518	-7 178	23 496
Financials, net	-3	-3	-1	0	0	0	0	0
EBT	-5 571	-10 541	-18 732	-20 408	-23 977	-20 518	-7 178	23 496
Taxes	0	0	0	0	0	0	0	0
Net profit	-5 571	-10 541	-18 732	-20 408	-23 977	-20 518	-7 178	23 496
Earnings per share (SEK)	-1.84	-1.78	-1.07	-0.73	-0.70	-0.47	-0.15	0.49
Growth (%)								
Net revenues	na	351.3%	115.4%	13.3%	46.5%	215.7%	146.9%	137.4%
EBITDA	na	na	na	na	na	na	na	na
EBIT	na	na	na	na	na	na	na	na
Net profit	na	na	na	na	na	na	na	na
% of revenues (%)								
EBITDA margin	neg	neg	neg	neg	neg	neg	neg	37.0%
EBIT margin	neg	neg	neg	neg	neg	neg	neg	34.3%
EBT margin	neg	neg	neg	neg	neg	neg	neg	34.3%
Profit margin	neg	neg	neg	neg	neg	neg	neg	34.3%
Personnel costs	16293.4%	2463.0%	2542.1%	1157.1%	659.8%	162.8%	66.6%	33.9%
Total OPEX	22357.3%	3695.5%	4852.7%	1834.0%	1055.2%	265.2%	110.5%	56.7%
Profitability (%)								
ROE	neg	neg	neg	neg	neg	neg	neg	42.7%
ROIC	neg	neg	neg	neg	neg	neg	neg	0.0%

Source: Västra Hamnen Corporate Finance

Balance Sheet - Annual Data

kSEK	2020	2021	2022	2023e	2024e	2025e	2026e	2027e
Inventories	0	0	0	0	0	0	0	0
Receivables	0	119	33	316	382	1 283	2 669	7 416
Other short-term receivables	165	578	1 176	1 680	3 832	9 369	9 741	10 964
Prepaid costs & accrued inc	220	1 744	1 656	1 874	1 988	2 087	2 189	2 295
Cash and cash equivalents	2 052	8 977	27 532	24 728	27 902	22 936	9 600	23 606
Total current assets	2 437	11 418	30 397	28 598	34 103	35 675	24 199	44 282
Tangible assets	597	1 223	7 487	7 536	8 737	11 748	16 395	22 521
Intangible assets	0	0	0	0	0	0	0	0
Financial assets	0	0	33	33	33	33	33	33
Total fixed assets	597	1 223	7 520	7 569	8 770	11 781	16 428	22 554
Total assets	3 034	12 641	37 917	36 167	42 873	47 456	40 627	66 836
Accounts payable	153	2 222	3 558	1 973	1 575	1 925	2 002	2 596
Accrued cost & prepaid incor	651	2 606	1 986	6 575	5 249	6 417	6 672	8 652
Other short term liabilities	546	251	477	395	315	385	400	519
Short term tax liabilities	30	63	129	66	52	64	67	87
Total current liabilities	1 380	5 142	6 150	9 008	7 191	8 791	9 141	11 853
Long term liabilities	0	0	0	0	0	0	0	0
Total equity	1 654	7 499	31 767	27 159	35 682	38 665	31 487	54 982
Total equity and liabilities	3 034	12 641	37 917	36 167	42 873	47 456	40 627	66 836

Source: Västra Hamnen Corporate Finance

Cash flow statement

kSEK	2020	2021	2022	2023e	2024e	2025e	2026e	2027e
Operating activities	-5 399	-10 182	-18 191	-19 657	-23 177	-19 529	-5 826	25 370
Changes in working capital	1 226	1 706	584	1 854	-4 149	-4 938	-1 510	-3 363
Investing activities	-151	-975	-6 774	-800	-2 000	-4 000	-6 000	-8 000
Financing activities	5 791	16 377	42 935	15 800	32 500	23 500	0	0
Cash flow for the period	1 467	6 926	18 555	-2 804	3 174	-4 967	-13 336	14 006
Beginning cash balance	585	2 052	8 978	27 532	24 729	27 903	22 936	9 601
Ending cash balance	2 052	8 978	27 532	24 729	27 903	22 936	9 601	23 607

Source: Västra Hamnen Corporate Finance

Income Statement - Quarterly Data

kSEK	Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023e	Q2 2023e	Q3 2023e	Q4 2023e
Net revenues	122	120	120	32	300	240	240	240
Other revenues	292	382	368	795	372	375	379	383
Total revenues	415	502	488	827	672	615	619	623
Cost of goods sold	-135	-307	-344	-558	-600	-720	-960	-1 200
Personnel costs	-1 967	-3 029	-2 199	-2 833	-2 827	-2 898	-2 971	-3 105
Other external costs	-992	-2 600	-2 410	-3 229	-1 551	-1 600	-1 651	-1 736
Other operating expenses	0	-10	-6	131	-88	-90	-92	-97
EBITDA	-2 679	-5 443	-4 472	-5 662	-4 394	-4 693	-5 055	-5 515
Amortisation & depreciation	-100	-117	-128	-131	-187	-187	-188	-188
EBIT	-2 779	-5 560	-4 599	-5 793	-4 581	-4 880	-5 243	-5 703
Financials, net	-0	-0	0	0	0	0	0	0
EBT	-2 779	-5 561	-4 599	-5 793	-4 581	-4 880	-5 243	-5 703
Taxes	0	0	0	0	0	0	0	0
Net profit	-2 779	-5 561	-4 599	-5 793	-4 581	-4 880	-5 243	-5 703
Earnings per share (SEK)	-0.19	-0.36	-0.29	-0.23	-0.18	-0.19	-0.17	-0.19
Y-o-Y Growth (%)								
Net revenues	206.2%	na	129.3%	-82.6%	144.9%	100.0%	100.0%	650.0%
EBITDA	na	na	na	na	na	na	na	na
EBIT	na	na	na	na	na	na	na	na
Net profit	na	na	na	na	na	na	na	na
% of revenues (%)								
EBITDA margin	neg	neg	neg	neg	neg	neg	neg	neg
EBIT margin	neg	neg	neg	neg	neg	neg	neg	neg
EBT margin	neg	neg	neg	neg	neg	neg	neg	neg
Profit margin	neg	neg	neg	neg	neg	neg	neg	neg
Personnel costs	474.3%	602.9%	451.1%	342.6%	420.9%	470.9%	479.8%	498.5%
Total OPEX	713.5%	1122.3%	946.7%	717.2%	664.8%	745.5%	761.3%	792.7%
Profitability (%)								
ROE	neg	neg	neg	neg	neg	neg	neg	neg
ROIC	neg	neg	neg	neg	neg	neg	neg	neg

Source: Västra Hamnen Corporate Finance

Balance Sheet - Quarterly Data

kSEK	Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023e	Q2 2023e	Q3 2023e	Q4 2023e
Inventories	0	0	0	0	0	0	0	0
Receivables	163	285	285	33	592	473	473	316
Other short-term receivables	1 637	7 361	3 539	1 176	3 000	2 160	1 920	1 680
Accrued cost & prepaid incor	1 768	1 871	1 918	1 656	1 858	1 881	1 883	1 874
Cash and cash equivalents	2 960	12 760	11 582	27 532	18 247	15 256	27 814	24 728
Total current assets	6 528	22 277	17 325	30 397	23 697	19 770	32 091	28 598
Tangible assets	1 311	1 707	1 621	7 487	7 500	7 512	7 525	7 536
Fiacial assets	33	33	33	33	33	33	33	33
Intangible assets	0	0	0	0	0	0	0	0
Total fixed assets	1 344	1 740	1 654	7 520	7 533	7 545	7 558	7 569
Total assets	7 872	24 017	18 979	37 917	31 229	27 316	39 648	36 167
Accounts payable	261	939	573	3 558	526	789	1 157	1 973
Other short term liabilities	270	814	338	477	197	237	316	395
Short term tax liabilities	37	30	22	129	33	39	53	66
Accrued cost & prepaid incor	2 584	2 388	2 800	1 986	3 288	3 945	5 260	6 575
Total current liabilities	3 153	4 171	3 733	6 150	4 044	5 010	6 786	9 008
Long term liabilities	0	0	0	0	0	0	0	0
Total equity	4 719	19 846	15 246	31 767	27 186	22 305	32 862	27 159
Total equity and liabilities	7 872	24 017	18 979	37 917	31 229	27 316	39 648	36 167

Source: Västra Hamnen Corporate Finance

Cash flow statement

kSEK	Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023e	Q2 2023e	Q3 2023e	Q4 2023e
Operating activities	-2 679	-5 378	-4 472	-5 662	-4 394	-4 693	-5 055	-5 515
Changes in working capital	-3 116	-4 931	3 336	5 295	-4 691	1 902	2 013	2 629
Investing activities	-222	-513	-42	-5 997	-200	-200	-200	-200
Financing activities	0	20 622	0	22 313	0	0	15 800	0
Cash flow for the period	-6 017	9 800	-1 177	15 949	-9 285	-2 991	12 558	-3 086
Beginning cash balance	8 977	2 960	12 760	11 582	27 532	18 247	15 256	27 814
Ending cash balance	2 960	12 760	11 582	27 532	18 247	15 256	27 814	24 728

Source: Västra Hamnen Corporate Finance

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