TÉCNICO LISBOA

Business Plan for FutureSiSens

"Development of a new Home Sleep Test (HST) device for the diagnosis of the Sleep Apnoea-Hypopnoea Syndrome (SAHS)"

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“Success is not the victory, it’s everything you’ve fought to win”

Rafael Nadal

Acknowledgments

With this project, I take the last step in finishing my engineering studies. After six years of hard work, with four years for my energy engineering bachelor at UPC, Barcelona, and two more for the InnoEnergy Master RENE Programme at UPC and IST, Lisbon, I can just feel proud and satisfied of the great experience and opportunity to learn things I was passionate about since I was young.

I always learned and tried different aspects during my career and had the opportunity to do a course in ESADE, Barcelona, for 6 months in which I learned how to create and develop a start up. Writing this thesis, which has big importance in the business area, was a real challenge for me even knowing I was not an expert on that subject or had the proper studies for doing it. However, I took this thesis as a challenge that made me see and learn new important knowledge for my future objectives. Therefore, and thanks to all the support of the people that helped me during all these hard months I can say now, after finishing my thesis, that I am satisfied with the work done and feel grateful for their support.

Moreover, I want to thank all the team of FutureSiSens in allowing and giving me the responsibility to create their business plan. In fact, they gave all the responsibility to a student that came form the energy engineering background and had little experience with the business plan development; I am sure that that was not an easy decision. During all the months working with them, I felt at home and they listened to my recommendations according to my findings. In the end, I just hope all the work done will help them to commercialize the product with the good strategy extracted from the marketing research and I would like to keep working with them in the future if all goes well.

Last but not least, I want to dedicate this thesis to all my family, they have given me all their support since I was young in order to obtain all the things I wanted to achieve in life. They have made big efforts to make me become what I am now and I can never be grateful enough.

Abstract

The purpose of this document is to elaborate a business plan for FutureSiSens. The company, FutureSiSens, was born in June 2016 and has the objective to launch a new home sleep test device for the diagnosis of the sleep apnoea-hypopnoea syndrome. This new device will incorporate their main product, the FutureSiSens gas flow sensor.

The business plan will explain all the information needed to understand what the company is about, description of members, structure and responsibilities. Within the business plan, all the technical characteristics of the particular gas flow sensor as well as the description of the new product will be shown. Moreover, a marketing plan will be carried out pointing out the strategy that the company will need to follow to succeed in the production and distribution of the device as well as an analysis of the competitors in the sector.

Last but not least, a financial analysis will be effected after making projections of sales. The results obtained will show the viability or not of this business idea.

Keywords: Business Plan; GFS; FutureSiSens; SAHS; HST device; marketing plan; financial analysis.

Resumo

O propósito deste documento é a elaboração de um plano de negócio. A empresa, FutureSiSens nasceu em junho de 2016 e tem como objetivo lançar um novo produto para diagnosticar o síndrome das apneias e hipoapneas desde casa. Este novo produto incorporará o produto estrela da empresa, o sensor de fluxo de gás FutureSiSens.

O plano de negócio explicará toda a informação necessária para entender em que consiste a empresa assim como descrever a sua equipa, estrutura interna e responsabilidades de cada um deles. Dentro do plano de empresa, todas as características do sensor de fluxo de gás bem como as do aparelho que se desenvolverá serão explicadas. Seguidamente, um plano de marketing se realizará extraindo os pontos mias importantes para o êxito da venda do produto e a sua distribuição assim como também se detalharão os principais competidores do sector.

Por último, uma análise financeira se elaborará depois de realizar as correspondentes projeções de vendas do produto. Os resultados obtidos das projeções que se consideraram mostrarão a viabilidade o não da ideia do negócio.

Palavras chave: Plano de empresa; SFG; FutureSiSens; SAHS; plano de marketing; análise financeiro.

Resumen

El propósito de este documento es la elaboración de un plan de empresa. La empresa, FutureSiSens, nació en Junio de 2016 y tiene como objetivo lanzar un nuevo producto para diagnosticar el síndrome de las apneas e hipoapneas desde casa. Este nuevo producto incorporará el producto estrella de la empresa, el sensor de flujo de gas de FutureSiSens.

El plan de empresa explicará toda la información necesaria para entender de que consiste la empresa así como describir su equipo, estructura interna y responsabilidades de cada uno de ellos. Dentro del plan de empresa, todas las características de el sensor de flujo de gas como también las del aparato que se desarrollará serán explicadas. A continuación, un plan de marketing se realizará extrayendo los puntos más importantes para el éxito de la venta del producto y su distribución así como también se detallaran los principales competidores del sector.

Por último, un análisis financiero se elaborará después de realizar las correspondientes proyecciones de ventas del producto. Los resultados obtenidos de las proyecciones que se han considerado mostrarán la viabilidad o no de la idea de negocio.

Palabras clave: Plan de empresa; SFG; FutureSiSens; SAHS; plan de marketing; análisis financiero.

Table of Contents

List of Figures

List of Tables

List of Acronyms

AHI Apnoea-Hypopnoea Index

BEP Break-Even Point

BLE Bluetooth Low Energy

BMI Body Mass Index

CEO Chief Executive Officer

CMOS Complementary Metal Oxide Semiconductor

CSIC Centro Superior de Investigaciones Científicas

CTO Chief Technology Officer

EBT Technology Based Company

EU European Union

GFS Gas Flow Sensor

HST Home Sleep Test

ICTS Infraestructuras Científicas y Técnicas Singulares

IoT Internet of Things

MEMS Micro-Electro-Mechanical Systems

NEMS Nano-Electro-Mechanical Systems

OSA Obstructive Sleep Apnoea

PSG Polysomnography

SAHS Sleep Apnoea-Hypopnoea Syndrome

Si Silicon

TE Thermo-Electric Technology

TEG Thermo-Electric Generator

UAB Universidad Autónoma de Barcelona

USA United States of America

WIFI Wireless Fidelity

WSAN Wireless Sensor and Actuator Network

1 Executive Summary

The purpose of this thesis is to develop and explore the creation of a business plan for a start-up considering different restrictions as assumptions. A research of the market related to the business will be carried out taking out the best decisions as strategies for the succeed of the business idea that will be developed.

The FutureSiSens main goal is to provide the most innovative gas flow sensor (GFS) for an intelligent monitoring applied to any sector of the market that can provide a solution to a problem.

Our first product, would be included in the health sector by making a home sleep test device (HST) for diagnosis of the sleep apnoea-hypopnoea syndrome (SAHS). We believe that by using our small GFS inside this type of device we can provide a better solution for this problem. We can reduce the size as few cables are required for diagnosing SAHS with our GFS as is the case of the existing HST products. This will enable a greater and user friendly experience for the users. We have also obtained a competitive price for our device that will represent a break through in the market seeing as the reliability and results obtained from our device will be the same or better as the more expensive ones already in the market.

As FutureSiSens is a company established in Barcelona, Spain, the first idea will be to start the sales of the device in the Spanish market during the first year. By doing that, we will analyse the feedback from first users and we will have time to solve any problem that arises. After the first year, our intention would be to expand to the European market first and then to the USA market and worldwide if all goes well.

To make this expansion possible, we believe that a partnership with a well known pharmaceutical laboratory has to be done in order to access our market by using their distribution channels. By making that, the total cost of marketing and distribution will be carried out by our partners and FutureSiSens will just need to take care of the production costs of the device. Of course, we will establish a selling price to the pharmaceutical laboratory which will give us some profit and they will be competitive in the market.

Doctors will be included as customers. They will buy our device for their patients for making an exploration of the severity of their sleep disorders. Another possible customer would be any person that would decide to rent or buy our product in a pharmacy thinking that he/she has some symptom of SAHS and so try it for a cheaper price at home without a visit to the doctor. A further suggestion would be to offer our device in a pharmacy so that people could rent it for a first test. The business idea is similar to the blood pressure measuring devices that you can find in a pharmacy.

Last but not least, FutureSiSens would not only focus its efforts on this device, because our main goal is the provision of solutions to existing problems that could be applied our GFS. Over the following years, more applications for other sectors of the market will appear. Technology licenses or projects related to the monitoring of flows will make their appearance making possible some extra income.

2 General Company Description

FutureSiSens is a Technology Based Company (EBT), participated by the Autonomous University of Barcelona and was established in June 2016.

FutureSiSens, S.L. is dedicated to the design, development, manufacture, installation and consultancy, including integrated generation, measurement and sensing solutions including thermoelectric sensors and associated electronics company.

FutureSiSens is a spin-off company from the University of Catalonia, specialized in the development of a gas flow sensor (GFS) with CMOS Si-compatible thermoelectric technology (TE).

2.1 Mission

The mission is related to the purpose of the company, referring to “the reason why the company exist”. FutureSiSens has a clear and straightforward defined mission “We have the mission to be the most innovative company in flow sensing and intelligent monitoring. We strive to grow our business through constant innovation in order to improve safety and energy efficiency.”

2.2 Vision

The vision is related to “where the company wants to be in the future”. The vision of FutureSiSens is “Become the most recognized new player in innovative flow sensing and intelligent monitoring through on-going innovation with differentiated products and customer centric development, where the best people prefer to build their careers and develop new, excellent ideas together with highly skilled colleagues.”

2.3 Slogan

The mission and vision is in alliance with their slogan: “Measure, Acts and Safe”.

2.4 Logo and Website

The *figure 1* illustrates the logo of FutureSiSens.

Figure 1.- Logo of FutureSiSens. [1]

The website of FutureSiSens is http://futuresisens.com/

2.5 Industry

The growing connectivity and Internet of Things (IoT) is a beneficial for sensor growth and innovation. Everyday, “Smart Sensors” have to become even more “Smart” than yesterday through continuous innovation. As FutureSiSens is composed of a team of entrepreneurs, but mainly researchers specialized in Physics, Smart Sensors and micro fabrication, FutureSiSens has the right knowledge for continuous sensor innovation needed to tackle these previously mentioned needs on the sensor market.

FutureSiSens has succeeded in developing microsystems that function highly precise through more accurate wireless network (WIFI and XBee), that do not need external power input, have significant increased sensitivity and most importantly, this all cost-effective. By this, FutureSiSens’ Smart Sensors close the gap between innovation and reliability by autonomous and wireless solutions, decreasing independency on human and other external errors.

As connectivity and business analytics is emerging in many markets, so is the need for improved intelligent and automated sensing data sources, also referred to as “Smart Sensors”. IoT makes it possible to manage not only more data, but also more in detail. Therefore, today’s sensors have to be more intelligent and “Smart” than ever. This implies a need for improved technical capabilities (e.g. higher sensitivity to measure, more accurate response, smaller size) but also reduced dependency on human interference and increased automation. “Smart” also refers to its adaptability towards different industries and markets, different mechanisms and processes, different environments and situations.

The Healthcare sector is an important market depending on several Smart Sensors for the continuous care of life and improvements upon patient's’ health conditions. In this sector, “Smart Sensor” refer to the need of (1) improved sensitivity of sensors, able to sense and measure differential changes in body conditions as significant signals. Further on, “Smart” also means (2) zero-power operating conditions of a sensor, so that patients can use body-integrated sensors for a lifetime. Also, (3) Wireless Sensor and Actuator Network (WSAN) removes any physical limitation, allowing the patient to freely walk around and enjoy every day activities, such as the need for wireless standards such as Bluetooth Low Energy (BLE) or also called “Bluetooth Smart”. This benefits also the continuous measure of the patient’s data real-time and through rapid response, quickly interfering in case of acute conditions. Finally, “Smart” also means (4) small size in order to fit into a human’s body, such as a tiny vain or cellular body skin.

2.6 Company Strengths and Weakness

FutureSiSens main strength and therefore the quality that enables the team to accomplish the company's mission is the innovative technology combined with a strong team specialized in innovation and research. The team is highly motivated and has a high degree of expertise as well as experience in the development of sensors. The technology and the materials used to produce the GFS are unique and unite different characteristics in one sensor.

Due to the fact that the GFS of FutureSiSens is still in the developing phase, the sensor neither has brand awareness nor experience in the market. Because of this there is no existing customer base so far. It will be very important to establish a customer base and hire specialized sales representatives that can create a strong network with several device producers. In order to distribute the product FutureSiSens needs to set up a supply and distribution network, which is non-existent so far. Also the size of the company can be seen as a weakness given the fact that the competitors are global players in a highly consolidated market with years of experience.

3 Product and Services

FutureSiSens has been developing low cost TE-based Si-CMOS microsystems with minimal power consumption to detect flow variations. The GFS with the integrated low-power electronics for signal management and wireless communication will allow real time monitoring of gas flow variations, useful in various integrated systems, such as gas networks, pipelines, in air-conditioning and building automation with the goal to improve safety and energy efficiency and in health applications.

The differential advantages consist of 8 advantages: FutureSiSens has developed a small and autonomous TE compatible Si-CMOS Gas Flow Sensor with high sensitivity, rapid response, wireless and real-time monitoring within a broad range of operational environmental temperatures and explosive gas measurements.

Due to all that advantages, there are many possible applications that can use our GFS. However, it will be described the GFS technically by its own and then it will be described and explained its integration in a health application.

3.1 Gas Flow Sensor Description

The potential decrease of the usage of fossil fuels and the urgent need to reduce green-house gas emissions caused FutureSiSens team to search for alternative, greener, sources of energy. Amongst the various available energy sources, waste-heat energy was considered as one of the most actual sources we have and that could be better employed for increasing efficiency in processes.

From there on, the members of FutureSiSens started to think about different ways of producing energy from that waste-heat that can be found in most processes. Thanks to their expertise in physics and microsystems, they discovered the development of a thermo-electrical generator (TEG). A Si-based micro thermogenerator built from silicon-on-insulator that uses standard CMOS processing.

The micro TEG is formed by ultrathin single-crystalline Si membranes of 100nm in thickness with embedded n and p-type doped regions. Moreover, it is electrically connected in series and thermally in parallel. The connections of these active elements of the thermoelectric device produces and generates thermopower under various thermal gradients with a result of output power density of 4,5 $\mu W/cm^2$ under a temperature difference of 5 K.

To understand the configuration of the TEG, the *figure 2* will help us:

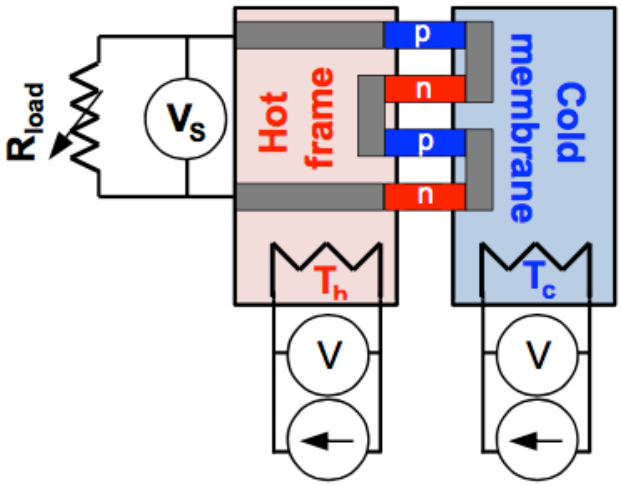


Figure 2.- Schematic design of the thermoelectric configuration. [2]

As seen in *figure 2,* there are two different frames, hot and cold. The temperature difference that occurs makes possible the generation of power helped by the n-p type Si membrane configuration.

Talking about the design of the TEG, we find that it is a planar device with a suspended very thin Si platform at the center (500 x 500 μm^2) which contacts to a Si frame through ultrathin n and p-type Si membranes, 50 µm wide x 150 µm long. The distance between hot and cold regions is also approximately 100 µm. To understand better its design, *figure 3* will illustrate the schematics of the device:

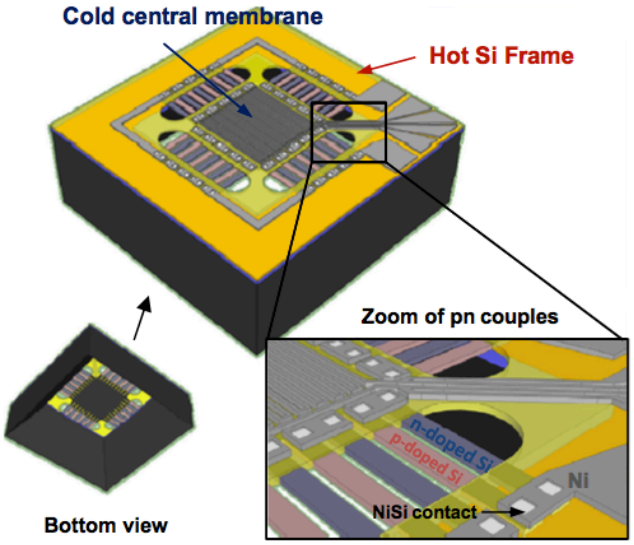


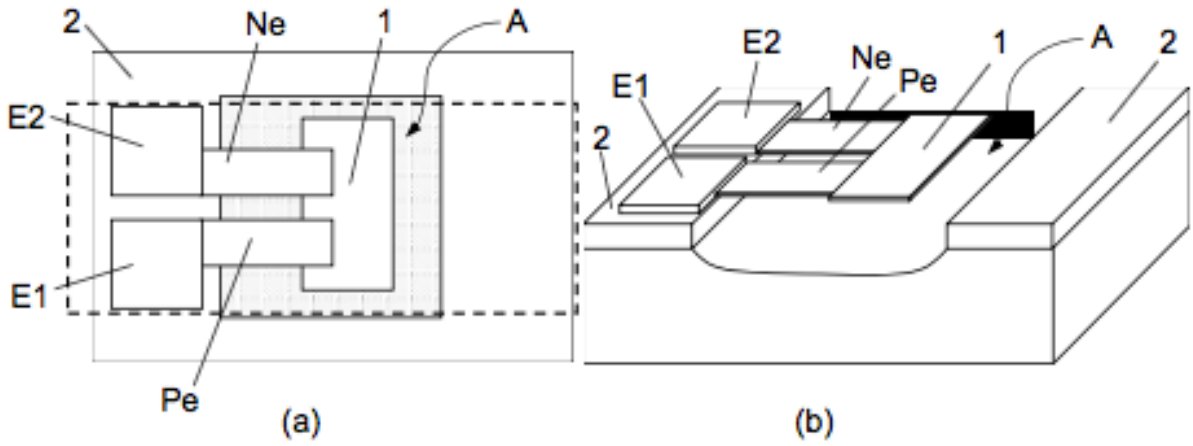
Figure 3.- Schematics of the TEG. [2]

In *figure 3*, the grey colour shows the Ni metal lines, the yellow represents the silicon nitride layer. In the central region is filled with a metal for heating/sensing purposes. Better observed in the zoom view, red and blue regions represent the n-p couples defined in the Si membranes and white the NiSi intermetallic at the open via contacts. Regarding the bottom view, it shows the free standing membrane after back side Si bulk etching.

For the FutureSiSens team the obtention of this TEG output power was not enough, the integration of two temperature sensors that could be powered by that output power generated by the temperature difference would make the TEG have a new possible use. It could give instant information about the variation of temperature from an external gas flow that passes through two frames.

From this last point, the FutureSiSens team elaborated a new configuration of the TEG to convert it into a GFS. Of course, to make that possible it was necessary to design the TEG with a different thickness in both frames. One would need to have a very thin layer to make an immediate increase in temperature when the gas flow passes through while the other would require a greater thickness to take longer in getting that new temperature from the inlet gas flow.

The result obtained after different tests produced the FutureSiSens GFS. The schematics and configuration of the final GFS, that used same characteristics as the TEG explained before, is illustrated in the *figure 4* from the FutureSiSens patent:



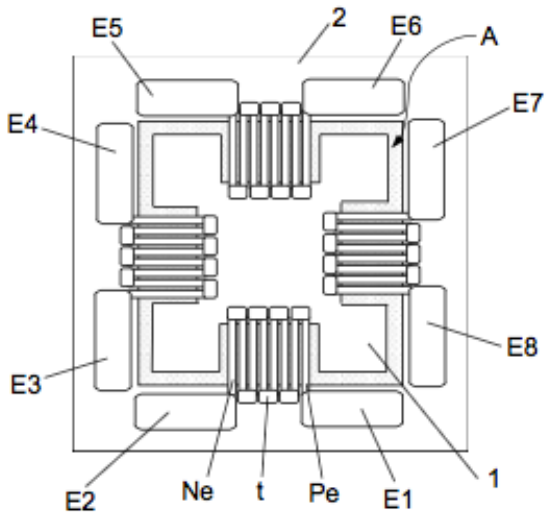


Figure 4.- Schematics of the FutureSiSens GFS. [3]

Figure 4, relates to the schematics of a fluid flow sensor or GFS comprising a thermoelectric device that has a first element (1) having a surface to be exposed to a fluid flow, to change its temperature along a temperature range. The second member (2) is submitted to a temperature difference compared to the first member as it is also thermally isolated. Moreover, the n-doped (Ne) and p-doped (Pe) thermoelectric elements are connected so that the differential in temperature between the first (1) and the second (2) members cause the generation of an electrical signal at the output electrodes (E1, E2) thanks to the Seebeck effect that it has created. Due to all of this it can be said that the GFS is energetically autonomous.

Last but not least, it is necessary to mention that the FutureSiSens patent for this invention also takes into consideration the manufacturing method.

3.2 Gas Flow Sensor Integrated in a Health Application Description

Once the main product and invention that FutureSiSens has been explained, the integration of that GFS inside the home sleep test (HST) device for diagnosis of the sleep apnoea-hypopnoea syndrome (SAHS) will also be explained.

The first thing to take into consideration is that the resulting **HST device will be the product analysed during the business plan**, with which product FutureSiSens wants to make a business. How FutureSiSens came up with creating this type of device will be also explained in the following sections.

To start with the description of the integration of the GFS inside the HST device, the first thing to do is list all the elements that form the HST device and which will contain the FutureSiSens final product.

- Nasal Prongs
- Slide
- Cannula
- Filter/ Connector
- Main device with electronics
- Battery
- User's Guide / Response Card
- Box

To have a better understanding of all the elements listed, *figure 5* will illustrate them and explain the place where the GFS will be collocated.

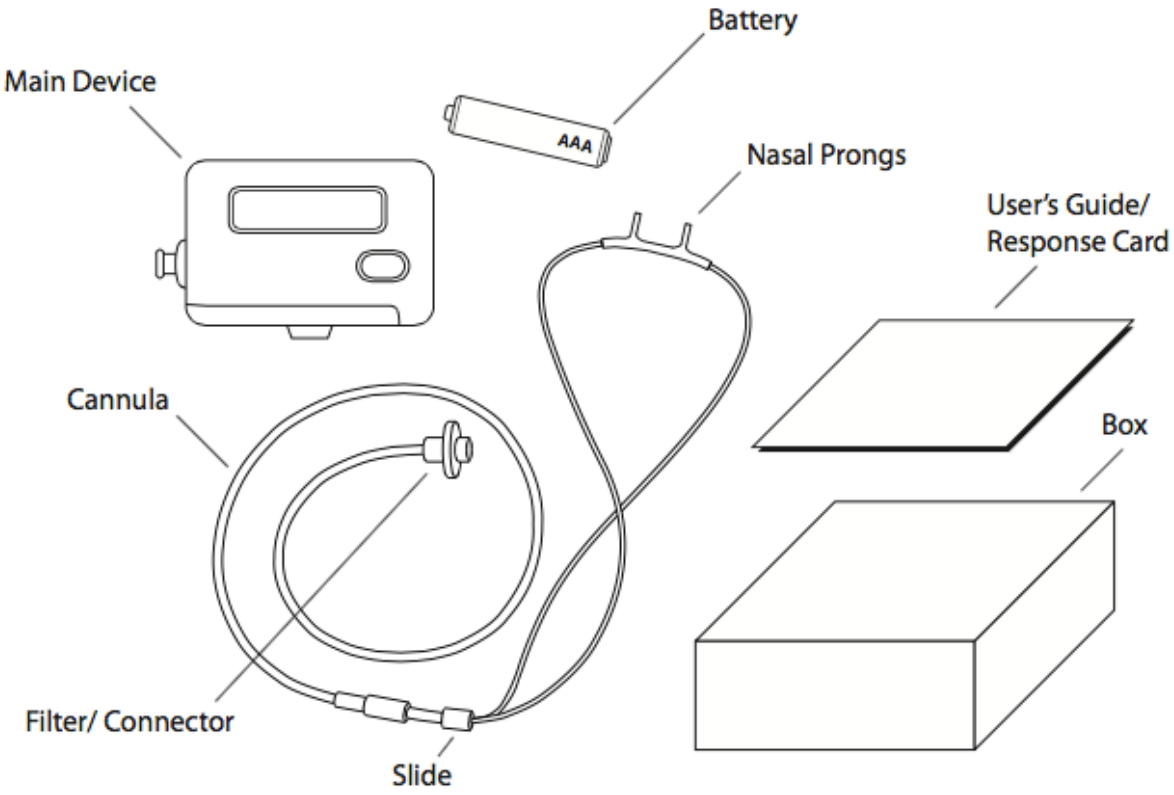


Figure 5.- Elements that form the FutureSiSens HST device for diagnosis of SAHS.

In *figure 5*, the elements of the final product that FutureSiSens will launch into the market are shown. To have a precise detection and a good use of the GFS inside the device, the nasal prongs has the perfect size for placement of the GFS. It is the inlet entrance of the air flow allowing precise detection.

It is possible to place the GFS inside the prongs due to the fact that we are talking about a really small GFS (2,6x2,6 mm), which will give very precise detection as quantification of the air flow in the cannula is in real time.

The connection of the GFS with the main device will be carried out by some cables that will be inserted in the cannula. The information received from the GFS will be stored inside the main device and will be processed by the software. Final results after each test will be displayed on the small screen incorporated in the main device. Moreover, there will be the possibility to transfer the results obtained from the main device to an external source throughout a mobile app. The users will be able to download the app free of charge in Google Play or Apple Store and easily display all the outputs collected from their test. Furthermore, the customer will have the opportunity of seeing the severity of their SAHS disorders and share the results with their doctor.

As the nasal cannula has a connector to the main device, it can be reused after sterilisation, extra nasal cannulas with the GFS incorporated will can also be offered to our customers if these don't want to use the sterilising process which could be time consuming or costly.

A user guide will be facilitated inside the box explaining how the product works. However, the idea is to make a product without the absolute need of instructions for the user. Moreover, after the user downloads the app, a visual tutorial of how to use the device correctly will be available.

4 Marketing Plan

4.1 Market Research

To start with, it is necessary to analyse and describe all the companies that have created similar GFS as FutureSiSens. The following list shows the most important ones around the world with a brief description.

1. **Sensirion:** Sensirion is undoubtedly one of the biggest competitors of FutureSiSens. The company is one of the leading manufacturers of high-quality sensors for both energy efficiency and safety solutions.

2. **Omron:** Is the second biggest global competitor with success based on similar CMOS-TE technology and competing with their competitive micro-sensor sizes (0.75 mm^2). They provide sensor solution mainly based on energy efficiency solutions.

3. **EnOcean:** EnOcean GmbH is a spin-off from the company Siemens AG, headquartered in Overreaching near Munich, Germany.

4. **MicropeIt:** MicropeIt was initiated in 2006 as a spin-off from Infineon Technologies and Fraunhofer Institute for Physical Measurement Techniques, representing a German manufacturer of semiconductors and a R&D partner, respectively.

5. **EKO Instruments:** EKO Instruments was initiated 85 years ago, with major focus on energy efficiency for in-house (micro)-sensor solutions (756 mm^2). Today their productions sites are located in Japan, Europe and United States.

As can be seen, there are several companies that develop GFS solutions for an industry that is growing constantly every year. That is because the market offers many opportunities for this type of sensors together with the objective of reaching higher efficiencies in most of the industrial processes and building units. The number of possible applications for these devices is high, as is the need to find the correct one to enter properly into the market and succeed. For that reason, FutureSiSens works everyday to be the leader with innovation and research when compared to competitors.

The big market related to GFS forces FutureSiSens to focus specifically on this and address our sensor to one type of solution. Therefore, it is necessary to examine all the different markets of the industry such as:

- Gas networks
- Pipelines
- Air-conditioning

- Health applications
- Safety for buildings or industry
- Energy efficiency monitoring buildings or industry

Discovery of the way for deciding which specific market to choose in order to focalise our efforts has been decided by finding one type of market in which our main competitors have not yet entered. The result showed us that the health applications are still not touched by companies that has similar GFS as FutureSiSens and made us think about a solution to that market.

The health market is a complex one, products need to be validated before being launched in the market. As we are talking about a GFS solution, the application would be focused on human breathing and motorization of air flow. That is possible thanks to the properties of the FutureSiSens sensor:

- It is small (2,6x2,6 mm)
- Has the ability to detect intensity and variations of airflow temperature (air temperature difference while someone is breathing in or breathing out)
- Has a quick response

By monitoring those variations, our device could be applied for evaluation and detection of some sleeping-disorders such as **apnoea and hypopnoea**.

For that reason, it is also necessary to thoroughly analyse, not only our direct competitors that produce similar GFS, but also, our competitors in the health applications for detecting apnoea and hypopneas and see the solutions that exist in the market already, so finding a way to produce a better one by integrating our GFS. All the competitors will be shown in the competition section.

Moreover, to understand the apnoea and hypopnoea health market it is necessary first to have an idea of what is a sleep-disorder. Sleep-disordered breathing is a chronic disorder caused by repeated upper-airway collapse during sleep, resulting in recurrent nocturnal asphyxia, fragmented sleep, major fluctuations in blood pressure, and increased sympathetic nervous system activity. [4] People that suffer from this type of disorders have difficulties to rest properly during the night and consequently during the day they feel much more tired and have higher risks of falling asleep, while driving for example. For that reason, it is very important to detect sleep-disorders for prevention of risks of accidents or of day time tiredness by means of the appropriate solution devices that are available on the market for each disorder.

4.2 Economics

The number of sleep-disorder cases has a direct proportion with the increase of the aging population such as large neck circumference, male sex, snoring and the growing levels of obesity. [5] [6] [7] However, there are different types of sleep-disorders such as: insomnia, hypersomnia, parasomnia, sleep related breathing disorders, circadian rhythm sleep-wake disorder and sleep movement disorders amongst others.

For our case study we will focus on the numbers related to the sleep apnoea-hypopnoea syndrome (SAHS) which belongs to the group of breathing disorders. The most common one is the obstructive sleep apnoea (OSA) which is characterized by the frequent starting and stopping of breathing while someone is asleep.

This kind of apnea happens when the muscles in the back of the throat relax and block the airway. These muscles help to bolster oral and pharyngeal structures like the tongue, uvula, soft palate, and tonsils. When the airway is either completely or partially blocked, there is usually 10 to 20 seconds of breathing cessation, which can lower blood oxygen levels. The brain panics when this happens and rouses the body to restart breathing. Generally, this is a very brief awakening that most people do not even notice or remember. It can happen over 30 times an hour all throughout the night, which significantly disrupts restful sleep cycles. [8]

To quantify the size of this market we have considered the results achieved from different studies done in the last years on a sample of random population of a specific area. Some tests where effected to analyse and detect how many of the selected group had a breathing disorder such as SAHS. The results show that there is an increasing tendency of people suffering from this type of disorders due to the growing levels of obesity around the world.

The first values seen in *table 1* corresponds to the total market size for the two areas that would be considered for FutureSiSens in Europe and the United States of America (USA).

	EUROPEAN + USA MARKET SIZE	
Sleep Apnoea-Hypopnoea Syndrome	**Nº of people**	**Nº of people affected**
a. Men (30-70 years old) / (>18)	243.419.355	72.663.144 (29,85%)
b. Woman (30-70 years old) / (>18)	252.779.953	34.321.894 (13,57%)
TOTAL	**496.199.308**	**106.985.038 (21,56%)**

Table 1.- European + USA market size of SAHS. [Own elaboration]

The values obtained shows that approximately, 3 out of 10 men have some type of SAHS while 1 out of 10 women has some type of SAHS. For both calculations a population between 30 and 70 years has been considered for Europe and a population older than 18 years for USA. The average value obtained for this range of market tell us that approximately 2 out of 10 people could have SAHS.

To study this market more profoundly, we will illustrate how these values have been obtained for each area. *Table 2* shows the numbers for Europe:

	EUROPEAN MARKET SIZE		
Sleep Apnoea-Hypopnoea Syndrome	**%**	**Nº of people**	**Nº of people affected**
a. Men (30-70 years old)	34% [7]	142.424.988 [9]	48.424.496
b. Woman (30-70 years old)	17% [7]	144.646.226 [9]	24.589.858
TOTAL		**287.071.214**	**73.014.354 (25,43%)**

Table 2.- European market size of SAHS. [Own elaboration]

The values obtained show that around 34% of men and 17% of woman between 30 and 70 years old suffer from SAHS at any level of the disease. These values where taken from the sample of population representing a standard type of person from the European Union.

Furthermore, the USA market will also be analysed as it is an interesting area for sale of our final product due to the higher levels of obesity compared to the European Union and therefore, the higher number of cases of SAHS. Moreover, to obtain the values of the American market, a different study case will be analysed. Comparing the different ethnical and race typology of the population in both areas. The USA National Institute of Health carried out a study that has obtained the final values to quantify the USA market.

The results extracted from it are shown on the following *table 3*:

	USA MARKET SIZE		
Sleep Apnoea-Hypopnoea Syndrome	**%**	**Nº of people**	**Nº of people affected**
a. Men (>18 years old)	24% [10]	100.994.367 [11]	24.238.648
b. Woman (>18 years old)	9% [10]	108.133.727 [11]	9.732.035
TOTAL		**209.128.094**	**33.970.648 (16,24%)**

Table 3.- USA market size of SAHS. [Own elaboration]

As shown, the average percentage of people affected by SAHS is lower than in Europe, however, the index of obesity in USA is higher, so it should be logical that the number of people suffering from SAHS in USA should be higher too. However, the apparent reason for this result is that the range of people included in Europe and USA its different. In USA a higher number of people from younger ages were included making the average value of SAHS cases decrease.

The last table regarding the market size will correspond to Spain. This country will be analysed as a FutureSiSens starting market which is located in Barcelona, Spain and the intention is to expand from there.

	SPANISH MARKET SIZE		
Sleep Apnoea-Hypopnoea Syndrome	**%**	**Nº of people**	**Nº of people affected**
a. Men (30-70 years old)	34% [7]	13.027.400 [12]	4.429.316
b. Woman (30-70 years old)	17% [7]	13.103.552 [12]	2.227.604
TOTAL		**26.130.952**	**6.656.920 (25,43%)**

Table 4.- Spanish market size of SAHS. [Own elaboration]

After examining these results, it is also important to predict what share of the total market size FutureSiSens will achieve during its expansion and how many people will use the final product. For that reason, Spain has been established as the first year target for testing the market and extraction of the potential of our device. This will provide an ideal strategy for the other areas analysed.

It should be mentioned that inside that total number of final SAHS cases, there are some that have already been diagnosed by other methods existing on the market. These people already know that they suffer this type of sleeping disorder and subsequently cannot be our final customers.

As will be explained in the next section, our final product would basically help people to detect if they suffer from SAHS with the use of a **portable, easy, handy, low cost and reliable device**. Nowadays, professionals form the SAHS medical sector have a long waiting lists for the traditional tests. People need to stay during at least one night in hospital for the polysomnography (PSG) test, the most used and complete one. As shown in *tables 5, 6 and 7*, there are important problems related to availability of a PSG test. Waiting list times are growing. The waiting list can be up to 60 months in some regions of the United Kingdom.

The *table 5* illustrates the waiting list times that exist in Spain and its different regions:

	Population	Health Centers	Centers/100.000 habitants	Waiting List	
				1st visit	PSG test
Andalucía	7.357.558	41	0,56	26 ± 24	51 ± 55
Aragón	1.204.215	12	1	10 ± 4,8	18 ± 27
Asturias	1.062.998	10	0,94	161 ± 211	64 ± 66
C. Valenciana	4.162.776	24	0,58	49 ± 47	71 ± 72
Canarias	1.694.477	8	0,47	55 ± 89	32 ± 47
Cantabria	535.131	1	0,19	30	60
Castilla-La Mancha	1.760.516	13	0,74	18 ± 10	105 ± 109
Castilla y León	2.456.474	14	0,57	19 ± 13	70 ± 108
Cataluña	6.343.110	33	0,52	144 ± 270	48 ± 49
Ceuta	71.505	1	1,40	15	30
Extremadura	1.058.503	8	0,76	33 ± 16	98 ± 68
Galicia	2.695.880	7	0,26	83 ± 60	114 ± 75
Islas Baleares	841.669	8	0,95	61 ± 63	61 ± 73
La Rioja	276.702	2	0,72	9 ± 6	5 ± 2
Madrid	5.423.384	12	0,22	74 ± 63	59 ± 33
Melilla	70.000	1	1,51	60	90
Murcia	1.197.646	8	0,67	46 ± 38	43 ± 25
Navarra	555.829	3	0,54	11 ± 6	15 ± 21
País Vasco	2.082.587	11	0,53	50 ± 52	67 ± 60
España	40.504.258	217	0,69 ± 0,34[b]	61 ± 130	60 ± 66

Table 5.- Spanish number of SAHS health centers by region with corresponding waiting list times in days. [13]

It is obvious that there is a clear problem. Therefore, there is an opportunity in the Spanish market.

The *table 6* shows us some other cases in different countries around the world including USA and some other European countries which are considered inside our target market.

Country	Population	No. of Sleep Labs	No. of Sleep Beds	No. of Beds/ 100,000	No. of Studies/yr	No. of Studies/yr/100,000	Waiting Time (mo)
United Kingdom	58,800,000	84	170	0.3	25,000	42.5	7–60
Belgium	10,000,000	50	150	1.5	17,716	177.2	2
Australia	18,970,000	65	244	1.3	53,500	282.0	3–16
United States	280,000,000	1,292			1,170,000	427.0	2–10
Canada	31,400,000	100	440	1.4	116,000	370.4	4–36

Table 6.- Sleep study rates per 100,000 population and waiting times in months for diagnosis of sleeping disorders. [14]

As can also be seen, the same problem exists around the world and solutions should be found. To summarize all the values, the *table 7* will illustrate all the important figures related to waiting lists for PSG test in the countries analysed.

	Centers with PSG / 100.000 hab.	Beds for PSG / 100.000 hab.	Annual studies of PSG / 100.000 hab.	Waiting time for PSG (months)
United Kingdom	0,14	0,3	42	7-60
Belgium	0,5	1,5	177	2
Australia	0,34	1,3	288	3-16
USA	0,46		427	2-10
Canada	0,32	1,4	370	4-36
Spain	0,24	0,5	64	1-18

Table 7.- Comparison of Spain with other countries of values related to SAHS tests. [13]

As can be seen, there is an enormous opportunity in the market to create an alternative solution, with home testing so eliminating the need to spend a night in the hospital with the use of a FutureSiSens product. Of course, our device will not give the doctor as much information as a PSG but will still offer reliable information by showing the possibility of SAHS.

This solution will be positive not only for the FutureSiSens, but also to our final users as this would avoid the need of spending a lot of money with the traditional PSG test that is much more expensive than our product. Moreover, it will be more positive for doctors to be able to apply correct treatment for more patients. Last but not least, also it would be beneficial for all the population as with more correct diagnosis there could for example be less driving accidents caused by effects of SAHS.

If we look at some drawbacks of the market, it can be seen that some devices already exist that offer similar tests for diagnosis of SAHS at home. However, all of them are usually prescribed by the doctor making a first visit necessary. These devices that are not complicated to use but have lots of cables and a still high price. All the FutureSiSens competitors are analysed in the competitive section showing the strength and weaknesses of our product compared to the others.

Due to the analysis of the existing solutions, FutureSiSens, will enter the market with an innovative and practical solution. The use of the GFS inside the device would significantly reduce the size and cables needed as it will allow the exploration and diagnosis of both apnoea and hypopnoea while other solutions can only test when there is a complete stop of breathing of 10 seconds, apnoea. The detection of both apnoea and hypopnoea will give a plus to FutureSiSens device.

Another important topic to consider is the validation and certification of the reliability of the product. Before entering the market, a partnership with some hospitals or specialised and well known doctors from the specific medical sector has to be effected. In this way, patients will have the feeling that it is a reliable way of testing SAHS. It is important that doctors prescribe and recommend our product for a first exploration. A competitive price and a handy product will make that possible and allow FutureSiSens to succeed.

To end this section of economics inside the market, it is also important to say that FutureSiSens has always been an innovative technology based company that continues doing R&D. New versions of the device will be developed and solution or improve any problem or inconvenience that it is extracted from the review of the users. Moreover, if any new competitor enters with a similar product, thanks to R&D, FutureSiSens will always have some new feature to offer and will always be one step ahead of competitors.

4.3 Product

In this section, the product will be described from a user point of view, analysing all the features and benefits of the product, with an explanation of its value for the users.

4.3.1 Features and Benefits

First of all, we have the basic and most important feature: it is a device that can detect and quantify the apnoea-hypopnoea index (AHI). This index informs the user, at the end of the sleeping period, about the severity of his or her SAHS.

Based on the AHI, the severity of OSA can be classified as follows: [15]

- **None or minimal:** AHI less than 5 per hour
- **Mild:** AHI between 5 to 15 per hour
- **Moderate:** AHI between 15 to 30 per hour
- **Severe:** AHI more than 30 per hour

This clear and valuable information will be stored in the device so the user can hand in the results of one or more tests to his/her doctor. Of course, with a result with a severity of less than 5 a visit to the doctor could just be ignored, letting other patients go first. By doing that, it would allow the reduction of waiting lists in most countries that have been analysed before.

Another interesting feature of the product is its reduced size. By introducing the FutureSiSens GFS inside the nasal cannulas it the number of cables and electronics can be reduced so allowing our product to be more competitive inside the market regarding that category.

From the last feature, a positive benefit can be extracted, the user will have less cables around his body and make the experience of the SAHS test more comfortable during sleep. Furthermore, an easy system with buttons of start-stop will be provided making the full experience easier even for unexperienced users with technological devices.

Another interesting feature is that the device can be reused after one test. It can be cleaned and sterilized for a second use allowing a longer life usage. Moreover, because of the low cost of the product most of the times it would be easier and cheaper for users to buy a new one.

Last but not least, we find the most important and interesting benefit from a user point of view. Users will be able to buy a cheaper product without the need of going first to the doctor and wait for a medical prescription for a device or putting them on the waiting list for a traditional SAHS test. Consequently, there will be a drastic increase in the use of our device and a great number of people around the world will be informed about their levels of SAHS, thus improving the treatment of sleep disorder.

4.4 Customers

In this section, two different different customers of FutureSiSens will be analysed: end consumers and middleman businesses to which our product will be sold.

Firstly, those which are the most important group of **end consumers** will be explained. And the following list will show the demographic profile:

- **Age:** the age of the end consumer profile is **between 30 and 70 years old** as has been considered in the size market analysis. Most of the people in that range tend to have a higher risk of suffering SAHS.

- **Gender:** in this case we see that the **male gender** has more probabilities for SAHS as shown in all the studies analysed.

- **Location:** obesity rates would be required to find more possible users, seeing as that index has direct correlations with high numbers of SAHS inside the population. In this case, **USA** would be one of the countries to consider. However, the strategy of the company and its first expansion cost would also be important indicators for choosing Spain or the rest of Europe because of proximity and easy location.

- **Income level:** regarding the income level, there is not a specific target or necessary income level status for being able to buy our product. The price will be **affordable to all end consumers**.

- **Ethnicity:** SAHS is more common in **African-Americans, Hispanics and Pacific Islanders** than in the white population. [16]

- **Education:** the user target of our product would be that that has a **deficient alimentary education** as this indicates more probabilities of obesity and consequently SAHS.

- **Health problems:** as was described in the location section, the most important risk factor for suffering SAHS is **obesity**. It has different markers, body mass index (BMI), neck circumference and waist-to-hip ratio. Furthermore, **family history** of OSA shows that family members will have a 25% to 40% probability of suffering it. [16]

- **National Health System:** it depends on each country, however, if it exists it may be interesting for FutureSiSens to approach this in order to offer our product so that more people could be reached.

Secondly, **middle man business or the business customers** will be analysed using some demographic factors:

- **Industry:** obviously, the industry that will be interested in offering our product will be: **hospitals, pharmacies, private or public health systems** and maybe some online sellers amongst others.

- **Location:** FutureSiSens intends to start in **Spain**, however, the business responsible for selling the FutureSiSens product would need to have a good distribution channel and a close access to most of the patients interested in acquiring the device. A Spanish company would be ideal but a foreign company in Spain would also be acceptable.

- **Status of company:** the company that will offer our product must have a good reputation and a **global market access**. However, some small local firms can also be interesting to start with to see the response of people and get more locals to know the product.

- **Quality:** as has been pointed out, the quality of the firm or companies that would sell the product needs to fit inside the heath market. In that way, it needs to show a **reliable and friendly relation** between end consumers and the company.

4.5 Niche

"People that think they suffer from SAHS and may want to test themselves without visiting their doctor, have an excellent possibility with our device, which is easy to use, cheap and comfortable."

4.6 Strategy

To succeed in our niche market, a clear strategy is really important. Learning from the mistakes that can occur during the strategy pathway can also help FutureSiSens to change the focus of the product and dealing with end consumers with the passage of time.

4.6.1 Proposed Locations for Sales

As there is an initial intention of focusing the first year of sales in Spain, the results from this first year will help us to decide if the strategy that will be described in the following sections is good enough.

Before describing the strategy, it is important to say that January 2019 will be the launching month of FutureSiSens HST device for detecting SAHS. Furthermore, all 2019 will be then focused on Spanish market sales.

From the results obtained, future destinations and periods of time will be analysed for expansion. However, if everything goes well, the second year, 2020, the FutureSiSens device will be expanded over all Europe seeing as it will be already have been accepted on the Spanish market with satisfactory results.

Finally, if the European market succeeds, the following year, 2021, the device could be introduced in the USA market.

Of course, all this strategy will have to be adjusted depending on the resources, sales and other factors. If necessary locations can be changed for others.

4.6.2 Distribution Channels

In this section, one of the most important decisions will be taken that will affect the success or otherwise of the company. For our product, regarding the distribution channels, two different possible ways of action has been defined:

- FutureSiSens as sole responsible for the distribution of the product.
- Use of a well-known company in the health market as distributor of our product.

The first intention of FutureSiSens is obviously that of deciding which option will make the company more successful. After all, it's a business and money is what is important for the success of a company. Moreover, FutureSiSens goal is to reach as many end users as possible by offering a solution to a common problem which is SAHS. Helping lots of people around the world by using our cheap and reliable device to detect and test without the need of going to a hospital, will be our objective too. Considering this, both possible options will be examined for deciding the distribution channels.

The first option regarding the fact that FutureSiSens will be responsible for the distribution of the product has a clearly positive effect. All the revenues obtained from selling our product will stay in the company. That means that with less sales, more profit can be obtained, although with this method sales will be more difficult.

To justify that, a study of the different business customers has to be done to analyse how that market of distribution works in the health sector and where do people go to buy our product. The possible business customers that FutureSiSens could have are:

- Pharmacies
- Private health system (private hospitals / doctors)
- Public health system (public hospitals / doctors)
- Online

Regarding the first three options, the market shows us a big inconvenience for FutureSiSens plans of being itself responsible for distribution channels seeing us as all pharmacies and doctors would have to recommend our product and do not have an administration that controls all of them. In other words, the effort that FutureSiSens would have to do for reaching all of them would be by individual visits with presentation of the product. Moreover, the money and personnel needed to do that would be considerable and difficult the growth of the company as a greater initial investment would be necessary.

However, the online option doesn't look that bad if we consider FutureSiSens as the only responsible for distribution. It's a cheap way of selling a product and an easy way to reach all the world without the need of physical action. Furthermore, all the investment would be to focus on a good marketing campaign with advertisements in websites that people with SAHS could see. However, there is a big drawback which is the need of a brand reputation for selling online. As it is a health application, even if the price range is cheaper than that of our competitors it may still be too high to be bought online by end users without the reliability of a well known brand behind the device.

Moving to the second option, the use of a well known company as the main distributor of FutureSiSens product, it is clear that there will be more clear advantages than with the first option as the range of business customers access will be wider and easier for the company. Using the name of a health brand, such as Bayer for example, will give the product a good reputation inside the market and be easier for people to buy in any of the 4 options mentioned above of selling business methods. The unique drawback of this form of distribution would be the sharing of revenues.

All in all, and after knowing the benefits and drawbacks presented by both options, that which appears best would be the second option. The need of a well known company that will put its name on our product and offer us their distribution channels for accessing the whole market, and which will be charged with obtaining the necessary contacts in the health sector. In case this option should fail, FutureSiSens will go for the first option of being sole distributor of the product.

4.6.3 Promotion

As has been said before, the decision of FutureSiSens on the distribution channel option is important for the overall strategy decisions. Regarding the promotion of the product, and taking into account that the option of making a partnership with a well known company succeed, the promotion of the product will be easier than by using only the FutureSiSens brand.

Moreover, it will be **necessary to examine the requirements of the partnership** with the chosen company and see their expectations in the project. The following marketing strategies will be necessary:

- **Online publicity campaign**: We will start with advertisements on specific websites where people search for information on SAHS, also where they go with the intention to buy a HST device or find solutions for their first tests. Furthermore, after some time and if all goes well the campaign will be extended to other websites, television or health programs.

- **International and local congresses of sleep disorders:** The intention of this strategy is to spread the name of our device to all the experts that attend this type of events. Some well known professional from the sector will give a brief talk about our product to recommend it to all his colleagues for first tests of patients.

- **Magazines and articles:** The creation of some health articles as analysis with the results obtained from the first explorations with our device compared to well known existing methods of diagnosis as PSG, will be needed. A clear representation of the results obtained which compare with existing techniques will be very important. Furthermore, some reviews and recommendations from a specialized doctor of the sector in some magazines will help us to get a better image and reputation.

- **Promotion in pharmacies:** Giving good conditions and special discounts in pharmacies who recommend our product will be crucial to start with as it's the most important business customer FutureSiSens will have.

- **Website and video review and explanation:** Having an excellent, professional and uncomplicated website as an online shop would be advisable. Moreover, a good video review of some end users giving feedback to possible new customers will be also important. An easy and simple explanation video telling how the product works will also be required.

With all these promotional strategies, FutureSiSens image around the world will little by little achieve the image we want to project to our customers which are: professionalism, reliability, comfort, accessibility, simplicity and helpfulness.

4.6.4 Promotional Budget

For achieving all the above objectives and strategies, a specific budget will be needed in order to grow with the expansion of the market size.

To start with, as the capital of the company is not that big, focus will be tried on cheaper promotions such as website and video reviews or online publicity campaigns. Depending on the injection of capital from investors and partnership with the pharmaceutical company, the path to follow to further spread the name of the product in the market will be decided.

4.6.5 Pricing

After explaining all the strategies regarding the sales method and marketing campaigns, it is time to elaborate on the selling price of our device and why and how we obtain it.

Of course, the first thing to do is evaluate the cost of the unit of the device. By having an approximate idea of the unit cost it can then be compared to competitors' prices and the final product selling price decided for the business customers and the end users.

It is important that the price does not vary too much with competitors or is not too low in comparison with the others as we are talking of a heath device, to the contrary people might see a low price as an index of unreliability or less category than others. It is a complex sector of the market insomuch that price has to be balanced taking into account all these facts.

To evaluate the unit cost of the device, *table 7* will be used which lists all the different variable costs that exist. There will not be listed the over head costs as the purpose is to get the final value of production per unit to have a better idea of the price that it will be required to pay to the manufacturing company in order to produce the device.

PRODUCT	***COST (€)***
Components of product	**€/unit**
Gas Flow Sensor	€5,00
Nasal Cannula	€0,52
Electronics	€40,00
Software	€1,50
Assembly + Packaging	€12,00
Warranty + Transport	€4,13
TOTAL	**€63,15**

Table 7.- Product costs. [1] [Own elaboration]

As can be seen, the total cost per unit is not that expensive. This achieves one of the objectives (be a cheap and competitive price inside the existing market). However, the selling price will not correspond to the 63,15€ listed. That cost per unit does not take into consideration any type of fixed costs of the company. Therefore, to cover those and make some profit, FutureSiSens decision will be to **sell for a price of 150 € per unit to the pharmaceutical company**.

COMPETITORS PRICES	
Alice NightOne *by Philips*	2.126,81 €
Respironics RUSleeping RTS *by OrthoApnea*	611,17 €
ApneaLink Air *by ResMed*	3.166,37 €
Vista O2*by NovaCor*	-
Polymate YH1000 *by BMC*	1.734,54 €
Choicemmed MD300W1 *by Choice*	173,43 €
SleepCare *by Hope2Sleep*	404,68 €
Watch Pat *by Itamar*	341,08 €
PM60A *by Contec*	136,30 €

Table 8.- Competitors Prices. [Own elaboration]

Even with this price, and comparing it to the rest of the competitors (*table 8*), it can be seen that it is still very cheap compared to other similar products. For that reason, the pharmaceutical company will have some margin to increase the price as they think necessary to sell the product inside the market and also make a profit to cover their fixed costs in the distribution and marketing channels.

For all these reasons, the final cost can be justified in the market and will be competitive and cheap as the initial idea. Moreover, it will be more functional and of better reliable quality thanks to the FutureSiSens GFS that will be incorporated in the HST device.

End users or business customers such as doctors will positively consider the fact that the product has a lower price compared to others and enjoys a recognised name and reputation thanks to the pharmaceutical laboratory partnership. This will encourage them to buy it.

4.7 Competition

The competition section regarding the direct competitors of HST devices for SAHS will be analysed by the use of the following table. All the main competitors will be shown. In the first column, FutureSiSens product will also appear for easy comparison.

	AIRTRACK FUTURESISENS	**ALICE NIGHTONE** PHILIPS	**RESPIRONICS RUSLEEPING RTS** ORTHOAPNEA	**APNEALINK AIR** RESMED	**VISTA O2** NOVACOR
PRODUCT	HST that provide values of average hourly apnoeic/hypo apnoeic events, total nightly apnoeic/hypo apnoeic events and apnoeic/hypo apnoeic events by hour	HST that provide seven channels of information as body position, pressure flow, snore, respiratory effort, SpO2, pleth and pulse rate	HST that provide values of average hourly apnoeic events, total nightly apnoeic events and apnoeic events by hour	HST that provide five channels of information as respiratory effort, pulse, oxygen saturation, nasal flow and snoring	HST that provide cardio-respiratory activities as arrhythmias, cardiac rhythm, sleep apnoea events and oximetry event
PRICE	150 €*	2.126,81 €	611,17 €	3.166,37 €	-
COMPANY NAME	FutureSiSens	Philips	OrthoApnea	ResMed	NovaCor
QUALITY	Medium	High	Low-Medium	High	Low-Medium
RELIABILITY	High	High	Medium-High	High	High
STABILITY	High	High	Medium-High	High	Medium-High
EXPERTISE	Medium-High	Well-known technological company	Medium-High	High	Medium-High
COMPANY REPUTATION	Low	High	Medium	High	Low-Medium
LOCATION	Spain	Netherlands	Spain	USA	United Kingdom
SALES METHOD	Use well known company for distribution	Hospitals and primary care centers	Use Philips as distributor	Online with an account of RedMed or in hospitals	Hospitals and primary care centers

Table 9.- Competitors 1. [Own elaboration]

- Price of sale of the HST device to the pharmaceutical well known company, not market selling price.

	AIRTRACK FUTURESISENS	**POLYMATE YH1000** BMC	**CHOICEMMED MD300W1** CHOICE	**SLEEPCARE** HOPE2SLEEP	**WATCH PAT** ITAMAR	**PM60A** CONTEC
PRODUCT	HST that provide values of average hourly apnoeic/hypo apnoeic events, total nightly apnoeic/hypo apnoeic events and apnoeic/hypo apnoeic events by hour	HST that provide eight channels of information as SpO2, Pulse rate, Airflow, Respiratory drive (2-CH), Snoring, Body position, CPAP pressure and patient event	HST that provide two channels of information as SpO2 and pulse rate	HST that provide five channels of information as patient respiratory oral and nasal airflow, snoring, blood oxygen saturation, pulse and CPAP pressure	HST that provide seven channels of information as real sleep time, AHI, oxygen desaturation index, heart rate, body position, snoring intensity and sleep stages	HST that provide two channels of information as oxygen saturation and pulse rate
PRICE	150 €*	1.734,54 €	173,43 €	404,68 €	341,08 €	136,30 €
COMPANY NAME	FutureSiSens	BMC	Choice	Hope2Sleep	Itmar	Contec
QUALITY	Medium	Medium-High	Medium	Medium	Medium	Low-Medium
RELIABILITY	High	High	Medium-High	Medium-High	Medium-High	Medium-High
STABILITY	High	High	Medium-High	Medium-High	Medium-High	Medium-High
EXPERTISE	Medium-High	High	Low-Medium	Medium	Medium	Medium-High
COMPANY REPUTATION	Low	Medium	Low-Medium	Low-Medium	Low-Medium	Medium
LOCATION	Spain	China	USA	United Kingdom	USA	China
SALES METHOD	Use well known company for distribution	Hospitals and primary care centers	Online	Online	Hospitals and primary care centers	Hospitals and primary care centers

Table 10.- Competitors 2. [Own elaboration]

Both tables above show all the competitors of FutureSiSens inside the market of HST devices for the testing of SAHS. However, not all of them offer the same outputs as the direct detection of SAHS with its index of AHI. For that reasons, after the analysis of the competitors it has been considered that Alice NightOne by Philips and Respironics by OrthoApnea will be the most important competitors as they offer a similar product to that of FutureSiSens final HST device.

To have a better representation of these two devices the *figures 6 and 7* will illustrate the product they are selling.

- **Alice NightOne by Philips**:

Figure 6.- Alice NightOne.

- **Respironics by OrthoApnea:**

Figure 7.- Respironics.

4.8 Sales Forecast

In the sales forecast section, the final figures of sales for the years between 2019 to 2023 have been estimated. First of all, the assumptions for the calculations will be taken into consideration:

- The product will be launched into the market in January 2019.
- The devices will be distributed and commercialized by the chosen pharmaceutical company.
- Sales values will come from a share of the total market size.
- In 2019 the market will be Spain.
- In 2020 the market will expand to all Europe.
- In 2021 the market will cover Europe and USA.
- In 2022 and subsequent years, the market will finally expand worldwide. An increase of 20% over the European and USA market will be considered for the world market size.
- In 2022 the market will be constant for the next years.

The system that has been selected to achieve the final values in *table 11*, consists basically on **getting a share of the total market analysed** in the *Economics* section (*table 12* shows the % of shares used). By doing that, even knowing that it is only a projection, the numbers obtained will be more real. Moreover, on the *table 11* and *figure 8*, it will be seen the three different scenarios or projections that have been considered. The average of the worst and best projections will be the one that has been used for the financial analysis calculations.

SALES FORECAST (units sold)

YEARS	**2019**	**2020**	**2021**	**2022**	**2023**	**TOTAL SALES**
Worst Guess Projection	333	3.651	5.349	6.419	6.419	**22.171**
Average Guess Projection	666	7.301	10.699	12.838	12.838	**44.342**
Best Guess Projection	999	10.952	16.048	19.257	19.257	**66.513**
Selling Locations	**Spain**	**Europe**	**EU + USA**	**World**	**World**	

Table 11.- Sales Forecast & Selling Locations. [Own elaboration]

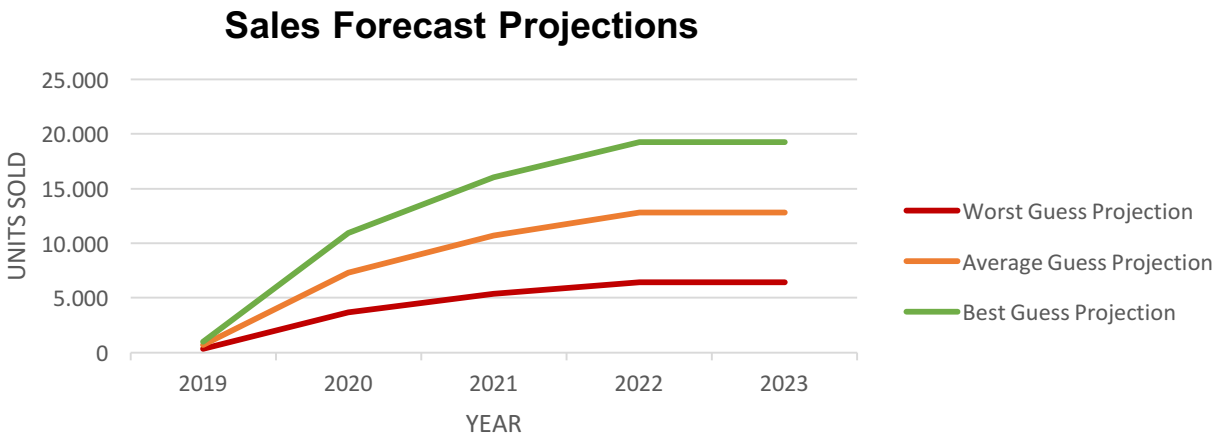


Figure 8.- Sales Forecast Projections. [Own elaboration]

As can be seen, the second year of sales compared to the first has a big increase in the products sold. The main reason for that corresponds to the strategy adopted in the first year to sell the product only in Spain, for analysis of the market and to see which drawbacks can be found with the product. This was done so during the second year some modifications could be effected to achieve the wider market in Europe by better reviews of the end users.

Furthermore, another thing that has to be mentioned is that from the year 2022 to the 2023 the market has started to be saturated, with steady growth of sales.

The percentage of share in the market that corresponds to the above values of sales, will be illustrated on *table 12*:

	% of the market reached
Worst Guess Projection	0,005%
Average Guess Projection	0,01%
Best Guess Projection	0,015%

Table 12.- % of the market reached. [Own elaboration]

The percentages show the conservative projections that have been considered for the sales forecast because the price of the product is not that cheap to allow easy sale. Moreover, it is believed that there will not be any problem to achieve those values as the partnership with the pharmaceutical company will help to get these results easily and enable the product to be known inside the health market.

Division of total values over 12 months will now be explained. First of all, for the first four months of the year there will be a continuous increase of the sales. During the summer months, there will be a stable growth of sales with no increase as the nights are hot and use of the device would appear uncomfortable. Finally, at the end of the summer, there will again be an increase of sales due to fresher nights and possible increases in weight over the summer. These assumptions will apply to all the periods as every year a new market will be achieved. The monthly sales for the year 2019 in Spain and 2020 in Europe are shown in the *figures 9 and 10*:

For the monthly sales during the first year in Spain:

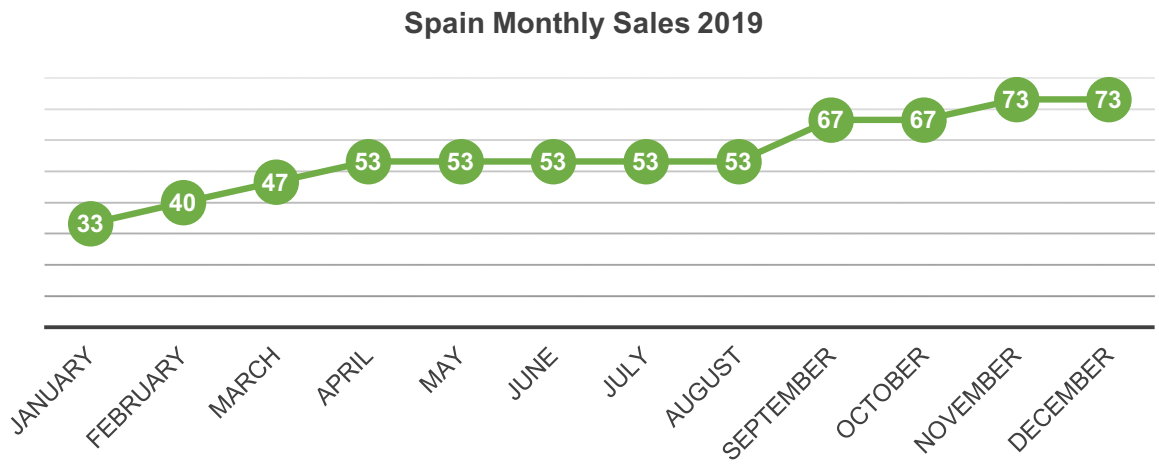


Figure 9.- Spain Monthly Sales 2019. [Own elaboration]

For the monthly sales during the second year in Europe:

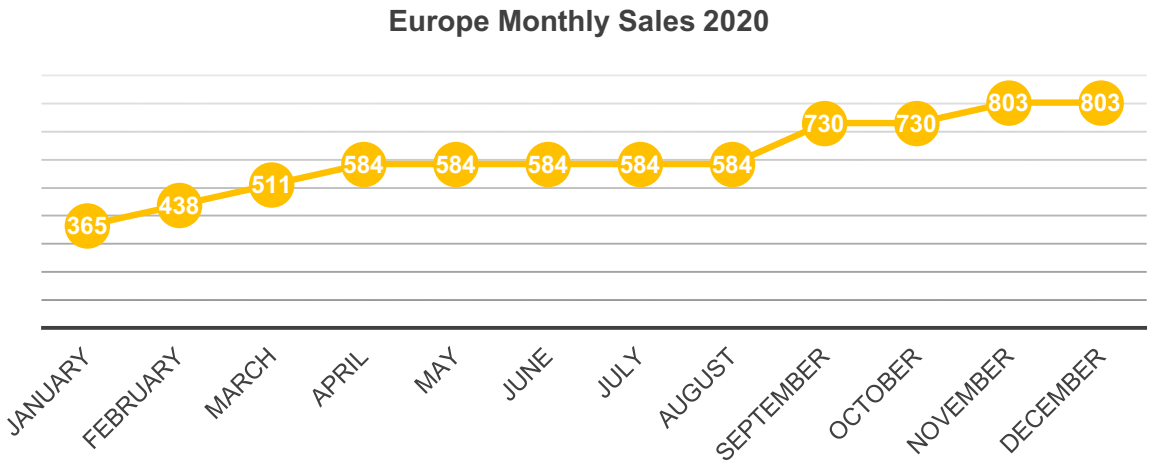


Figure 10.- Europe Monthly Sales 2020. [Own elaboration]

5 Operational Plan

In the operational plan section, the explanation of business development, management and location will be described as well as all the processes and partnerships FutureSiSens will require for a successful business.

5.1 Production

Having calculated the projections of sales for the first year, the way that FutureSiSens wants to proceed will depend on orders to the production company: Centro Superior de Investigaciones Científicas (CSIC), which will supply the units needed every month. In other words, the production orders will be done monthly and in advance.

The *figure 11* illustrates an example of management regarding the HST device production for the first two months of sales:

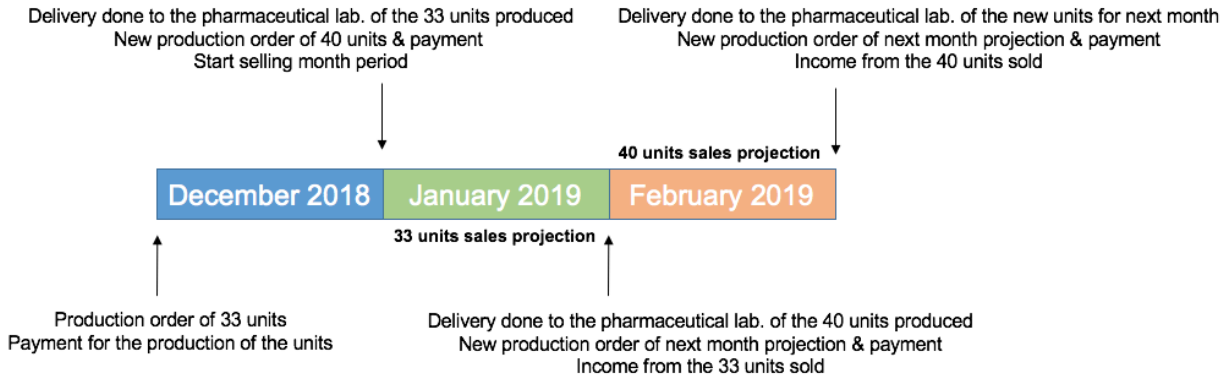


Figure 11.- Management example of the production methodology that FutureSiSens will consider. [Own elaboration]

CSIC will be the manufacturer of the device. This company corresponds to the Institute of Microelectronics of Barcelona. It is the largest public research and development center of microelectronics in Spain. The facilities of the IMB-CNM-CSIC include a series of laboratories for Micro-Nano-electro-mechanical systems (MEMS & NEMS), biochemical processes, electronic instrumentation, physical characterization and nanotechnology as well as a manufacturing production line that could be done for the production of FutureSiSens device. In Spain, IMB-CNM-CSIC houses a research facility classified as Infraestructuras Científicas y Técnicas Singulares (ICTS): a clean room of micro and nanofabrication (1500m^2), which makes this institute a reference for micro and nanotechnologies in the south of Europe.

5.2 Location

FutureSiSens is located in the Autonomous University of Barcelona (UAB), Bellaterra, no more than 20 minutes by car from Barcelona city and train connected. Furthermore, the CSIC is located in the same place, which prompted the decision to produce the device in the CSIC installations. FutureSiSens has a good relationship with the personnel of the CSIC. A good control of the production can also be easily done.

Moreover, FutureSiSens is already collaborating with the CSIC as first prototypes of the GFS are done in those installations. A good access and easy location of the facilities are important. Barcelona is well communicated by road, sea or air which will assist transportation of the elements needed for manufacture as with the delivery of the final product to the pharmaceutical laboratory company for its distribution.

The offices of FutureSiSens are located in the Eureka building, inside the Autonomous University of Barcelona. The company has a collaboration with the university and that is why the office has reduced rent.

5.3 Legal Environment

Regarding the legal environment, there will be no requirements as license or permits are not necessary for the production and operation of the company. The manufacturing of the device will be subcontracted to the CSIC.

FutureSiSens has a patent of its GFS regarding the design as manufacturing procedure. That would avoid any type of plagiarism from competitors.

5.4 Personnel

Nowadays, the company is formed by seven people which includes the research team. In *section 6* of this business plan, the organization chart will be explained in more detail for each member.

However, the intention of FutureSiSens regarding the HST device management will consist of a different team. The following positions must be occupied for the success of the business idea:

- Managing Director
- Commercial Agent
- Software development expert
- Electronics expert for the main device
- Administration Agent

All the positions mentioned will be filled either by new personnel or someone already working inside the company.

5.5 Inventory

The intention of FutureSiSens is to stock the HST devices in the facilities of the pharmaceutical laboratory, in which way the company will not take care of the stocks, minimizing expenses.

5.6 Suppliers

In order to be able to explain the main suppliers that FutureSiSens will have for all the materials needed for the production of the device the collaboration of our main partner, the pharmaceutical laboratory will be necessary. Because as they are a well known company they will have partners that could provide us with better economic conditions for the materials needed. However, to start with, all the materials needed will be acquired from local suppliers or suppliers which give us the most favourable conditions. Other suppliers should be considered in case of failure with that in principal chosen.

For all those reasons, the production cost of the device could get cheaper in time as better conditions with suppliers will be achieved and more units will be produced at a lower cost.

5.7 Credit Policies

For the HST device, the main credit policy that FutureSiSens has decided to give to the pharmaceutical laboratory consists of entire payment of the total devices delivered at the beginning of that month at 30 days. There will be no possibility to pay in fractionated periods from an initial strategy point of view. Due to that strategy, income from the device will be considered to be obtained at the end of the selling month as explained in the production section.

Regarding the selling price of the product to the end customers the pharmaceutical company will decide their own strategy.

6 Management and Organization

The management and organization of FutureSiSens will be explained along this section of the business plan.

6.1 Professional and Advisory Support

The existing Board consists of CEO **Sebastián Moreno**, holding a Physic Degree at UAB. He is the Managing Director of Pfisterer, also founder of Upresa S.A.U., CEO of Infisat, and finally founder and shareholder of Sema Cables, S.L.

The Vice-CEO and team coordinator role is dedicated to **Javier Rodríguez**, UAB full professor for 25 years.

Aitor Lopeandía takes the role of Chief Technology Officer (CTO), he is also an UAB associate professor for more than 12 years.

The research team consists of engineer **Ivan Álvarez**, who has been responsible for UAB technical support for the past year. **Llibertat Abad**, who is responsible for microfabrication part of the team and is a CNM-CSIC, RyC researcher with more than 12 years of experience in his sector. Moreover, we find **Javier Gallardo**, responsible of the electronics and software department that has **Antonio Miguel López,** an UPC associate professor with more than 20 years of experience, with him working in the electronics part.

To summarize all that internal professional and advisory support of FutureSiSens it will be illustrated in the *figure 12*:

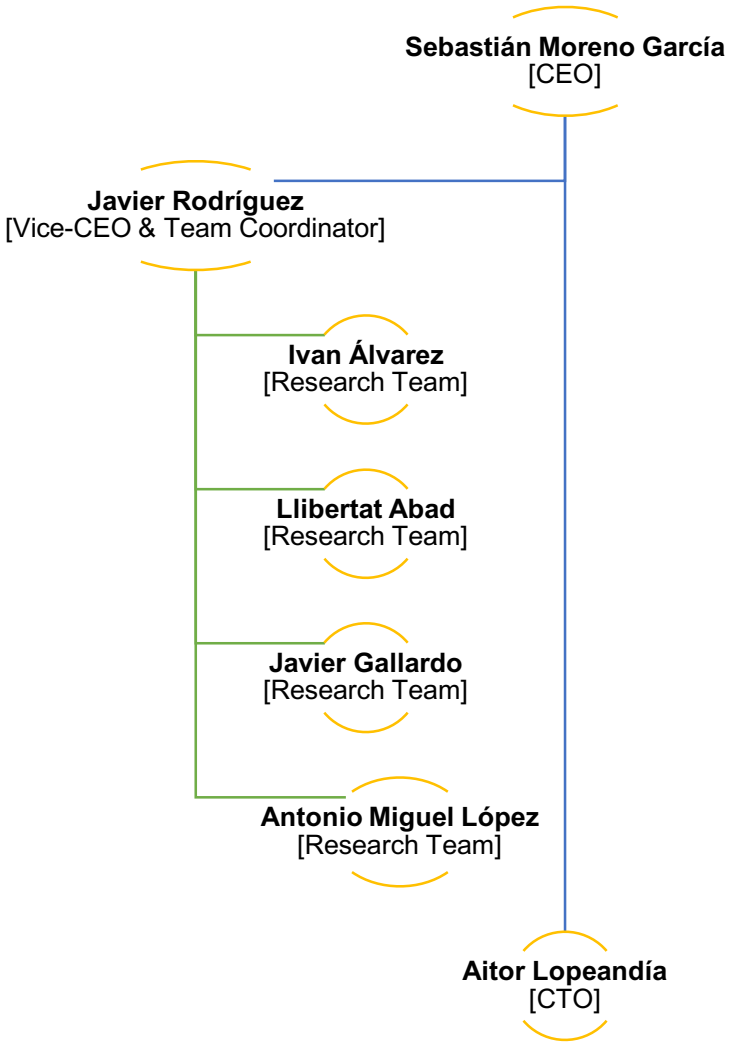


Figure 11.- Organization chart of FutureSiSens. [Own elaboration]

7 Founder Capital

The founder capital corresponds to the total money contributed by each of the owners of the company. These amounts are shown in *table 13*:

Founder Name	***Capital***	***Share***
Sebastián Moreno García	600,00 €	20%
Javier Rodríguez Viejo	660,00 €	22%
Aitor Lopeandía Fernández	660,00 €	22%
Libertad Abad Muñoz	300,00 €	10%
Antonio López Martínez	300,00 €	10%
Francisco Javier Muñoz Pascual	180,00 €	6%
UABFIRMS	300,00 €	10%
TOTAL	**3.000,00 €**	**100%**

Table 13.- Founder Capital. [Own elaboration]

8 Startup Expenses and Capitalization

8.1 Expenses

The initial investment required for FutureSiSens to launch the product into the market will be low. The idea is to spend some money developing the first prototype of the HST device. Afterwards, with the collaboration of a well known hospital near Barcelona, that has already accepted to test our device free of charge and compare the results obtained with the traditional method of PSG test with the FutureSiSens HST device prototype. The comparison of both results will validate the reliability of the product and will allow FutureSiSens to certify the product as a validated option for testing SAHS. After that, the next FutureSiSens step will be to contact the pharmaceutical companies, for example Bayer, to interest them in the product.

Regarding the expenses for marketing and distribution, it is assumed that the costs will be practically zero as the intention is to let the pharmaceutical partner use their selling method strategy such as economical resources so that FutureSiSens will need no expenditure. Obviously, there will be negotiation about the shares of the revenue of the products sold for recuperation of the means invested. However, some cash will be needed to promote the device in the local area or for propagandistic events.

Last but not least, some money will be needed: for R&D of the product, office supplies, computers, travelling, food expenses amongst others.

The *table 14* illustrates all the expenses of FutureSiSens:

EXPENSES	
1. Product	**€/year**
App Licenses	114,15 €
Software	10.000,00 €
Patents	10.000,00 €
TOTAL	**20.114,15** €
2. Salaries	**€/year**
Managing Director	100.000,00 €
Commercial	80.000,00 €
Technical 1 Software	60.000,00 €
Technical 2 Electronics	60.000,00 €
Administration	40.000,00 €
TOTAL	**340.000,00** €
3. Facilities	**€/year**
Rent	6.000,00 €
Travel & Accommodation	12.000,00 €
Office supplies & Computers	2.125,00 €
Administrative Agency	3.000,00 €
Others	1.200,00 €
TOTAL	**24.325,00** €
4. Marketing	**€/year**
Partnership with well-known company	10.000,00 €
Website	6,95 €
Distribution of product	0,00 €
Events	2.000,00 €
TOTAL	**12.006,95** €
OVERALL TOTAL	**396.446,10** €

Table 14.- FutureSiSens Expenses. [1] [Own elaboration]

As seen, the overall expenses during first year, 2018, will achieve a total value around 400.000 € for fixed costs. Some expenses will increase during future years seeing as the company will have increased sales and importance inside the market.

8.2 Capitalization

The way that FutureSiSens will achieve all the cash needed during subsequent years will be based on different sources:

- Founders Capital
- Subsidies
    - Fundació Repsol
    - EIT Health
    - SME Instrument – H2020 European Union
    - NeoTec
- Technology License
- Design of microchips for other clients
- New Client Projects

As can be seen in the above list, the intention is to use **non debt capitalization methods**. To understand it better, FutureSiSens doesn't want any capitalization methods such as bank credits, external investors (private equity, crowdfunding or business angels) amongst others that signifies you are sharing your business with others and you will need to return money to them with interest rates. The reason for this type of capitalization strategy is because of the revenues with the well known pharmaceutical laboratory and supposing that the company can survive with this type of capitalization it is safer and more efficient.

Regarding the methods that FutureSiSens will use, it is important to know, that nowadays, Fundació Repsol is already paying 72.000€ a year, 6.000€ a month, to subsidise the company. That is because FutureSiSens won the 1st prize award of "Fondo emprendedores, V convocatoria" of Fundació Repsol in July 2016 and will have that money in cash until September 2018. Of course, should that not be enough, there are other subsidies that FutureSiSens will apply for: EIT Health, SME Instrument from the H2020 of the European Union or NeoTec between others. [17] [18] [19] [20]

Moreover, the intention of the company is that the GFS by itself will be used not only for the HST device for testing SAHS but also for other applications because other external companies could come to FutureSiSens asking for the license or for some projects related to the GFS. In April 2017, the well known Spanish company ENDESA, from the energy sector, has offered 20.000€ to develop a project by using the GFS in one of their subterranean power stations in the city of Barcelona. With monitorization they can know if there is any leakage in any pipes. There are hundreds subterranean stations around Barcelona and thousands in Spain which means that if the project is successful FutureSiSens can obtain more related projects. [21]

By finding subsidies, new client projects, new sub products of the GFS or even selling the license of the technology of the GFS to other companies for external products the necessary money can be obtained to survive and make a profit. However, financial analysis must be effected. The cash flow will show the amount of money needed to produce the HST devices for testing SAHS and evidence any discrepancy over some period of time. Therefore, some assumptions will be done as a prevision of the amount of money that could be obtained from subsidies and new projects in the following years. If those assumptions fail, the final option would be to go for some debt capitalization as external investors or bank credits.

The *table 15* illustrates the financing of the company for the next 5 years taking into account the different assumptions explained of possible cash incomes even if some of them are considered as revenue from sub products:

FINANCING

	2017	**2018**	**2019**	**2020**	**2021**	**Total**
Founders Capital	6.000 €					**6.000 €**
Fundación Repsol	72.000 €	54.000 €				**126.000 €**
EIT Health	25.000 €	25.000 €				**50.000 €**
SME Instrument - H2020			50.000 €			**50.000 €**
*Technology License**			50.000 €	50.000 €	100.000 €	**200.000 €**
*Other Projects**	20.000 €	20.000 €	40.000 €	60.000 €	80.000 €	**220.000 €**
Capital from financing	**123.000 €**	**99.000 €**	**140.000 €**	**110.000 €**	**180.000 €**	**652.000 €**

*revenues projects considered inside the financing just to illustrate also extra incomes.

Table 15.- Financing. [1] [Own elaboration]

The variation of financing from the first year 2017 to the year 2021 will be illustrated:

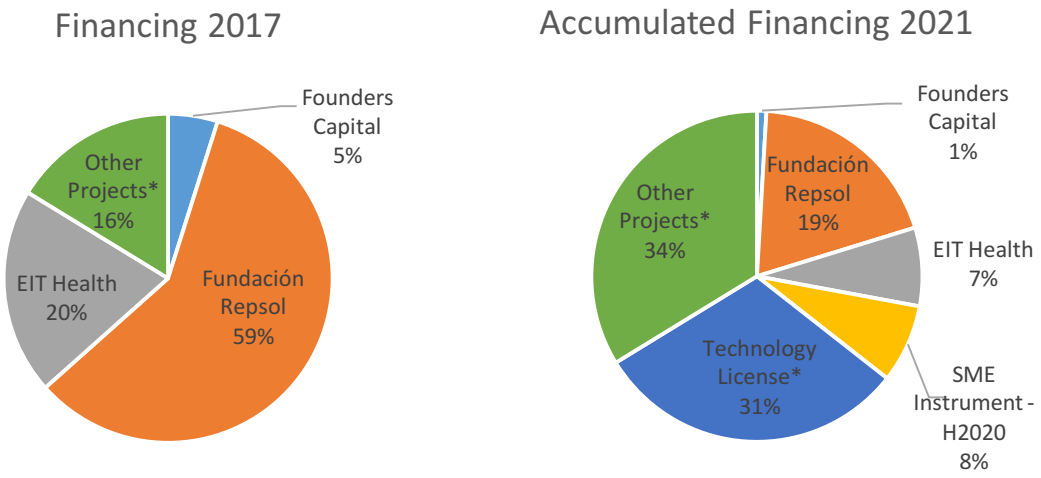


Figure 12.- Accumulated financing shares 2017 and 2021 of FutureSiSens. [1] [Own elaboration]

As can be seen, the revenues from the HST device are not considered instead the revenues from other projects and technology license are considered. Furthermore, the differences of percentage between both years show the expansion of the company for greater benefit and the search for new solutions that can be used with the GFS in the market.

9 Financial Plan

In this section of the business plan it will be illustrated all the financial analysis effected will be illustrated with its corresponding assumptions. The assumptions taken into account are listed below:

- The product has been successfully validated and it is ready to be commercialized at the beginning of 2019.
- A well known pharmaceutical laboratory has agreed their partnership and the use of their distribution channel as marketing resources.
- Sales will start on January 2019.
- The first year will be focused on the Spanish market only. The second year will expand to all Europe. The third year will cover also the USA market. Subsequent years will consider a worldwide market.
- All financing required will come from the list explained in the capitalization section. No bank credits or external investors have been considered.
- Taxes will be subjected to the current legislation. [22]
- Sales values after year 2020 will remain constant.
- Production costs of the products will be paid by FutureSiSens.
- Production cost will be reduced by 10% after the first year of sales. The following year by 2%. From that point, the last two years considered, will be by 1% each year.
- Marketing, stock and distribution costs will be the responsibility of the pharmaceutical laboratory. Therefore, these costs will not be considered in the financial analysis.
- Salaries will increase by 2% every year from 2019.
- Office supplies and computers have been quantified at the same price every year.
- Travel and accommodation expenses will increase by 10% every year from 2019.
- Administrative agency will also increase by 2% every year from 2019 and will be paid in January.
- The term of “others” is considered for any office materials or other minor expenses during that year.
- 10.000€ each for product related prices such as software and the patent has been considered.

After examining all these assumptions, the calculation will proceed of the break-even point.

9.1 Break-Even

The break-even point (BEP) will show us the total number of units that has to be sold in order to make revenues equal to operational expenses.

The formula of the BEP corresponds to:

$$BEP = \frac{Fixed\ Costs}{(Unit\ Sale\ Price - Varaiable\ Costs)}$$

For calculating the BEP, the fixed costs, variable costs and unit sale price for completing the formula will be listed:

Fixed Costs	
App License	114,15 €
Software	10.000,00 €
Patent	10.000,00 €
Salaries	340.000,00 €
Rent	6.000,00 €
Travel and Accommodations	12.000,00 €
Computers	2.125,00 €
Administrative Agency	3.000,00 €
Marketing	12.006,95 €
Others	1.200,00 €
Total Fixed Costs, FC	**396.446,10 €**

Table 16.- Fixed Costs. [Own elaboration]

Variable Costs	***Cost (€/unit)***
Gas Flow Sensor	5,00 €
Nasal Cannula	0,52 €
Electronics	40,00 €
Software	1,50 €
Assembly + Packaging	12,00 €
Warranty + Transport	4,13 €
Total Variable Costs, VC	**63,15** €

Table 17.- Variable Costs. [Own elaboration]

Unit Sale Price, P *(€/unit)*	***150,00 €***

Table 18.- Unit Sale Price. [Own elaboration]

Having all the required values we obtain that the BEP is:

$$\boldsymbol{BEP} = \frac{Fixed\ Costs}{(Unit\ Sale\ Price - Varaiable\ Costs)} = \frac{396.446{,}10\ €}{(150\ € - 63{,}15\ €)} = \boldsymbol{4.565\ units}$$

Obtaining a value of **4.565 units** means that FutureSiSens would need to sell that amount of devices every year in order to make revenues equal to expenses.

9.2 Balance Sheet

The following balance sheet show us an image of the legacy of FutureSiSens at the end of the 2016 exercise. The values will be divided into two different tables, one for assets and the other one for the liability and equity.

BALANCE SHEET FUTURESISENS S.L.

31/12/2016

Assets

Current Assets	
Debtors	6.000,00 €
Prepaid expenses	1.499,51 €
Other credits with the Public Administrations	7.189,29 €
Short-term financial investments	1.697,16 €
Treasury	56.111,99 €
Total Current Assets	**72.497,95 €**
Fixed Assets	
Immobilized material	1.539,30 €
Deferred tax assets	12.003,32 €
Total Fixed Assets	**13.542,62 €**
TOTAL Assets	**86.040,57 €**

Table 19.- Assets. [Own elaboration]

Liabilities and Equity

Current Liabilities	
Various creditors	2.751,90 €
Current tax liabilities	5.040,33 €
Other debts with the Public Administrations	1.797,75 €
Total Current Liabilities	**9.589,98 €**
Long-term Debt	
Bonds received in the long term	-716,80 €
Total Long-term Debt	**-716,80 €**
Total Liabilities	**8.873,18 €**
Owners' Equity	
Result of the exercise	74.167,39 €
Social capital	3.000,00 €
Total Owners' Equity	**77.167,39 €**
TOTAL Liabilities & Equity	**86.040,57 €**

Table 20.- Liabilities & Equity. [Own elaboration]

9.3 12-Month Profit and Loss Projection

In this section, the monthly profit and loss projection will be shown following the assumptions explained at the beginning of the financial analysis.

ANNUAL PROFIT & LOSS ACCOUNT 2019

	January	February	March	April	May	June	July	August	September	October	November	December
Sales	4.993 €	5.991 €	6.990 €	7.988 €	7.988 €	7.988 €	7.988 €	7.988 €	9.985 €	9.985 €	10.984 €	10.984 €
Cost of goods sold	2.102 €	2.522 €	2.943 €	3.363 €	3.363 €	3.363 €	3.363 €	3.363 €	4.204 €	4.204 €	4.624 €	4.624 €
Gross Margin	2.891 €	3.469 €	4.047 €	4.625 €	4.625 €	4.625 €	4.625 €	4.625 €	5.781 €	5.781 €	6.360 €	6.360 €
App Licenses	114 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Salaries	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €
Travel and Accommodations	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €
Administrative Agency	3.000 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Others	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €
Total Overhead (Fixed Costs) & Marketing	32.547 €	29.433 €	29.433 €	29.433 €	29.433 €	29.433 €	29.433 €	29.433 €	29.433 €	29.433 €	29.433 €	29.433 €
EBITDA	**-29.657 €**	**-25.964 €**	**-25.386 €**	**-24.808 €**	**-24.808 €**	**-24.808 €**	**-24.808 €**	**-24.808 €**	**-23.652 €**	**-23.652 €**	**-23.074 €**	**-23.074 €**
% over sales	-594%	-433%	-363%	-311%	-311%	-311%	-311%	-311%	-237%	-237%	-210%	-210%
Depreciation & Amortization	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Earnings before interest and taxes (EBIT)	**-29.657 €**	**-25.964 €**	**-25.386 €**	**-24.808 €**	**-24.808 €**	**-24.808 €**	**-24.808 €**	**-24.808 €**	**-23.652 €**	**-23.652 €**	**-23.074 €**	**-23.074 €**
Interest expense (7%)	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Earnings before taxes (EBT)	-29.657 €	-25.964 €	-25.386 €	-24.808 €	-24.808 €	-24.808 €	-24.808 €	-24.808 €	-23.652 €	-23.652 €	-23.074 €	-23.074 €
*Taxes**	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Tax Credits	4.449 €	3.895 €	3.808 €	3.721 €	3.721 €	3.721 €	3.721 €	3.721 €	3.548 €	3.548 €	3.461 €	3.461 €
Tax Credits Cumulated	4.449 €	8.343 €	12.151 €	15.872 €	19.594 €	23.315 €	27.036 €	30.757 €	34.305 €	37.853 €	41.314 €	44.775 €
Earnings after taxes (EAT)	**-29.657 €**	**-25.964 €**	**-25.386 €**	**-24.808 €**	**-24.808 €**	**-24.808 €**	**-24.808 €**	**-24.808 €**	**-23.652 €**	**-23.652 €**	**-23.074 €**	**-23.074 €**
% yearly variation EAT		12%	2%	-2%	0%	0%	0%	0%	-5%	0%	-2%	0%

Table 21.- Monthly Annual Profit & Loss Account 2019. [Own elaboration]

9.4 Six-Year Profit and Loss Projection

After the monthly profit and loss account projection example for the year 2019, the P&L projections for the years 2018 to the 2023 will be shown. All the values will follow the assumptions explained at the beginning of the financial analysis. Furthermore, *figures 14 and 15* will show a better representation of the values from the *table 22*.

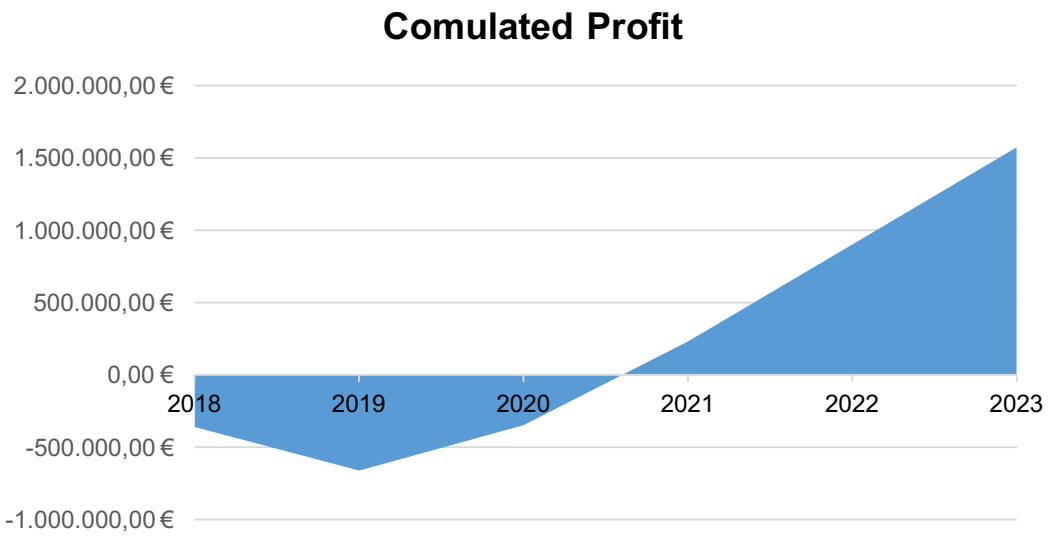


Figure 13.- Cumulated Profit. [Own elaboration]

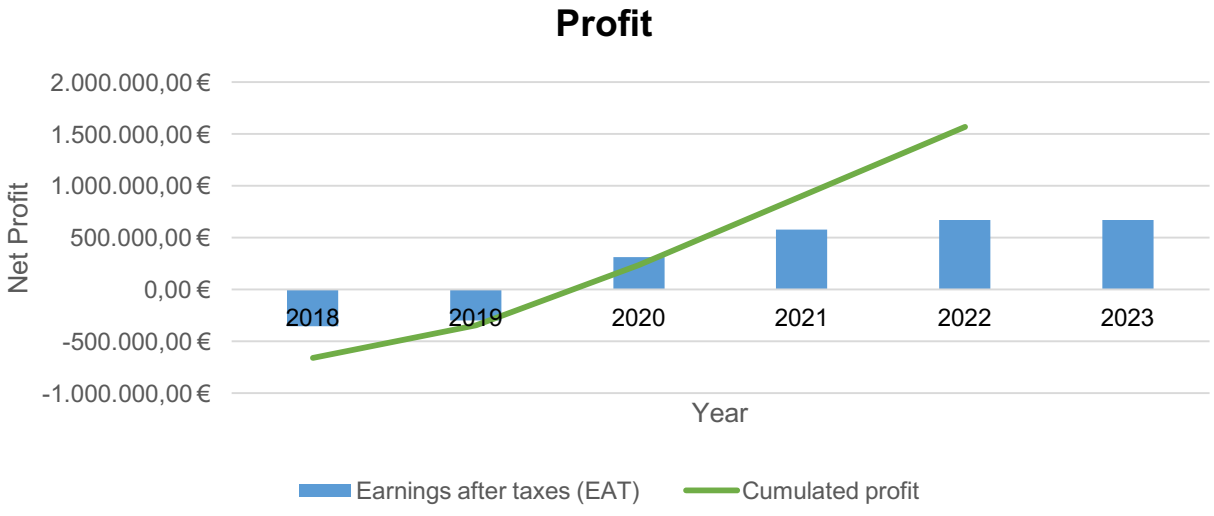


Figure 14.- Profit. [Own elaboration]

ANNUAL PROFIT & LOSS ACCOUNT

	2018	2019	2020	2021	2022	2023
Sales	0,00 €	99.853,80 €	1.095.215,32 €	1.604.775,57 €	1.925.730,68 €	1.925.730,68 €
Cost of goods sold	0,00 €	42.039,38 €	414.986,28 €	594.550,43 €	705.353,01 €	697.245,51 €
Gross Margin	0,00 €	57.814,42 €	680.229,03 €	1.010.225,13 €	1.220.377,67 €	1.228.485,17 €
App Licenses	114,15 €	90,17 €	90,17 €	90,17 €	90,17 €	90,17 €
Salaries	340.000,00 €	340.000,00 €	346.800,00 €	353.736,00 €	360.810,72 €	368.026,93 €
Office supplies & computers	2.125,00 €	2.125,00 €	2.125,00 €	2.125,00 €	2.125,00 €	2.125,00 €
Travel and Accommodations	12.000,00 €	12.000,00 €	13.200,00 €	14.520,00 €	15.972,00 €	17.569,20 €
Administrative Agency	3.000,00 €	3.000,00 €	3.060,00 €	3.121,20 €	3.183,62 €	3.247,30 €
Others	1.200,00 €	1.200,00 €	1.200,00 €	1.200,00 €	1.200,00 €	1.200,00 €
Total Overhead (Fixed Costs) & Marketing	358.439,15 €	358.415,17 €	366.475,17 €	374.792,37 €	383.381,51 €	392.258,60 €
EBITDA	**-358.439,15 €**	**-300.600,75 €**	**313.753,86 €**	**635.432,76 €**	**836.996,15 €**	**836.226,57 €**
% over sales		-301,04%	28,65%	39,60%	43,46%	43,42%
Depreciation & Amortization	0,00 €	0,00 €	0,00 €	0,00 €	0,00 €	0,00 €
Earnings before interest and taxes (EBIT)	**-358.439,15 €**	**-300.600,75 €**	**313.753,86 €**	**635.432,76 €**	**836.996,15 €**	**836.226,57 €**
Interest expense (7%)	0,00 €	0,00 €	0,00 €	0,00 €	0,00 €	0,00 €
Earnings before taxes (EBT)	-358.439,15 €	-300.600,75 €	313.753,86 €	635.432,76 €	836.996,15 €	836.226,57 €
*Taxes**	0,00 €	0,00 €	0,00 €	58.029,34 €	167.399,23 €	167.245,31 €
Tax Credits	71.687,83 €	60.120,15 €	0,00 €	0,00 €	0,00 €	0,00 €
Tax Credits Cumulated	71.687,83 €	131.807,98 €	69.057,21 €	0,00 €	0,00 €	0,00 €
Earnings after taxes (EAT)	**-358.439,15 €**	**-300.600,75 €**	**313.753,86 €**	**577.403,42 €**	**669.596,92 €**	**668.981,26 €**
% yearly variation EAT		16,14%	204,38%	84,03%	15,97%	-0,09%

Table 22.- Six Years Projection Annual Profit & Loss Account. [Own elaboration]

9.5 Projected Cash Flow

To end with the financial analysis, the most important projection, the cash flow, will be shown. Thanks to the cash flow the monthly needs of cash that FutureSiSens will have during all the years analysed will be seen. In that way, FutureSiSens will have a clear idea of cash flow and the need or not to find some other financing system to make the company achieve their objectives.

The following projection of the cash flow will show the values corresponding from the period of September 2018 to the end of 2020. Moreover, all the values will follow the assumptions explained in the beginning of the financial analysis plus the following ones:

- From January 2018 to August 2018, 7.000 € of the monthly Fundación Repsol payment will be saved making it available at the beginning of the cash flow, September 2018.
- The income of "other projects" will be received in September of every year.
- Software will be a cost considered in the start-up month.
- Marketing expenses will only be considered during the year 2018 as they correspond to all the costs related for obtaining the pharmaceutical laboratory partnership. 5.000 € will be considered for the start-up month and the rest divided among the other months of the year.
- In December 2018 the amount of 25.000 € will be received from EIT Health.
- The technology license income will be divided equally every month over the whole year.
- Regarding the production cost of goods, orders of production payments will be effected one month in advance of the availability of the product.
- Revenues from sales of the HST device will be received one month after the sale.
- The App license is paid at the end of the year, first year, 2018,114,15 € and following years reduced to 90,17€.

The total cash flow will be divided into 3 tables. One for every year. After the *tables 23, 24 and 25*, the *figures 16 and 17* will be shown to better describe the results obtained from the cash flow and equal ending balance for all the period projected.

CASH FLOW 2018

	Start-up month	September	October	November	December
Revenues					
HST GFS					
Technology License					
Other Projects		20.000,00 €			
Total Revenue		20.000,00 €			
Receipts					
Cash	7.000,00 €	20.000,00 €			25.000,00 €
Accounts Receivable					
Investment					
Total	**7.000,00 €**	**20.000,00 €**	**- €**	**- €**	**25.000,00 €**
Cost of Goods					
Disbursements					
Accounts Payable					2.101,97 €
Software	10.000,00 €				
Salaries		28.333,33 €	28.333,33 €	28.333,33 €	28.333,33 €
Marketing	5.000,00 €	1.250,00 €	1.250,00 €	1.250,00 €	1.250,00 €
Rent		500,00 €	500,00 €	500,00 €	500,00 €
Administrative Agency					
Travel and Accommodation		1.000,00 €	1.000,00 €	1.000,00 €	1.000,00 €
App License					114,15 €
Others		100,00 €	100,00 €	100,00 €	100,00 €
Total	**15.000,00 €**	**31.183,33 €**	**31.183,33 €**	**31.183,33 €**	**33.399,45 €**
Cash Flow	-8.000,00 €	-11.183,33 €	-31.183,33 €	-31.183,33 €	-8.399,45 €
Cash Balance	- €	-8.000,00 €	-19.183,33 €	-50.366,67 €	-81.550,00 €
Plus Receipts	7.000,00 €	20.000,00 €	- €	- €	25.000,00 €
Less Disbursements	15.000,00 €	31.183,33 €	31.183,33 €	31.183,33 €	33.399,45 €
Equal Ending Balance	-8.000,00 €	-19.183,33 €	-50.366,67 €	-81.550,00 €	-89.949,45 €
Quantity Sold 2018 by months (units)		0	0	0	0
	Fraction of yearly sales	0%	0%	0%	0%

Table 23.- Cash Flow 2018. [Own elaboration]

CASH FLOW 2019

	January	February	March	April	May	June	July	August	September	October	November	December
Revenues												
HST GFS	4.993 €	5.991 €	6.990 €	7.988 €	7.988 €	7.988 €	7.988 €	7.988 €	9.985 €	9.985 €	10.984 €	10.984 €
Technology License	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €
Other Projects									40.000 €			
Total Revenue	9.159 €	10.158 €	11.156 €	12.155 €	12.155 €	12.155 €	12.155 €	12.155 €	54.152 €	14.152 €	15.151 €	15.151 €
Receipts												
Cash	4.167 €	4.167 €	29.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	69.167 €	4.167 €	4.167 €	4.167 €
Accounts Receivable		4.993 €	5.991 €	6.990 €	7.988 €	7.988 €	7.988 €	7.988 €	7.988 €	9.985 €	9.985 €	10.984 €
Investment												
Total	**4.167 €**	**9.159 €**	**35.158 €**	**11.156 €**	**12.155 €**	**12.155 €**	**12.155 €**	**12.155 €**	**77.155 €**	**14.152 €**	**14.152 €**	**15.151 €**
Cost of Goods	2.102 €	2.522 €	2.943 €	3.363 €	3.363 €	3.363 €	3.363 €	3.363 €	4.204 €	4.204 €	4.624 €	4.624 €
Disbursements												
Accounts Payable	2.522 €	2.943 €	3.363 €	3.363 €	3.363 €	3.363 €	3.363 €	4.204 €	4.204 €	4.624 €	4.624 €	20.749 €
Software												
Salaries	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €	28.333 €
Marketing												
Rent	500 €	500 €	500 €	500 €	500 €	500 €	500 €	500 €	500 €	500 €	500 €	500 €
Administrative Agency	3.000 €											
Travel & Accommodation	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €	1.000 €
App License												90 €
Others	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €
Total	**35.456 €**	**32.876 €**	**33.296 €**	**33.296 €**	**33.296 €**	**33.296 €**	**33.296 €**	**34.137 €**	**34.137 €**	**34.558 €**	**34.558 €**	**50.773 €**
Cash Flow	-31.289 €	-23.717 €	1.861 €	-22.140 €	-21.142 €	-21.142 €	-21.142 €	-21.982 €	43.018 €	-20.406 €	-20.406 €	-35.622 €
Cash Balance	-89.949 €	-121.238 €	-144.955 €	-143.094 €	-165.234 €	-186.375 €	-207.517 €	-228.658 €	-250.641 €	-207.623 €	-228.029 €	-248.434 €
Plus Receipts	4.167 €	9.159 €	35.158 €	11.156 €	12.155 €	12.155 €	12.155 €	12.155 €	77.155 €	14.152 €	14.152 €	15.151 €
Less Disbursements	35.456 €	32.876 €	33.296 €	33.296 €	33.296 €	33.296 €	33.296 €	34.137 €	34.137 €	34.558 €	34.558 €	50.773 €
Equal Ending Balance	-121.238 €	-144.955 €	-143.094 €	-165.234 €	-186.375 €	-207.517 €	-228.658 €	-250.641 €	-207.623 €	-228.029 €	-248.434 €	-284.056 €
Quantity Sold 2019 by months (units)	33	40	47	53	53	53	53	53	67	67	73	73
Fraction of sales	5%	6%	7%	8%	8%	8%	8%	8%	10%	10%	11%	11%

Table 24.- Cash Flow 2019. [Own elaboration]

CASH FLOW 2020

	January	February	March	April	May	June	July	August	September	October	November	December
Revenues												
HST GFS	54.761 €	65.713 €	76.665 €	87.617 €	87.617 €	87.617 €	87.617 €	87.617 €	109.522 €	109.522 €	120.474 €	120.474 €
Technology License	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €
Other Projects									60.000 €			
Total Revenue	58.927 €	69.880 €	80.832 €	91.784 €	91.784 €	91.784 €	91.784 €	91.784 €	173.688 €	113.688 €	124.640 €	124.640 €
Receipts												
Cash	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	4.167 €	64.167 €	4.167 €	4.167 €	4.167 €
Accounts Receivable	10.984 €	54.761 €	65.713 €	76.665 €	87.617 €	87.617 €	87.617 €	87.617 €	87.617 €	109.522 €	109.522 €	120.474 €
Investment												
Total	**15.151 €**	**58.927 €**	**69.880 €**	**80.832 €**	**91.784 €**	**91.784 €**	**91.784 €**	**91.784 €**	**151.784 €**	**113.688 €**	**113.688 €**	**124.640 €**
Cost of Goods	20.749 €	24.899 €	29.049 €	33.199 €	33.199 €	33.199 €	33.199 €	33.199 €	41.499 €	41.499 €	45.648 €	45.648 €
Disbursements												
Accounts Payable	24.899 €	29.049 €	33.199 €	33.199 €	33.199 €	33.199 €	33.199 €	41.499 €	41.499 €	45.648 €	45.648 €	29.728 €
Software												
Salaries	28.900 €	28.900 €	28.900 €	28.900 €	28.900 €	28.900 €	28.900 €	28.900 €	28.900 €	28.900 €	28.900 €	28.900 €
Marketing												
Rent	500 €	500 €	500 €	500 €	500 €	500 €	500 €	500 €	500 €	500 €	500 €	500 €
Administrative Agency	3.060 €											
Travel and Accommodation	1.100 €	1.100 €	1.100 €	1.100 €	1.100 €	1.100 €	1.100 €	1.100 €	1.100 €	1.100 €	1.100 €	1.100 €
App License												90 €
Others	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €	100 €
Total	**58.559 €**	**59.649 €**	**63.799 €**	**63.799 €**	**63.799 €**	**63.799 €**	**63.799 €**	**72.099 €**	**72.099 €**	**76.248 €**	**76.248 €**	**60.418 €**
Cash Flow	-43.409 €	-722 €	6.081 €	17.033 €	27.985 €	27.985 €	27.985 €	19.685 €	79.685 €	37.440 €	37.440 €	64.223 €
Cash Balance	-284.056 €	-327.465 €	-328.187 €	-322.106 €	-305.073 €	-277.088 €	-249.103 €	-221.118 €	-201.433 €	-121.748 €	-84.308 €	-46.868 €
Plus Receipts	15.151 €	58.927 €	69.880 €	80.832 €	91.784 €	91.784 €	91.784 €	91.784 €	151.784 €	113.688 €	113.688 €	124.640 €
Less Disbursements	58.559 €	59.649 €	63.799 €	63.799 €	63.799 €	63.799 €	63.799 €	72.099 €	72.099 €	76.248 €	76.248 €	60.418 €
Equal Ending Balance	-327.465 €	-328.187 €	-322.106 €	-305.073 €	-277.088 €	-249.103 €	-221.118 €	-201.433 €	-121.748 €	-84.308 €	-46.868 €	17.354 €

Quantity Sold 2020 by months (units)		365	438	511	584	584	584	584	584	730	730	803	803
Fraction of sales	5%	6%	7%	8%	8%	8%	8%	8%	10%	10%	11%	11%	

Table 25.- Cash Flow 2020. [Own elaboration]

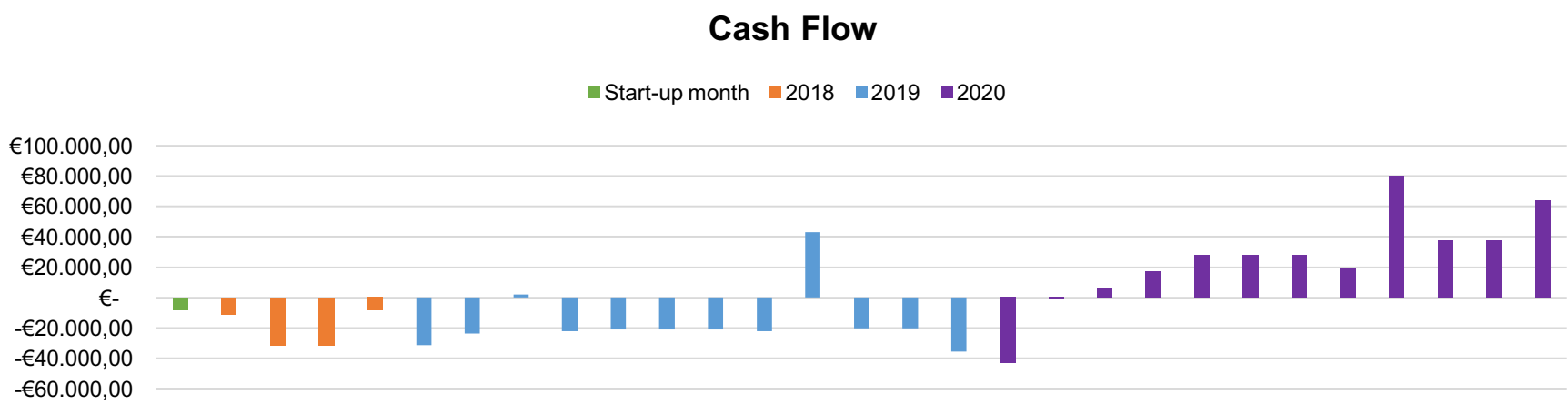


Figure 15.- Cash Flow. [Own elaboration]

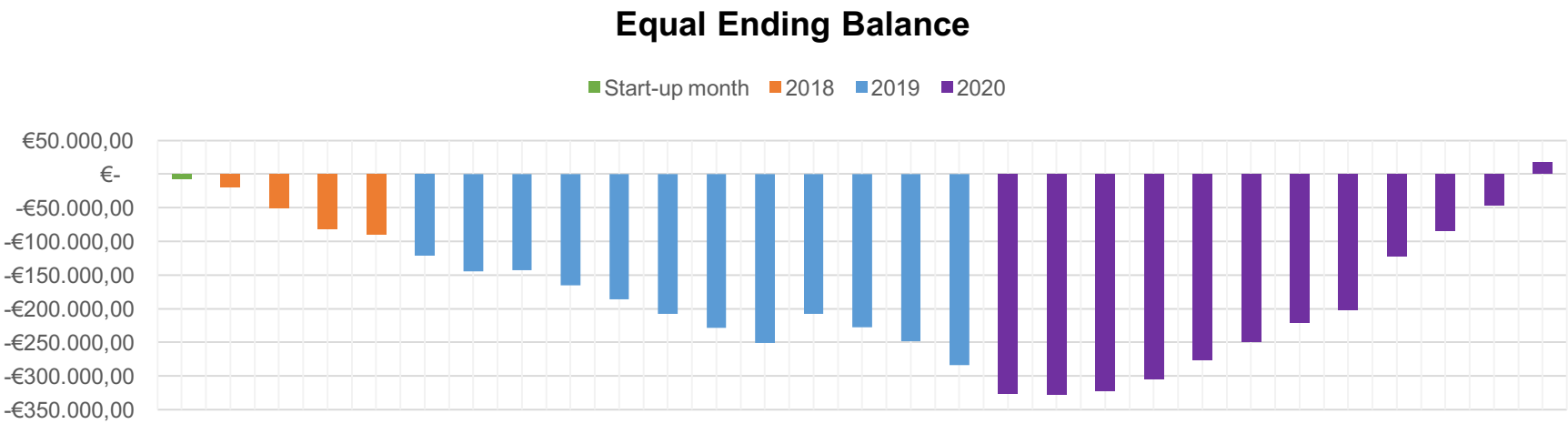


Figure 16.- Equal Ending Balance. [Own elaboration]

10 Conclusion

A project with reasonable profitability has been defined, not only economical but also social, as it gives the opportunity to a sector of the population to have a first diagnosis of SAHS at home for a reasonable price, easily accessible by renting it from the pharmacy which will allow adequate treatment.

The development of all the sections of the business plan has been carried out successfully in general terms. For a brief conclusion, and to make sure all sections have been successfully described, a summary of all the important points considered throughout the business plan will be listed in a Business Model Canvas format:

1. **Customer Segments:** as can be extracted form the niche of our business, our main customer segment corresponds to the people that think they suffer from SAHS and may want to test themselves by using a HST device for a first exploration. Moreover, doctors and pharmacies will also play an important role for our customer segment.

2. **Value Proposition:** the value proposition that our device will give to our customer segments will consist of the easy way of using it, its cheap price, its comfort, its more than one usage and its high reliability.

3. **Channels:** regarding the channels they will be those of the pharmaceutical laboratory that will take care of making the product reach all the customer segments.

4. **Customer Relationship:** the relationship with the end users will be practically null. FutureSiSens will sell the product to the pharmaceutical laboratory company and it will be them who have the relationship with customers. However, regarding the product and any damage or problem that may occur to it, we will have some warranty and technical service to help customers to solve their problems.

5. **Revenue Streams:** the incomes of FutureSiSens will come mainly from the sales of the HST device, however, other revenues from the technology licenses, design of microchips and other external projects related to the use of the main product that is the GFS will also be considered.

6. **Key resources:** the key resource that FutureSiSens has is the gas flow sensor (GFS) which is the main product of the company.

7. **Key Activities:** for FutureSiSens, the key activity is innovation and R&D which is clearly its mission. Furthermore, for the success of the business idea described in this business plan, we find other key activities also important such as: validation of the HST device and agreement with the pharmaceutical laboratory for use of their distribution channel and image.

8. **Key Partnership:** as mentioned before in the key activities, the key partnership will be with the pharmaceutical laboratory.

9. **Cost Structure:** as listed in the expenses section, all the costs related to the production of the HST device will be taken into consideration (variable costs). Moreover, other expenses of the company such as the lists of fixed costs described in the financial analysis will also have to be considered.

As a consequence of all the above mentioned, a great business opportunity emerges as shown in the financial analysis. However, even with the viability of the project, there are also some weaknesses that can be found in the business idea. To see a SWOT analysis will be used:

Strengths	**Weaknesses**
• High skilled technology based team. • Good microchip design skills. • Patent for the FutureSiSens GFS.	• Low knowledge of the health sector. • Low experience with business.
Opportunities	**Threats**
• Partnership with a pharmaceutical laboratory that has good knowledge of the health market and a good distribution channel. • High number of people with SAHS that have not yet been diagnosed due to long waiting lists or high price of existing tests.	• Validation of the product. • Failure of agreement with the pharmaceutical laboratory company. • Unwillingness of customers to buy the product. • Doctors not convinced of our device results.

Figure 17.- SWOT. [Own elaboration]

All in all, as the author of this business plan and the knowledge I have acquired during my university studies related to the creation and development of a start-up, I consider that this business idea is viable and its development with the parameters explained above would make it successful with very controlled risks.

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12 Appendices

In *table 25 and table 26,* the values of total number of Spanish male and female respectively, between the age of 30 and 70 are shown. They have been used to quantify the total market size of the Spanish market for SAHS. The tables were obtained from the Spanish Institute of Statics.

	Hombres
	2016
TOTAL ESPAÑA	
30-34 años	
TOTAL	1.585.077
35-39 años	
TOTAL	1.979.773
40-44 años	
TOTAL	2.009.139
45-49 años	
TOTAL	1.873.686
50-54 años	
TOTAL	1.720.389
55-59 años	
TOTAL	1.507.166
60-64 años	
TOTAL	1.241.920
65-69 años	
TOTAL	1.110.250

Table 26.- Total number of Spanish male between age of 30-70 [12]

	Mujeres
	2016
TOTAL ESPAÑA	
30-34 años	
TOTAL	1.569.636
35-39 años	
TOTAL	1.908.500
40-44 años	
TOTAL	1.931.914
45-49 años	
TOTAL	1.842.480
50-54 años	
TOTAL	1.739.135
55-59 años	
TOTAL	1.562.045
60-64 años	
TOTAL	1.320.046
65-69 años	
TOTAL	1.229.796

Table 27.- Total number of Spanish female between age of 30 -70 [12]

In *table 27,* the values of total number of USA male and female over the age 18 is shown. It has been used to quantify the total market size of the USA market for SAHS. The table was obtained from the US Institute of Statics.

18 years and over	209,128,094	74.3
Male	100,994,367	35.9
Female	108,133,727	38.4

Table 28.- Total number of US male and female over the age of 18 [11]

The following pages refer to the patent that FutureSiSens has created in order to protect their main product, the gas flow sensor as the manufacturing processes involved for its production. The patent has been used to understand and describe the structure and composition of the FutureSiSens GFS.